Prestige Academy Charter School

Unit Title: Diversity of Life **Grade Level(s): 7th**

Subject/Topic Areas: Defining Life & Cells

Key Vocabulary: Cell, Living, Non-living, Dead, Dormant, Reproduction, Stimulus, Organism, Kingdom, cells, tissues, organ, organ sys., organism, organelle, cell membrane. Nucleus, mitochondria, chloroplast, cell wall, photosynthesis, cellular respiration.

Designed By: **Time Frame: 26 class meetings**
Date: 09/30/2011

SUMMARY OF PURPOSE:
In this unit, students explore the commonalities among all life forms and determine what it means to be "alive." Students also investigate the micro-world and realize that life is diverse, ranging from the tiniest of cells to the largest multi-cellular life forms. Regardless of size, all things are made of cells, and all cells carry out basic life functions. Students are introduced to the basic concept of cellular metabolism and resource acquisition.

Stage 1: Desired Results

Common Core/ Delaware Standards

Primary: **Standard 1: The Nature and Application of Science and Technology**
Students will know and be able to:

1. Understand that: Scientific investigations involve asking testable questions. Different kinds of questions suggest different scientific investigations. The current body of scientific knowledge guides the investigation.
   - Be able to: Frame and refine questions that can be investigated scientifically, and generate testable hypotheses.
2. Understand that: A valid investigation controls variables. Different experimental designs and strategies can be developed to answer the same question.
   - Be able to: Design and conduct investigations with controlled variables to test hypotheses.
3. Understand that: In a scientific investigation, data collection involves making precise measurements and keeping accurate records so that others can replicate the experiment.
   - Be able to: Accurately collect data through the selection and use of tools and techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, and display and facilitate analysis of data. Compare and question results with and from other students.
4. Understand that: There is much experimental and observational evidence that supports a large body of knowledge. The scientific community supports known information until new experimental evidence arises that does not match existing explanations. This leads to the evolution of the scientific body of knowledge.
   - Be able to: Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.
5. Understand that: Evaluating the explanations proposed by others involves examining and

comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Conflicting data or conflicting interpretations of the same data suggest the need for further investigation Continued investigation can lead to greater understanding and resolution of the conflict.

- Be able to: Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.

6. Understand that: Scientific habits of mind and other sources of knowledge and skills are essential to scientific inquiry. Habits of mind include tolerance of ambiguity, skepticism, openness to new ideas, and objectivity. Other knowledge and skills include mathematics, reading, writing, and technology.

Be able to: Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Secondary: Science, Technology, and Society

Students should know that:

1. Advances in technology can expand the body of scientific knowledge. Technological tools allow people to observe objects and phenomena that otherwise would not be possible. Technology enhances the quality, accuracy, speed and analysis of data gathered.

Students should know that:

2. Science and technology in society are driven by the following factors: economical, political, cultural, social, and environmental. Increased scientific knowledge and technology create changes that can be beneficial or detrimental to individuals or society through impact on human health and the environment.

Students should be able to:

- Research and report on selective breeding. Select an organism (e.g., race horses, pedigree dogs, drought resistant plants) and trace its history of development and the traits of the plant or animal that were enhanced by selective breeding.
- Recognize that the health profession uses pedigree charts to trace genetic disorders in past generations make predictions for future generations. Research and report on a chromosomal disorder. Complete a simulated pedigree for a fictional family based on your research.
- Explain how sanitation measures such as sewers, landfills, and water treatment are important in controlling the spread of organisms that contaminate water and cause disease.

History and Context of Science

Students should know that:

1. Over the course of human history, contributions to science have been made by different people from different cultures. Studying some of these contributions and how they came about provides insight into the expansion of scientific knowledge.

Students should be able to:

- Research the sequence of events that led to the formation of the cell theory and correlate these events with technological advancements (e.g., hand lens, microscopes, and staining techniques).

Standard 6:Life Processes

Structure/Function Relationship

Students should know that**:**

1. Living organisms share common characteristics that distinguish them from non-living, dead,

and dormant things. They grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, eliminate waste, and are composed of cell(s).

Students should be able to:

- Identify and apply criteria for determining whether specimens or samples are living, dead, dormant or nonliving.

Students should know that:

2. Living systems in all kingdoms demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, tissues, organs, organ systems, and organisms.

Students should be able to:

- Classify organisms based on shared characteristics into currently recognized kingdoms and justify their placement. Give examples of organisms from each kingdom.

Students should know that:

3. Most organisms are single celled while others are multi-cellular. Multi-cellular organisms consist of individual cells that cannot survive independently, while single-celled organisms are composed of one cell that can survive independently.

Students should be able to:

- Explain that individual cells are able to carry out basic life functions that are similar in organisms; however, explain that in multi-cellular organisms, cells become specialized, interdependent upon one another, and unable to survive independently.

Students should know that:

4. The cell is the fundamental unit of life. Cells have basic needs for survival. They use energy, consume materials, require water, eliminate waste, and reproduce.

Students should be able to:

- Describe the hierarchical organization of multi-cellular organisms. Recognize that multi-celled organisms are organized as specialized cells within tissues that make up organs within organ systems, which work together to carry out life processes for the entire organism.

Students should know that:

5. Most cells contain a set of observable structures called organelles which allow them to carry out life processes. Major organelles include vacuoles, cell membrane, nucleus, and mitochondria. Plant cells have a cell wall and chloroplasts.

Students should be able to:

- Observe and sketch cells using microscopes and other appropriate tools. Compare and contrast plant, animal, protist, and bacterial cells by noting the presence or absence of major organelles (i.e., cell membrane, cell wall, nucleus, chloroplasts, mitochondria and vacuoles) using the sketches and other resources.
- Research the sequence of events that led to the formation of the cell theory and correlate these events with technological advancements (e.g., hand lens, microscopes, and staining techniques

Matter and Energy Transformations

Students should know that:

1. All organisms require energy. A general distinction among organisms is that plants use solar energy to make their own food (sugar) and animals acquire energy directly or indirectly from plants.

Students should be able to:

- Recognize that the process of photosynthesis occurs in the chloroplasts of producers. Summarize the basic process in which energy from sunlight is used to make sugars from carbon dioxide and water (photosynthesis). Indicate that this food can be used immediately, stored for later use, or used by other organisms.

Students should know that:

2. Plants use the energy from sunlight, carbon dioxide, and water to produce sugars (photosynthesis). Plants can use the food (sugar) immediately or store it for later use.

Students should be able to:

- Recognize that the process of cellular respiration in the mitochondria of both plants and animals releases energy from food. Indicate that this food provides the energy and materials for repair and growth of cells. Explain the complementary nature between photosynthesis and cellular respiration.

Students should know that:

3. Most living things use sugar (from food) and oxygen to release the energy needed to carry out life processes (cellular respiration). Other materials from food are used for building and repairing cell parts.

Standard 7: Diversity and Continuity of Living Things

Reproduction, Heredity and Development

Students should know that:

1. Reproduction is a characteristic of all living systems and is essential to the continuation of every species.

Students should be able to:

- Recognize that reproduction is a process that occurs in all living systems and is essential to the continuation of the species. Use models or diagrams to identify the structures of a flowering plant that produce eggs and sperm and explain that plants, as well as, animals can reproduce sexually.

Students should know that:

2. Some organisms reproduce asexually involving one parent. Asexual reproduction results in offspring that are genetically identical to the parent organism (clones). This process is advantageous in maintaining the genetic make-up of organisms that are successful in a specific environment.

Students should be able to:

- Given varied scenarios (including one or two parent reproduction, and having traits identical to or different than the parents), classify offspring as either sexually or asexually produced and justify your response.

Students should know that:

3. Some organisms reproduce sexually involving two parents. Sexual reproduction results in offspring that have greater genetic diversity than those resulting from asexual reproduction. One-half of the offspring's genetic information comes from the "male" parent and one-half comes from the "female" parent. These genetic differences help to ensure the survival of offspring in varied environments.

Students should be able to:

- Compare and contrast asexual and sexual reproduction in terms of potential variation and adaptation to a static or changing environment. Relate advantages and/or disadvantages of each strategy.

Students should know that:

4. In sexual reproduction after the egg is fertilized, each of the new cells in the developing organism receives an exact copy of the genetic information contained in the nucleus of a

fertilized egg.

Students should be able to:

- Make a simple labeled drawing of asexual reproduction as it occurs in sexually produced organisms at the cellular level. Indicate that resulting cells contain an identical copy of genetic information from the parent cell.

Diversity and Evolution

Students should know that:

1.. There is a wide diversity of organisms on Earth. These organisms may be classified in a number of ways. One classification system places organisms into five kingdoms (monera, protista, fungi, plantae, and animalia) based on similarities in structure.

Students should be able to:

- Identify "kingdom" as the first main level of the standard classification system. Observe a variety of living organisms and determine into which kingdom they would be classified.

Students should know that:

2.. The great variety of body forms and structures found in different species enable organisms to survive in diverse environments.

Key Concepts/Big Ideas

• Observation and Evidence	All living things need water, reproduce, require energy, ingest food, perform gas exchange, eliminate waste, respond to stimuli and are made up of cells.
• Structure Function	The structure of organelles and cells determine its function The structure of flowers determine how it is pollinated
• Process Skills	Microscopes are used to observe various living organisms and develop of lab techniques with regard to microbial sampling
• Classification	Organisms are classified according to set criteria based on structure and function
• Investigation	The effects of changing conditions on living organisms can be observed and collected. Evidence can be represented and/or presented in the form of data tables, projects, or reports
• Interactions	The behavior of single cells or multi-celled organisms within a given environment can be observed.
* Adaptation	The structure of seeds and pollen determine how each are dispersed to help contribute to a species

survival

Enduring Understandings

Students will understand that…

Enduring Understanding: The common characteristics of living things include growth, need for nutrition, exchange of gases, response to stimulus, reproduction, need for water, elimination of waste, and the presences of cells.

Enduring Understanding: Organisms can be classified according to set criteria based on structure and function.

Enduring Understanding: Multi-cellular organisms have levels of organization of structure and function.

Enduring Understanding: Unicellular organisms live independently while multi-cellular organisms contain cells that can not live independently.

Enduring Understanding: The cell is the basic unit of life. Cells have structures may include membranes, cell walls, nuclei, vacuoles, mitochondria, and cytoplasm. The type of cell determines what structures are present. Unicellular organisms have the same needs and perform the same general functions as complex organisms (Diversity of Life Unit Science Concepts page 18).

Enduring Understanding: The Cell Theory is supported through the use of technological advancements such as microscopes.

Essential Questions

- What distinguishes living things from non-living things?
- How is structure related to function in cells, tissues, organs, organ systems and multi-cellular organisms?
- How are organisms classified into different kingdoms with emphasis also given to single-celled organisms?
- What is the difference between a single celled organism and a single cell from multi-celled organisms?
- How have technological advancements led to and helped to further develop the cell theory?
- How do the mechanisms of seed dispersal contribute to a plant's survival?
- What are the adaptations of flowering plants that increase their chances of successful sexual reproduction?
- How are the characteristics of life related to the processes of photosynthesis and cellular respiration?

Real World Context

Students will know….

- Any living thing, plant, animal, fungi or microorganisms is an organism.
- All living organisms exhibit common characteristics; they grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, and eliminate waste.
- Cells, tissues, organs and systems are organized to coordinate life processes.
- Organisms are classified into Kingdoms based on cell structure, and how they obtain energy.
- A single celled organism can perform all the necessary life processes to survive independently.

Multicellular cells are specialized for specific functions and are dependent on one another for survival.
- As new technology has been invented that extends our ability to observe things scientific discoveries and evidence can further support or refute existing theories.
- The structures of seeds are adaptations for dispersal by wind, water, gravity, and animal.
- Flower use color, scent, and time of gamete maturation to promote cross fertilization. The quantity of seeds that are produced and the way they are dispersed are related.
- Photosynthesis and cellular respiration are life processes that enable organisms to acquire and use energy and are dependent on gas exchange.

Learning Targets/Goals

Students will know…
- Any living thing, plant, animal, fungi or microorganisms is an organism.
- All living organisms exhibit common characteristics; they grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, and eliminate waste.
- Cells, tissues, organs and systems are organized to coordinate life processes.
- Organisms are classified into Kingdoms based on cell structure, and how they obtain energy.
- A single celled organism can perform all the necessary life processes to survive independently. Multicellular cells are specialized for specific functions and are dependent on one another for survival.
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- Photosynthesis and cellular respiration are life processes that enable organisms to acquire and use energy and are dependent on gas exchange.

Students will be able to… (21st century skills)
- Use a microscope to make observations of microscopic organisms and observe their life processes.
- Classify a variety of organisms based on their characteristics.
- Design a controlled experiment based on a testable question, collect evidence, organize data and form conclusions.
- Sort pictures into categories of living, non-living, dead, or dormant.
- Make observations, collect data, organize the data, analyze data, draw conclusions, communicate results, and form explanations.
- Observe and compare structures and behaviors of single-celled organisms.
- Dissect seeds to observe the structures.
- Observe germinating seeds and record changes.
- Investigate transpiration.
- Observe and label plant reproductive structures. Describe the function of each structure.
- Describe different methods of seed dispersal.
- Observe a simulation of bacterial growth and describe the rate of growth.

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task

This Diversity of Life unit is assessed through the use of an end-of-unit summative assessment. This assessment is intended to uncover student misconceptions which will then direct instruction. Both the student guide and teacher directions and rubrics are included. To access the end-of-unit summative assessment, go to the website listed below. <u>Click on the Delaware Science Comprehensive Assessment Program.</u>

http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Rubrics for Transfer Tasks

Performance Task

	4	3	2	1
Description of work submitted in by student.	Each question of the lab packet is attempted and work is legible.	Work is submitted late. Each question is attempted and work is legible.	Work is submitted in on time/late and work is neat and legible however, much of the lab packet is left blank.	Work is sloppy, packet is in poor condition (unprofessional) and incomplete.

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.

Summative Assessments:

Final Summative Assessment provided by the coalition. This assessment is not meant to be graded but is meant to be an informative piece to help drive instruction. The assessment can be used as a grade, however, as students have had access to all information being assessed throughout the course of the unit. (This assessment is currently under construction).

Student Self-Assessment and Reflection

Pairs Communication Activity
Students should keep a running journal that tracks their learning as they progress through the unit. This journal should be a combination of self reflection and data collected as a result of unit investigations.

When students complete the lessons in this unit, they should be encouraged to make notes on their work that indicates growth in understanding. Not all worksheets should be officially graded, but all work should include opportunities for student reflection. Only those assignments that measure knowledge that should be solidified in the minds of the students should be graded. Learning experiences should not be graded as they are developed to draw out student misconceptions.

Specific Self-Assessment opportunities:

Page19 of Diversity of Life Lab Notebook. Response Sheet*—Microscopic Life. To be given at the end of Investigation 3—Microscopic Life.

Page 28 of Diversity of Life Lab Notebook. Ribbon of Life. To be given in co-ordination with work done with the unit CD-ROM. This worksheet helps students assess their understanding of the content on the CD-ROM as they work through the various activities.

Page 34 of Diversity of Life Lab Notebook. Response Sheet—Seeds of Life. To be given at the end of Investigation 5—Seeds of Life.

Page 45 of Diversity of Life Lab Notebook. Response Sheet—Plant Reproduction. To be given at the end of Investigation 7—Plant Reproduction.

*Response sheets should be non-punitive and students should be allowed to discuss their viability based on a self-assessment rubric provided with the teacher's guides.

Instructional Resources

- **What text/print/media/kit/web resources best support this unit?**

Resource; The Regents of the University of California. <u>FOSS Diversity of Life.</u> 2003.

- **What tips to teachers of the unit can you offer about likely rough spots/student misunderstandings and performance weaknesses, and how to troubleshoot those issues?**

Students struggle with the concept of dormancy. Consistent refreshment of these concepts throughout the unit will help them come to grips with this abstract idea.

One of the biggest misconceptions held by students is that when they look through a microscope the object that they see is larger. This is addressed directly in Investigation 2, part B when students investigate the ACTUAL measured size of their field of view using a transparent mm ruler.

Students do not understand, upon entry to this grade level, that there are billions of life forms that are completely invisible to the naked eye. They observe several of these life forms and observe them while performing various characteristics of life to help solidify that these species do indeed exist and that they are alive.

Students come to 7th grade with little to no knowledge of cells. This is their first introduction to the concepts of cells. The misconception commonly held by students is that they can get cells from their body (i.e. cheek cells) but that they are not really MADE OF CELLS. That they are a self sufficient mobile ecosystem is a concept that is completely foreign to them. They will not let go of this misconception by the end of 7th grade, but they are exposed to multiple evidences that this is the case. This should prime these students for further understanding at the high school level.

Differentiation

The use of group activities throughout this unit enables students with difficulty to gain insight from fellow classmates. Pair them with strong students.

The use of computers and internet are great tools to complete activities and gain additional insight on topics students may be uncomfortable with.

Lab demonstrations and lab activities students participate in.

Extended time to finish activities.

KWL technique

Review previous day's lesson and continuously reinforce concepts from the unit.

Weekly graphing and analysis of weather data allow for ample time to gain understanding of weather patterns.

Permit the apt student to accelerate their rate of progress and work independently on some content.

Pre test students to determine their prior knowledge and misconceptions

Students may use graphic organizers, maps and diagrams to effectively facilitate differing levels of cognitive processing for students of different ability levels.

Enrichment

Students will be given the opportunity to complete a virtual activity; however, it will not be requirement.

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

Resource; The Regents of the University of California. <u>FOSS Diversity of Life.</u> 2003.

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know <u>W</u>here the unit is going and <u>W</u>hat is expected? Help the teachers know <u>W</u>here the students are coming from (prior knowledge, interests)
H – <u>H</u>ook all students and <u>H</u>old their interest?
E – <u>E</u>quip students, help them <u>E</u>xperience the key ideas and <u>E</u>xplore the issues?
R – Provide opportunities to <u>R</u>ethink and <u>R</u>evise their understandings and work?
E – Allow students to <u>E</u>valuate their work and its implications?
T – Be <u>T</u>ailored (personalized) to the different needs, interests, and abilities of learners?
O – Be <u>O</u>rganized to maximize initial and sustained engagement as well as effective learning?

Investigation 1: What is Life?

- Students investigate the characteristics that are common to all living organisms.
  - Part One: Living or Nonliving
    - Students observe a mystery substance in a Petri dish and use their observations to determine whether the contents of the dish are living or non-living.
    - Upon completion of their discussions, students develop a rough list of criteria for evidence of life.
  - Part Two: Is Anything Alive in Here?
    - Students observe 5 items in Ziploc bags and use their observations to determine which items may be living.
    - Students brainstorm how to test each of the five items to investigate whether any of them are living things.
    - Upon placing the items in environments including liquid, students observe their vials for 5 days and record their observations.
    - The list of evidence of life is revised after students completer their investigations.

Investigation 2: Introduction to the Microscope

- Students are introduced to the microscope as the tool used by scientists to observe organisms in detail.
  - Part One: Meet the Microscope
    - Students investigate the field of view by observing the letter "e", a color photograph from newsprint and a feather.
  - Part Two: Exploring the Micro world.
    - Students measure the field of view at 10, 20 and 40X magnification using a clear mm ruler.
    - Students measure netting without magnification using their rulers and then place the netting under 10X magnification for measurement.
    - This activity directly attacks the misconception that items that are under magnification are larger than they are when not magnified.
    - Students investigate Focal Plane by focusing one ribbons that are layered one atop the other.

•A multimedia disk is used to illustrate correct procedures and the mechanism involved in focusing on individual focal planes.

•Part Three: Microscopic Life

•Students observe the response of brine shrimp to light.

•Students continue to observe the brine shrimp under magnification. This activity includes providing dyed yeast for the shrimp to eat while under magnification.

•Students are given a list of characteristics of life to check off for evidence that the brine shrimp is a living organism.

Investigation 3: Microscopic Life

•Students discover cells and begin to understand their importance as the basic units of life.

–Part One: Discovering Cells

•Students observe *Elodea* cells. These observations include focusing through the focal plane and measuring cell size. Students are also introduced to movement within the cell as they observe cytoplasmic streaming.

–Part Two: Paramecia

•Students observe paramecia under the microscope and record evidence that what they are observing is a living organism.

•Students are challenged to compare single celled organisms to the cells in multi-cellular organisms. Students are introduced to the concept that multi-cellular organisms have cells that cannot live independent lives such as the lives of single celled organisms.

–Part Three: Micro worlds

•Students look at multiple single celled organisms including amoeba, euglena and other mixed flagellates.

•After looking at organisms from pure cultures, students observe organisms living within mini-pond cultures that students created from sticks, soil, leaves and pond water.

•This activity introduces students to the diversity of microscopic life, previously unknown to them.

Investigation 4: The Cell

•This lesson helps introduce students to the concept that the cell is the basic unit of life. Students also gain an appreciation for the diversity of cells that contribute to the diversity of life on Earth.

–Part One: Human Cells

•Students look at human cheek cells as a comparison of multi-cellular organisms (humans) to the myriad of single celled organisms they have observed.

–Part Two: Ribbon of Life

•Students use a multi-media program to investigate the complex organization of multi-cellular organisms (from cell to tissue, tissue to organ, organ to organ system, organ system to organism).

•Students also compare prokaryotic and eukaryotic cell structures, and are able to compare plant and animal cells through the multi-media presentation.

Investigation 5: Seeds of Life

• Students see seeds as living organisms in a dormant state. They also observe and describe the first developmental stages of a plant (growth and development--cellular reproduction within a single organism that also reproduces at the organismic level).

— Part One: Lima Bean Dissection
- As a direct tie to lessons learned in the Fourth grade "Structures of Life" unit, students dissect a lima bean to look at the seed coat, cotyledon, and the embryo. They add to their understanding of seeds by determining the conditions necessary for seeds to grow and develop into mature plants. (Understanding of dormancy)

— Part Two: Sprouting Monocots and Dicots
- Students observe rye grass seeds and radish seeds as they sprout. Students are directed to notice the difference between the monocot and dicot development (diversity among plants).
- Students notice that the dicotyledon seems to "lose" its cotyledons as they are pushed upward to capture sunlight while the cotyledon in the grass seed remains at "ground level" as it nourishes the plant as it grows above the ground.

— Part Three: Root Cells
- Students are introduced to structure/function relationships as they observe root structures.
- Root Cap: Protection during growth
- Root Tip: High levels of cell reproduction
- Zone of Elongation: Cells beginning to form channels
- Zone of Maturation: Root hairs and "pipe-like" cells for water acquisition and transport in the plant.

Investigation 7: Plant Reproduction

• Students investigate the reproductive systems in flowers to understand the origin of seeds, and to explore plant adaptations for seed dispersal. This is an introduction to sexual reproduction as a source of diversity in organisms.

— Part One: Flower Dissection
- Students dissect the flower of a tulip, gladiolus or daffodil to observe the various organs involved in seed production.
- After dissection is complete students are told how pollination occurs in plants and are referred to reading materials and visuals provided on the CD-ROM.

— Part Two: Seed Dispersal
- Students investigate their campus plants and look for seeds that may be around them. After observing various seeds and seed types, students are led in a discussion regarding the multiple seed dispersal techniques utilized by plants.
- This lesson is a nice introduction to sexual reproduction and the diversity of life that is covered in the genetics unit for seventh grade.

(Note: Investigations 8 and 9 in the teacher guide are not to be completed).

Investigation 10: Kingdoms of Life

- Students explore the Monera, Protista and Fungi kingdoms to understand their roles in the scheme of life.
  - Part One: Bacteria and Fungi
    - Students sample various surfaces and observe the microscopic life that is prolific in those areas after samples are incubated on agar.
      **This lesson is simulated using digital photography.
  - Part Two: Exponential Growth
    - While students wait to see what happens to their inoculated agar plates, they work through a mathematical lesson that illustrates exponential growth.
    - Mathematics involved
      - »Basic computation
      - »Graphing
  - Part 3: Microbes We Eat
    - Students taste samples of food that are created with ingredients including or created by organisms in various kingdoms.
    - Examples:
      - »Cheese--bacteria
      - »Yogurt--bacteria
      - »Sauerkraut--Bacteria
      - »Ice Cream--algae
      - »Toothpaste--algae

Check for Understanding

INVESTIGATION 2: INTRODUCTION TO THE MICROSCOPE

GOAL

Introduction to the Microscope acquaints students with the microscope as a tool used by scientists to study organisms in detail.

OBJECTIVES

SCIENCE CONTENT

- An optical microscope is composed of a two-lens system (eyepiece and objective lens), a stage on which to mount the material being observed, a light source (radiant or reflective), and a mechanical system for adjusting the position of the focal plane.
- Focal plane is a thin plane at a fixed distance from the objective lens where the image is in focus.
- Optical power is the product of the magnifications of the eyepiece and the objective lens.
- A microscope image appears reversed (flipped left to right) and inverted (flipped top to bottom).

CONDUCTING INVESTIGATIONS

- Measure the field of view for each objective lens on the microscope.
- Demonstrate proper use of the microscope when studying layers in a sample and structures of brine shrimp.
- Draw scale representations of images seen in a microscope to estimate size accurately.

BUILDING EXPLANATIONS

- Explain how the focal plane affects the image seen through a microscope.

INVESTIGATION 2: INTRODUCTION TO THE MICROSCOPE

	SYNOPSIS	OBJECTIVES	ASSESSMENT
PART 1	***Meet the Microscope.*** Students learn to handle and operate a microscope. They learn the parts of the microscope and the tools in the microscope kit. They observe print and simple objects to learn about image orientation. The CD-ROM provides informational videos and a virtual microscope to reinforce care and use.	• An optical microscope is composed of a two-lens system (eyepiece and objective lens), a stage on which to mount the material being observed, a light source (radiant or reflective), and a mechanical system for adjusting the position of the focal plane. • A microscope image appears reversed (flipped left to right) and inverted (flipped top to bottom).	**Student Sheet** *Microscope Images*
PART 2	***Exploring the Microworld.*** Students observe organza ribbon and fine netting to learn about focal plane and magnification. They use small, transparent millimeter rulers to discover the diameter of the field of view at various magnifications. Students begin to develop fundamental skills in using a microscope and interpreting what they are viewing.	• Focal plane is a thin plane at a fixed distance from the objective lens where the image is in focus. • Optical power is the product of the magnification of the eyepiece and the objective lens. • Measure the field of view for each objective lens on the microscope. • Draw scale representations of images seen in a microscope to estimate size accurately.	**Student Sheet** *Focal Plane*
PART 3	***Microscopic Life.*** Students observe tiny brine shrimp with their microscopes to confirm that they are living organisms. They observe that the shrimp respond to light, eat, and perhaps eliminate waste. This is the first opportunity for students to use the microscope to make scientific observations.	• Demonstrate proper use of the microscope when studying layers in a sample and structures of brine shrimp. • Draw scale representations of images seen in a microscope to estimate size accurately. • Explain how the focal plane affects the image seen through a microscope.	**Teacher Observation** Uses microscope to estimate the size of brine shrimp ***Mid-summative Exam 2***

AT A GLANCE

FOSS

PREPARATION	STEP-BY-STEP	MEDIA
• Assemble microscope kits. • Prepare for glass disposal. • Arrange the classroom. • Get newspaper photos. • Check your brine shrimp. • Preview the multimedia. • Plan assessment: student sheet.	• Introduce the microscope • Describe carrying microscopes • Orient students to microscopes • Introduce microscope kits • Prepare a dry mount • View the letter e • Introduce "field of view" • Observe a photo and a feather • Reinforce image behavior with multimedia	***FOSS Diversity of Life* CD-ROM** Lab Virtual Microscope Lab Techniques Videos • Moving the Microscope • Setting up the Station • Learning Parts of the Microscope • Focusing the Microscope • Making a Dry Mount
• Cut ribbons. • Cut nylon netting. • Plan assessment: student sheet.	• Reflect on the e image • Measure field of view • Measure netting without the microscopes • Measure the mesh squares using the microscopes • Discuss magnification • Assemble ribbon layers • Introduce the focal plane sheet • Define focal plane • View multimedia of focal plane • Assess progress: student sheet	***FOSS Diversity of Life* CD-ROM** Lab Virtual Microscope Lab Techniques Videos • Making a Wet Mount slide
• Dye the yeast. • Transfer brine shrimp to vials. • Preview multimedia of brine shrimp slide. • Establish waste cups. • Plan assessment: teacher observation. • Make copies of *Mid-summative Exam 2* and plan 10–15 minutes when students can complete it.	• Review characteristics of life • Introduce *Brine Shrimp Alive!* • Start the observation • Illuminate your brine shrimp culture • Offer guidance to students • Orient students to yeast • Discuss the results of the shrimp investigation • Look at the multimedia • *Mid-summative Exam 2*	***FOSS Diversity of Life* CD-ROM** Lab Lab Techniques Videos • Brine Shrimp Slides Database • Collection—Brine Shrimp

SCIENTIFIC AND HISTORICAL BACKGROUND

The scientific instrument with which we are most familiar—perhaps the most widely used icon of science—is the compound microscope. A compound microscope employs two lenses or lens systems: the eyepiece that you look through and the objective that is trained on the object being studied. The compound microscope has extended human knowledge of the invisible universe in ways unimaginable four centuries ago. At that time we had a rather large view of the world, limited to what we could make out with a squint, bright light, and perhaps a simple magnifying lens. Small, in the experience of the natural philosophers of the time, was something about the size of the eye of a fly.

The barrier to more minute exploration was breached around the turn of the 17th century. Dutch spectacle maker Hans Janssen and his son Zacharius crafted what is credited with being the first compound microscope. By all assessments it was a sorry piece of work in terms of its practical applications, but it presented the scientific world with a concept that worked. It was an instrument that trained a second magnifying lens on the image produced by the first magnifying lens. What a great idea! All that remained to be done was to improve and strengthen the lenses to produce a tool of incredible importance.

Microscopes improved incrementally for the next three centuries. In 1774 Benjamin Martin applied the recently discovered achromatic lens to the microscope and made a major stride forward in resolution. Until that time much of the advantage gained by magnification was neutralized by distortion of the image caused by chromatic and spherical aberration. Late-18th-century microscopes produced an impressively large blurry image.

In the 19th century optics were pretty good, and the quest for finer images pushed forward on other fronts. It was discovered that the resolving ability of a scope was in part related to the wavelength of the light it used. Ultraviolet-light microscopes, using the short wavelengths of light just beyond the range of vision of humans, produced greater resolution, and oil immersion lenses were developed to refract light at more radical angles, again enhancing magnification.

The path logically led to the high frequency and high energy of a beam of electrons to generate an image. The idea was put forward in 1924 by a high-energy physicist, Louis De Broglie, and through the 1930s electron microscopes proliferated, pioneered and advanced by Russian-born American engineer Vladimir Zworykin. Resolution was down to an angstrom (1 ten-millionth of a millimeter, or 10^{-10} m).

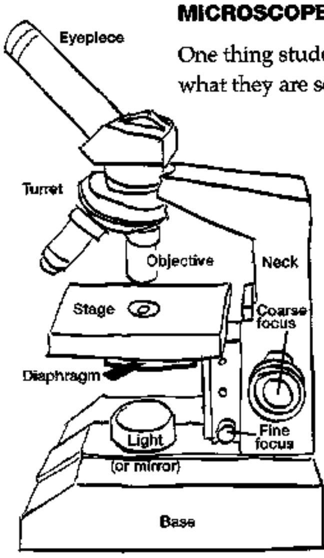
Today there are microscopes that eclipse the early electron microscopes many times over. The most powerful machines peer into the very structure of matter, producing images of atoms, aligned in strict crystalline structures, in many cases just the way it was predicted they would look.

FOSS

STUDENT MICROSCOPES

The microscope that students will likely use gives them perhaps their first look at a cell, the fundamental unit of life. It just might capture their imagination and propel them into a career pursuing the small, smaller, and smallest structures of this amazing universe.

The basic microscope is constructed on a solid base for stability. A platform, called the stage, is where the specimen under study is placed. Directly above the stage is the tube holding the lenses. A mechanism, usually operated by turning a knob, moves either the stage or the tube up and down to bring the specimen into focus.



Frequently a turret fitted with three different lenses is mounted on the lower (objective) end of the tube. By rotating the turret the user can select objective lenses of three different strengths.

A microscope's power refers to the amount of magnification it produces. A 10-power (written 10x) microscope produces an image ten times larger than the object. Similarly, a 100-power microscope produces an image 100 times larger than life.

Power can be computed if you know the magnification of the eyepiece lens and the objective lens. If the eyepiece magnifies 10 times, and the objective lens magnifies 4 times, the product of the two produces a 40x magnification. Typical student microscopes have a 10x eyepiece and three lenses on the turret, 4x, 10x, and 40x, producing 40, 100, and 400 power.

MICROSCOPE IMAGES

One thing students will have to learn is what they are seeing under the microscope. When they look through the eyepiece, they will see a circular field of view. They will see the same circular field of view no matter what power they have the microscope set for. What changes is how much of the specimen appears in that circular field.

At 40x students may be able to see an entire letter e on a page of print. At 100x they may see only a third of the letter in the same circular view, and at 400x they will see only gross globs of ink on an irregular surface. The field of view is the same, but less and less of the subject appears in the field as the power goes up, and that little bit is seen dramatically enlarged.

The optical microscope depends on light to produce an image and direct it into the user's eye. Light can originate from a lamp built into the base of the microscope, or it can come from an external source and be reflected with a mirror up through a hole in the stage. Light that passes through the specimen to illuminate it is called transmitted light. Transmitted light is particularly good for studying specimens that are transparent or translucent. Most microscopes have a diaphragm or other device to adjust the amount of light passing through the object under observation. Students should learn to manipulate the lighting to obtain the most useful illumination of the specimen.

Opaque objects don't transmit light, so they look black when lit from below. Opaque objects must be illuminated from above with a lamp or other source. Light from surface illumination is reflected light. Students should become familiar with both kinds of illumination and when to use each effectively.

Because of the nature of the optics used in microscopes, light rays cross in the process of producing an image, and things get turned around. The image seen through the eyepiece is actually reversed (flipped right to left) *and* inverted (flipped top to bottom). This means when students nudge the slide they are studying away from them, the image moves toward them. Similarly, when they push the slide a bit to the left, the image heads off to the right.

This obstinate optical behavior can be disconcerting for students at first, particularly when they are attempting to follow a protozoan that is swimming toward the edge of the viewing field. They will get the hang of it with experience, however, learning to coordinate their hand movements with their brain's intentions.

One skill that is essential for students to master is focusing. The microscope is designed to gather light from a plane that is parallel to the stage and to focus it on the retina of the observer's eye. Think about a slide projector. If you want to view the slide effectively, you have to get the image focused precisely on the screen. If you are using a slide projector that doesn't have any focus controls, you have to move the screen into the exact position where the image is in focus. Hold onto that idea and think about the microscope.

The lens system will focus only light that is a precise distance away from the objective lens. If an object is placed at exactly that distance, the observer will see it in focus. If the object is placed a little too far away from or close to the objective lens, the image will be out of focus. Students will learn to use the gross focus knob and the fine focus knob to study specimens closely.

Because the objects students will study are three-dimensional, students will frequently not be able to have the whole object in focus at one time. They will be seeing one level in the object in focus. As they focus up and down through a specimen, they will be seeing what it looks like at different levels. It is rather like focusing down through a loaf of sliced bread standing on end. They will see the heel in focus, then the first slice, followed by the second slice, and so on. This is a very important skill for students to develop in this investigation.

WHY DO I HAVE TO LEARN THIS?

"Why should I look for stuff you can't see anyway? What good is something that's so tiny? What could you use it for?"

The idea of scale is imbedded in this introduction to microscopes. As humans we are restricted to a narrow range of perception of the universe. There is a lot of it that we can't perceive because it is either too big or too small to register on our unaided senses. We can, however, extend our sense of vision by employing optical technologies, one of which allows us to see into the minute reaches of the universe. And it is amazing. The patterns, colors, designs, and structures seen in every material we look at reveal a whole new level of complexity of our everyday world.

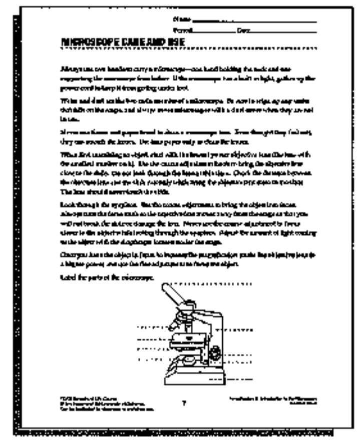
Middle school students are ready to incorporate this new point of view into their expanding understanding of the universe. This is a good time for them to discover that the diversity of life is not restricted to the lions and tigers that represented variety of life during childhood. They can now appreciate the fantastic diversity of life that swarms all around, on, and in them, as well as in every conceivable other place on the planet. And it's not nasty or yucky; it's marvelous.

If students ask why they have to look at little bitty stuff, turn the tables and see if they respond. Tell them they don't *have* to venture into the microscopic world, they *get* to, thanks to the power of the microscope. Encourage them to relax and forget about the science assignment and just take an excursion through wonderland and report what they see. And they'll be engaged in science.

MATERIALS FOR PART 1
MEET THE MICROSCOPE

FOR EACH GROUP

- 2 Microscopes, compound *
- 1 Microscope kit
  - 3 Dropper bottles, 15-ml
  - 2 Droppers
  - 2 Forceps
  - 2 Transparent 50-mm rulers
  - 1 Cotton ball
  - 2–3 Glass microscope slides
  - 3–4 Plastic coverslips
  - • Lens paper
  - • Blotter paper (See Getting Ready, Step 1.)*
  - • Toothpicks
- 2 Feathers
- 1 Plastic cup
- 2 Pieces of colored newspaper photograph *
- 1 Piece of text, 10-point font (from newspaper or magazine) *
- • Colored pencils *
- 4 Pieces of notebook paper (optional) *
- 4 *Diversity of Life Lab Notebooks*
  - • *Microscope Care and Use*, page 7
  - • *Microscope Images*, page 9



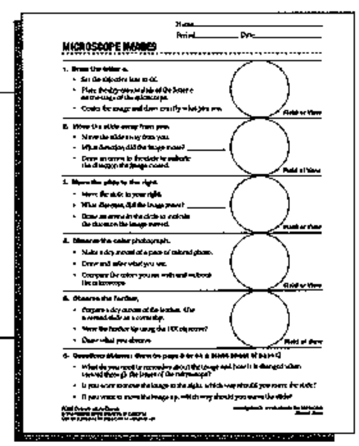
Lab Notebook, p. 7

FOR THE CLASS

- 1 Plastic juice bottle, 1.5 liter *
- • Multiple-outlet extension cords (optional) *
- • Brine shrimp culture in 1/2-liter container *
- 1 Multimedia setup *
- 1 *FOSS Diversity of Life* CD-ROM
- • Scissors

FOR ASSESSMENT

- • *Assessment Chart for Investigations 1 and 2*
- • *Diversity of Life Lab Notebook*
  - • *Microscope Images*, page 9



Lab Notebook, p. 9

* Supplied by the teacher

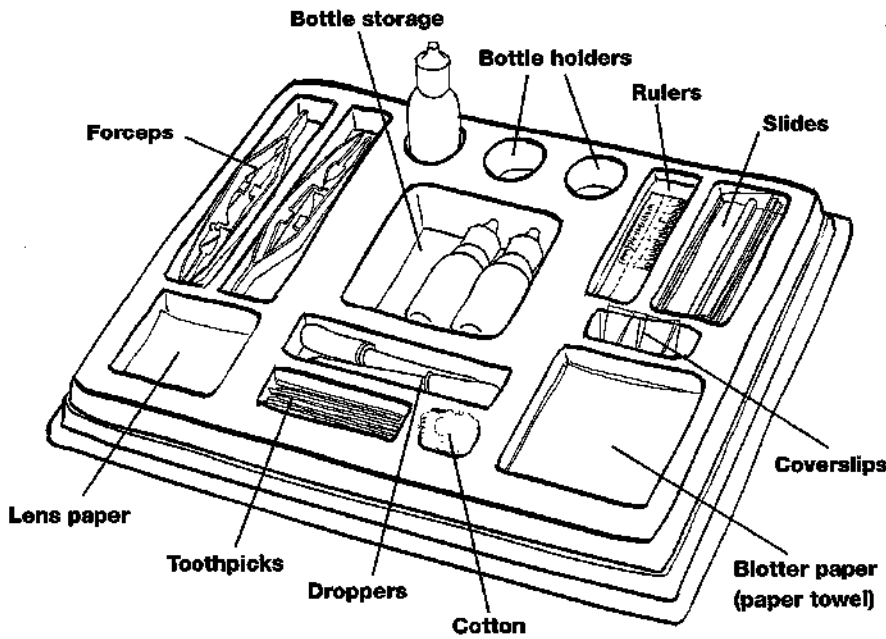
GETTING READY FOR PART 1

1. ASSEMBLE MICROSCOPE KITS

These activities are written assuming each pair of students will have access to a microscope. The microscope kits contain the materials needed to work with a microscope. Assemble one kit for each group of four students.

- Cut the 50-mm transparent rulers from the transparency provided. Put two rulers in each kit.
- Put 2–3 glass slides and 3–4 plastic coverslips in each kit.
- Fill two-thirds of the dropper bottles with water. Bottled spring water is good, but not essential. Put two water bottles and one empty bottle in each kit.
- Cut the sheets of lens paper to fit the small lens-paper well in the kit. Each 3″ × 4″ sheet will make four pieces of lens paper. Put about ten pieces in each kit.
- Obtain some very absorbent paper towels. Cut them to fit the larger blotter-paper well in the kit. Put about ten pieces in each kit.
- Place the other materials listed in the materials section in the kits.

You will need to inventory the kits periodically. Replenish lens paper, blotter paper, and water as needed.



2. PREPARE FOR GLASS DISPOSAL
Broken glass microscope slides can have very sharp edges. Students should learn to handle them with care. Broken pieces are very difficult to see; use caution when cleaning them up. They should be disposed of immediately in a proper container.

You can make a "sharps" disposal container from a 1.5-liter plastic juice bottle. Label it "Sharps Disposal." When you are ready to dispose of the container, recap it and tape it shut. It can then be safely disposed of without fear of loose glass in trash cans.

3. ARRANGE THE CLASSROOM
Consider where students will use the microscopes. The best arrangement is a lab setting with electric outlets where the microscopes can be left in position and students come to them. Lacking that, plan how to use the microscopes safely with minimal equipment moving.

If students will be using the microscopes at their desks, they must be flat-top desks. If possible, move student tables toward the edges of the room where they will be close to outlets. Try to keep extension cords to a minimum.

The microscopes should be stored where they are easy for students to fetch and return.

4. GET NEWSPAPER PHOTOS
Get a couple of color photographs from a newspaper. Cut them into pieces small enough to fit on a microscope slide.

Also bring in samples of higher-quality print, such as a magazine or catalog. Ten-point type is a good size—that's about the size of typical newspaper copy. Students will cut or tear a letter e from a sample of text. Put a few scraps of photograph, a block of text, and a couple of feathers in a plastic cup for each group.

5. CHECK YOUR BRINE SHRIMP
If you don't have a good supply of lively little brine shrimp, start a new batch right away so they will be ready for Part 3. Review the culturing suggestions in Getting Ready for Part 2 in Investigation 1.

6. PREVIEW THE MULTIMEDIA
The CD-ROM section called Lab Techniques Videos demonstrates several slide mounts that students will use. It can be used as a learning tool for students and as a refresher for you. Familiarize yourself with the several mounts used in this course. Also preview the Virtual Microscope, which can be used to help students understand microscope operations.

7. PLAN ASSESSMENT: STUDENT SHEET
Use *Microscope Images*, page 9 in the lab notebook, to check that students understand that images viewed through a microscope are reversed and inverted, and that they can draw scale representations. Note what most students understand and what you may need to review.

CONDUCTING PART 1

MEET THE MICROSCOPE

1. **INTRODUCE THE MICROSCOPE**
   Tell students that the results of the investigation of the five materials indicated that three of them were alive—they were organisms. Two of the organisms were so small that they were difficult or impossible to see. In order to take a closer look at the organisms a specialized tool is needed—the microscope.

2. **DESCRIBE CARRYING MICROSCOPES**
   Demonstrate the proper way to hold (using two hands), carry, and position a microscope on a desk. The multimedia video can be used to provide this information.

3. **ORIENT STUDENTS TO MICROSCOPES**
   Emphasize right from the start that a microscope is an intricate scientific instrument that cannot stand up to rough or irresponsible treatment. Students should pay close attention to the well-being of the microscopes at all times when they are in use.

   Have students bring microscopes to their desks. When the scopes are in place, ask students to open their lab notebooks to page 7, *Microscope Care and Use.* Tell students,

   This short article has lots of terms printed in bold text. As we read it together, we will discuss the importance of the bold and italic words and phrases.

   When we reach the end of the article, you should label the parts of the microscope diagram at the bottom of the page.

   You will be responsible for knowing the information and following the rules in the article when you use a microscope.

   Read the complete passage on page 7, emphasizing the words and phrases in bold and italic type. Allow time for students to fully understand the features of the scope as you progress through the article, and to label the parts of the microscope.

NOTE for Step 3

See page 357 for answers to labeling parts of the microscope.

4. **TRY OUT THE MICROSCOPES**
   Provide time for hands-on exploration of the microscopes. Make sure students are fully familiar with
   - The light source, switch, and diaphragm, if it has one.
   - The stage, including the stage clips for holding a slide.
   - The eyepiece and the objective lenses, including the rotating turret with its three lenses of different sizes and, if the scope has them, the rotating eyepiece and pointer.
   - The two focus adjustment knobs—coarse and fine. Some microscopes focus by moving the stage up and down; others focus by moving the lens system up and down.

   If your school requires a microscope contract, have students fill out and sign the contract as soon as the orientation is complete.

   If you have more than one kind of microscope, you may want to rotate the scopes from group to group during the course to give students experience with various instruments.

5. INTRODUCE MICROSCOPE KITS
Each group of four students will share a microscope support kit. Have GETTERs pick up a kit and orient students to the contents. Emphasize that

- Microscope slides are glass and should be treated with care. The plastic coverslips bend easily, so they must be handled with care.
- The dropper bottles of water and stain are to be used only as directed.
- Lens paper (in the small square) is used to clean microscope lenses only, not to wipe slides.
- Blotter paper (in the larger square) is used to soak up excess water on a slide and to clean slides after use.
- All materials should be cleaned and replaced in the kit in an organized manner before returning the kits to the materials station at the end of class.

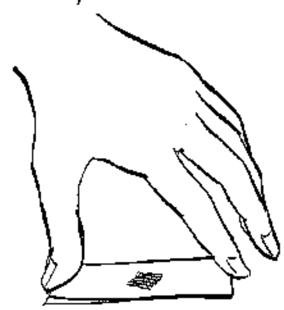
6. PREPARE A DRY MOUNT
Demonstrate how to make a dry mount using two microscope slides.

a. Place the material to be observed in the center of a slide.

b. Place another slide on top of the material to hold it flat.

c. Handling the dry mount by the edges only, place it on the microscope stage.

d. Use only the low (4x) and medium (10x) objective lenses to view the dry mount. A dry mount prepared with two slides is too thick to be used with the 40x objective lens.



Have GETTERs get a cup containing the bit of print, the portions of colored picture, and the feathers. Ask students to prepare dry mounts of a lowercase letter e. It is difficult to excise only an e, so they may have parts of other letters. That's OK.

a. Cut or rip the letter e from the text.

b. Capture it between two slides so that it is right side up.

c. Select the 4x objective lens. Place the slide on the stage with the letter e centered under the objective lens.

7. VIEW THE LETTER E
Allow 3–4 minutes for this initial observation. Students should note the inverted and reversed orientation of the image seen through the microscope.

8. INTRODUCE "FIELD OF VIEW"

Call for attention and tell students,

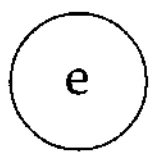
What you see when you look through the eyepiece of a microscope is called the field of view.

- *What shape is the field of view in your microscope?* [Round.]

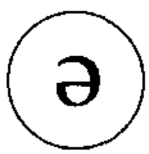
9. RECORD OBSERVATIONS OF THE LETTER E

Have students open their *Diversity of Life Lab Notebook* to page 9, *Microscope Images*. Ask them to complete parts 1–3 on the sheet.

Circulate and observe the drawings. Many students will draw the e in the correct orientation even though it appears inverted and reversed, and some will reproduce the image much smaller than it appears in the field of view. Look for these inaccuracies in image recording.



Students might record the image incorrectly.



Students should record this image.

When everyone has completed parts 1–3, ask,

- *What is the relationship between the orientation of the object on the stage and the appearance of the image in the field of view?* [The image is inverted (flipped top to bottom) and reversed (flipped left to right).]
- *What is the relationship between the movement of the slide on the stage and the movement of the image in the field of view?* [The image moves in the direction opposite to the direction the slide moves.]

10. OBSERVE THE PHOTO AND THE FEATHER

Ask students to complete parts 4 and 5 on the sheet. Students should use colored pencils to illustrate what the newspaper photograph looks like.

When students get to part 6, the questions, have them write their answers on the grid on page 8 or on blank paper.

11. REVIEW IMAGE BEHAVIOR WITH MULTIMEDIA

The simulation on the *FOSS Diversity of Life* CD-ROM called Virtual Microscope can be used to reinforce the relationship of slide and image movement. This activity allows students to simultaneously observe what is happening on the microscope stage and what is seen through the eyepiece.

12. ASSESS PROGRESS: STUDENT SHEET

Collect the lab notebooks. Check the *Microscope Images* student sheets. If students have drawn all the images as they would see them in the microscope, including the e upside down and backwards, and have correctly answered the questions at the bottom of the sheet, give them a ✓ on the assessment chart. If they have drawn all images to scale, give them another ✓.

NOTE for Step 10

See the answer sheet on page 358 of the teacher guide.

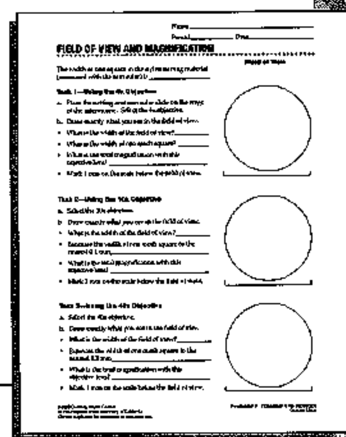
13. CLEAN UP

Ask students to clean the slides and return them to the microscope kits. GETTERs should return all materials to the materials station and store the microscopes in their places. If microscopes are to be left at lab stations, students need to check to see that lights are turned off before covering them.

MATERIALS FOR PART 2
EXPLORING THE MICROWORLD

FOR EACH GROUP

- 2 Microscopes *
- 1 Microscope kit
- • Blank paper *
- • Colored pencils for drawing *
- 1 Zip bag, containing
  - 8 Pieces of ribbon (4 colors)
  - 2 Pieces of nylon netting
- 4 *Diversity of Life Lab Notebooks*
  - *Field of View and Magnification*, page 11
  - *Focal Plane*, page 12



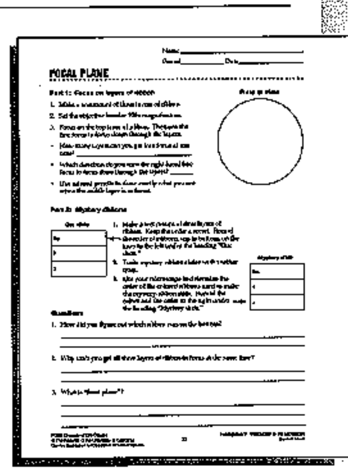
Lab Notebook, p. 11

FOR THE CLASS

- 1 Scissors *
- 1 Forceps
- 1 Zip bag with extra ribbon pieces
- • Multiple-outlet extension cords *
- 1 Multimedia setup *
- 1 *FOSS Diversity of Life* CD-ROM

FOR ASSESSMENT

- *Assessment Chart for Investigations 1 and 2*
- *Diversity of Life Lab Notebook*
  - *Focal Plane*, page 12



Lab Notebook, p. 12

* Supplied by the teacher

GETTING READY FOR PART 2

1. CUT RIBBONS

To learn how to focus from top to bottom of a sample, students will assemble layers of colored organza ribbons, which are woven from very fine threads. You need to cut and package the four colors of ribbon in advance.

a. The bits of ribbon unravel very easily. If you pull one loose thread, the ribbon will be gone before you know it. To reduce unraveling, cut the pieces at a slight angle, not quite on the bias.

Cut the ribbon into pieces about 1 cm long. They should be shorter than the width of a microscope slide.

b. Use forceps to place two pieces *of each color* of ribbon in a zip bag for each group. Try to place them flat.

c. Store the extra pieces of ribbon in a labeled zip bag.

Be prepared to replace pieces that just disappear in student hands.

2. CUT NYLON NETTING

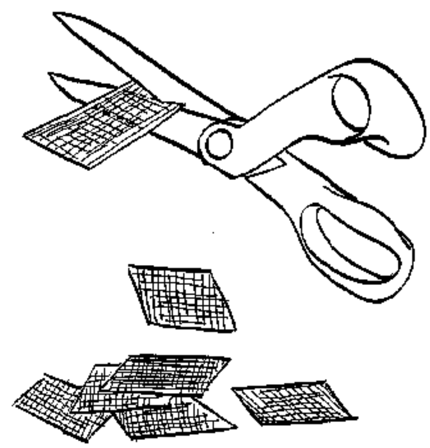
Cut the nylon netting to the same size as the pieces of ribbon. Put two pieces of nylon netting in each zip bag with the pieces of ribbon.

3. STORING PIECES AT THE END OF THE INVESTIGATION

At the end of Part 2, put all the ribbon and netting pieces into one zip bag for storage. Save the empty zip bags for use in Investigation 8 (snail substrate bags).

4. PLAN ASSESSMENT: STUDENT SHEET

Use *Focal Plane,* page 12 in the lab notebook, to check that students understand the focal plane of a microscope. Keep notes about what students understand and what you may need to review. See the answer sheet on page 360.



CONDUCTING PART 2
EXPLORING THE MICROWORLD

1. REFLECT ON THE E IMAGE
Tell students,

Yesterday we looked at the microscopic image of the letter e and discovered some of the relationships between an object and its image. However, we didn't figure out how big the e really is. It looks huge in the microscope, but in reality it is quite small.

- *How can we figure out how big something is by looking at it in the microscope?*

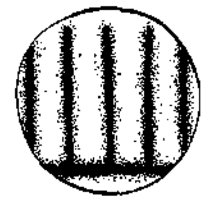
2. MEASURE FIELD OF VIEW
Ask students to get microscopes (for pairs) and microscope kits (for the group). Challenge them to find the diameter of the field of view with the 4x objective, using the materials in the microscope kit.

Let students talk in their groups for a couple of minutes to figure out a way to do this. If students have difficulty figuring out what to do, point out the little transparent millimeter rulers.

When they first look through the eyepiece at the ruler, they may say that they can't measure because they can't see all the numbers on the ruler. Ask,

- *What is the distance between the lines on the ruler?* [1 mm.]
- *If you saw five lines, how long would that be?* [4 mm.]

It may help students who are a little confused if they position the slide so that one of the millimeter marks is right at the edge of the field of view.



3. DISCUSS THE FIELD OF VIEW
Ask,

- *What is the field of view in your microscope when you are using the 4x objective?* [About 4 mm.]
- *If the field is 4 mm, can you estimate the diameter of the letter e you observed yesterday?* [Around 2 mm, depending on the type size.]
- *What do you think will happen to the field of view if you use the 10x objective lens?* [The field of view will get smaller.]

4. DESCRIBE MAGNIFICATION
Tell students,

*The word **magnify** means "make bigger." The numbers on microscope lenses tell you how much they magnify the image of the object you are looking at. The eyepiece has 10x written on it. This means it magnifies things ten times—things look ten times bigger when viewed through the eyepiece alone. The magnification of a lens is also referred to as its **power**.*

*The objective lenses have different numbers on them. To determine the **total magnification** of an objective lens and the eyepiece working together, you multiply the magnifications together.*

For instance, when you use the 10x eyepiece with the 4x objective lens, the *product is 40, so the object looks 10 times 4, or 40 times bigger.*

5. MEASURE NETTING WITHOUT THE MICROSCOPES

Have GETTERs get one zip bag containing scraps of ribbon and netting. Ask each pair to get one of the samples of netting and to place it on white paper. Ask,

- *Look closely at the netting. It is made of little squares. How far is it across one of the little squares?*

Students should use the 50-mm rulers in the microscope kits to measure the net fabric. Encourage them to count the number of squares in a centimeter and to divide by 10 mm to get a more precise value for the width of an individual net square. They should determine that the squares are about 1 mm or a little more in width.

6. INTRODUCE THE STUDENT SHEET

Ask students to open their lab notebooks to page 11, *Field of View and Magnification.* The sheet has three tasks. Have students start by recording the value they determined for the width of a netting square in the first blank above part 1. See the answer sheet on page 359.

7. PREPARE A WET MOUNT OF NETTING

Demonstrate (or use the multimedia) how to make a wet mount using the nylon netting and transparent ruler.

a. Place a piece of nylon netting on a slide.

b. Add 2 or 3 drops of water.

c. Place the ruler on top of the netting, so that the hatch marks run down the center of the slide.

d. Add another drop of water on top of the ruler.

e. Add a coverslip.

Any water that drips out should be dried from the bottom of the slide with the blotter paper before putting it on the microscope stage.

8. MEASURE THE MESH SQUARES USING THE MICROSCOPES

Ask students to complete the three tasks described on the sheet. They should estimate the width of the netting squares to the nearest 0.1 mm.

Observe students as they draw the netting in the field of view at each magnification. You may need to remind them to draw exactly what they observe.

9. DISCUSS MAGNIFICATION

After students have completed parts 1–3, hold a brief discussion. Ask,

- *How big are the squares on the nylon netting?*
- *What is the magnification when you use the 4x objective?* [40x.]

- *How wide is the field of view?* [About 4 mm.]
- *What about the 10x objective?* [The magnification is 100x, and the field of view is about 1.8 mm.]
- *What about the 40x objective?* [The magnification is 400x and the field of view is about 0.4 mm.]
- *What is the relationship between magnification and the diameter of the field of view?* [The greater the magnification, the smaller the field of view.]

It is important for students to determine the width of the field of view at each magnification. In later investigations they will be asked to estimate the size of organisms that they are seeing. If they know the width of the field of view, they can estimate the size of the organisms.

10. INTRODUCE THREE-DIMENSIONAL OBJECTS

Tell students,

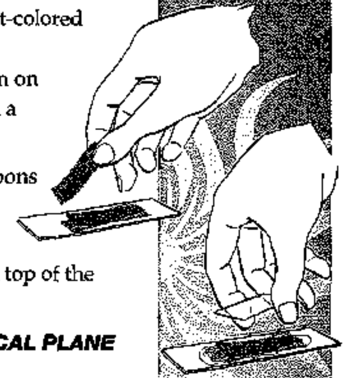
We've been using microscopes to look at materials that are flat—paper and netting. It was pretty easy to get these materials in focus.

Sometimes, however, microscopes are used to look at thicker materials. Let's find out what new factors come into play when we use the microscope to focus on three-dimensional materials.

11. ASSEMBLE RIBBON LAYERS

Ask students to remove the piece of netting from their slide, blot it on a paper towel, and return it to the zip bag. Then describe putting together a ribbon-layer slide.

a. Select three different-colored samples of ribbon. Carefully place them on top of each other on a slide.
b. Wet the layer of ribbons with 3–4 drops of water.
c. Place a coverslip on top of the ribbons.



12. INTRODUCE THE *FOCAL PLANE* SHEET

Ask students to open their lab notebooks to page 12, *Focal Plane*, and to work through the tasks and questions.

13. DEFINE "FOCAL PLANE"

When students have completed the mystery-ribbon activity using three layers of ribbon (including comparing their conclusions with those of the team that assembled the mystery slide), and have answered questions 1 and 2 at the bottom of the sheet, call for attention. Discuss students' ideas about the first two questions.

Students should have discovered that, when the bottom layer of ribbon is in focus, the objective lens is at its closest position to the slide. As they rotate the fine focus, the objective lens moves farther and farther from the slide. As the lens moves away, the higher layers of ribbon come into and pass out of focus.

Students may have noticed that they can't get all three layers of ribbon in focus at one time. The microscope will focus on only one level at a time.

- *How wide is the field of view?* [About 4 mm.]
- *What about the 10x objective?* [The magnification is 100x, and the field of view is about 1.8 mm.]
- *What about the 40x objective?* [The magnification is 400x and the field of view is about 0.4 mm.]
- *What is the relationship between magnification and the diameter of the field of view?* [The greater the magnification, the smaller the field of view.]

It is important for students to determine the width of the field of view at each magnification. In later investigations they will be asked to estimate the size of organisms that they are seeing. If they know the width of the field of view, they can estimate the size of the organisms.

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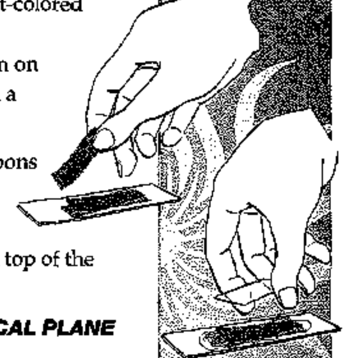

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Students may have noticed that they can't get all three layers of ribbon in focus at one time. The microscope will focus on only one level at a time.

Tell students,

*The lens system in the microscope is designed to focus **at one distance** from the end of the lens. If an object is not exactly at this distance, it is out of focus. The distance at which a microscope lens system focuses is called the **focal plane.** Things that fall into the precise and limited distance from the lens are in focus; things above or below the focal plane are out of focus.*

14. VIEW MULTIMEDIA OF FOCAL PLANE

Call students around the multimedia monitor or allow small groups to view the focal-plane simulation using the Virtual Microscope. Have students explain in terms of focal plane how the microscope focuses through the layers of an object.

After the multimedia demonstration have students write their response to question 3 on the *Focal Plane* sheet.

15. ASSESS PROGRESS: STUDENT SHEET

Collect the lab notebooks when students are finished. Check the *Focal Plane* sheet after class. If students appear to have a clear understanding of the concept of focal plane, give them a ✓.

16. CLEAN UP

Place the ribbons on a piece of paper towel, fold it over, and press to blot the ribbons dry. Return them to the zip bags.

Make sure all slides and coverslips are dry before returning them to the microscope kits. The easiest way to dry a coverslip without bending it is to place it on a piece of blotter paper on the table. Lay a second piece of blotter paper on the coverslip and press gently. The coverslip can be safely blotted dry.

The students need to get in the habit of cleaning and drying slides and coverslips. Wet, dirty slides that stick together are a safety nuisance when students struggle to get them apart.

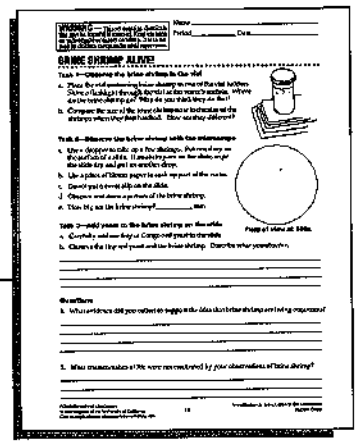
At the end of the last period, when all ribbon pieces are dry and flat, store the ribbon and netting pieces into one zip bag. Save the empty zip bags for snail substrates in Investigation 8.

MATERIALS FOR PART 3

MICROSCOPIC LIFE

FOR EACH GROUP

- 2 Microscopes *
- 1 Microscope kit
- 1 Vial of brine shrimp
- 1 Vial holder
- 1 Flashlight, small
- 1 Plastic cup (for waste)
- • Colored pencils *
- 4 *Diversity of Life Lab Notebooks*
  - *Brine Shrimp Alive!* page 13



Lab Notebook, p. 13

FOR THE CLASS

- 8 Labels
- 4 Dropper bottles
- 1 Set of measuring spoons
- 1 Flashlight, large (optional) *
- 1 Graduated cylinder, 50-ml *
- 1 Bunsen burner *
- 1 Beaker *
- 1 Minispoon
- 1 Dropper
- • Yeast
- • Congo red stain
- • Sugar *
- • Multiple-outlet extension cords (optional) *
- 1 Multimedia setup *
- 1 *FOSS Diversity of Life* CD-ROM
- 1 Overhead projector (optional) *
- 1 Blank overhead transparency (optional) *
- 1 Overhead-transparency marker (optional) *
- • Safety goggles *

FOR ASSESSMENT

- *Assessment Chart for Investigations 1 and 2*
- *Mid-summative Exam 2*

* Supplied by the teacher

GETTING READY FOR PART 3

1. DYE THE YEAST

Prepare a suspension of yeast dyed with Congo red stain. The yeast suspension will keep 1–2 weeks in the refrigerator. It will be used in this part of Investigation 2 and in Investigation 3.

a. Mix 3 minispoons of Congo red stain powder with 100 ml of water.

b. Heat the mixture to about 90°C to disperse the stain.

c. Add 2 ml of dried yeast and stir.

When the suspension cools to room temperature, put about 25 ml in four small dropper bottles for students to share when they feed their brine shrimp. Keep the bottles refrigerated.

2. TRANSFER BRINE SHRIMP TO VIALS

Check your brine shrimp culture by holding it up to the light. If you see little white motes swimming around, they are OK. Correct the water level with spring water if necessary.

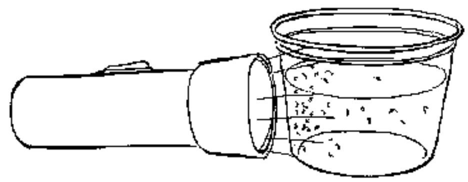
Each group will need a 12-dr. vial containing a few brine shrimp.

a. Fill each vial three-fourths full with salt water from the culture container.

b. Use a dropper to transfer a few tiny brine shrimp to each vial.

c. Cap the vials.

If the brine shrimp are hard to catch, reduce the lighting in the room and hold a flashlight on the side of the container near the waterline. You can use a small flashlight from the kit or, better yet, a larger flashlight of your own. The shrimp will swim toward the light. Carefully draw out a few using a dropper and transfer them into vials.



It may be necessary to renew the supply of brine shrimp in one or more of the vials during the day, if you have multiple classes.

3. VIEW MULTIMEDIA OF BRINE SHRIMP SLIDE

Preview the demonstration of making a slide with brine shrimp. You may want to show this to students to help them prepare this slide.

a. Use a dropper to take up one or two brine shrimp.

b. Put a single drop of water with shrimp on the slide.

c. Touch a piece of blotter paper to the edge of the drop to draw off most of the excess water.

d. Add one drop of Congo red–dyed yeast suspension.

e. Do *not* put a coverslip on this slide.

There should be enough liquid for the shrimp to move around a little bit, but not too much. The yeast should be concentrated, so that students will see the shrimp eat.

4. **ESTABLISH WASTE CUPS**
   Label a plastic cup "waste water" for each group. These can stay at the microscope stations, if they are permanent setups. Otherwise empty them at the end of each class.

5. **PLAN ASSESSMENT: TEACHER OBSERVATION**
   Attach *Assessment Chart for Investigations 1 and 2* to a clipboard and keep it with you during the activity. In Step 6 check to see that students use their microscopes correctly and estimate the size of the brine shrimp.

6. **PLAN MID-SUMMATIVE ASSESSMENT**
   Make copies of *Mid-summative Exam 2*. Give the exam when you have finished this investigation and feel that students understand the concepts in it.

   Give each student a copy of the exam. They should need 10–15 minutes to complete the exam. See the scoring guide on page 403 to grade the exam.

PRESTIGE ACADEMY

A COLLEGE PREPARATORY CHARTER SCHOOL
FOR BOYS
WILMINGTON, DELAWARE

GIVING BOYS A REAL CHANCE FOR A REAL FUTURE

October 2, 2011

Education Associate for Charter School Program
Delaware Department of Education
401 Federal Street, Suite 2
Dover, DE 19901

7th Grade Mathematics

Units of Instruction

Overview:

Curriculum development is an important part of what every teacher does, and at Prestige Academy Charter School, we spend a lot of time and energy documenting this work in a consistent and useful format. Prestige Academy Charter School teachers must develop curriculum aligned with the Delaware State Standards and the National Common Core Standards. While State and Common Core learning standards, objectives and skills are not all-encompassing, they must be the starting point for all teacher planning and course curriculum. Prestige Academy Charter School teachers must ensure that every unit addresses Delaware and Common Core standards and that each and every standard receives sufficient attention during the school year.

All curricula is comprised of **clear** and **measurable** standards. Clear and measurable standards are those that clearly define what students should know and are easily assessable. At Prestige Academy Charter School, our teachers and instructional leaders approach curriculum and instruction with urgency and a focus on achievement while making our lessons and day-to-day activities fun and engaging as to create a lifelong love of learning for our scholars.

The following units of study for 7th Grade Mathematics were chosen because they clearly illustrate Prestige Academy Charter School's commitment to rigorous, engaging, standards-based instruction. Furthermore, the units chosen, Percents, Solving Equations, and Variables, Expressions, and Integers encompass numerous standards that are heavily assessed on the Delaware Comprehensive Assessment System (DCAS). Some modifications to these units of study were made to accommodate our all-boys demographic including: more hands-on learning, collaborative partner work, and clearly communicated performance goals.

The following units of instruction reflect our commitment to mathematics, with each 7th Grade student receiving 100-130 minutes of math instruction per day. In closing, please note that our teachers are using a modified version of the Delaware State Model Units for Math. The units we have submitted reflect a deep dive into the most essential skills and standards for our scholars.

Enclosures:

7th Grade Unit 1- Percents

7th Grade Unit 2- Solving Equations

7th Grade Unit 3- Variables, Expressions, and Integers

Interim Cycle 1

Teacher: Baltimore

Subject: MATH

Grade: 7

Focus for Week 1: **Sub-Skills:**				
Monday, August 29, Day #6	Tuesday, August 30, Day #7	Wednesday, August 31, Day #8	Thursday, September 1, Day #9	Friday, September 2
RE-ORIENTATION: NO ACADEMIC CLASSES	**RE-ORIENTATION: NO ACADEMIC CLASSES**	**<u>State Standard</u>** **7.NSO-N.1** **Compare and Order, Equivalency** **<u>Sub-Skill 1:</u>** SWBAT convert (non-repeating) decimals to fractions.	**<u>State Standard</u>** **7. NSO-N.1** **Compare and Order, Equivalency** **<u>Sub-Skill 1:</u>** SWBAT write fractions as decimals by finding equivalent fractions	**LABOR DAY: NO SCHOOL**
Focus for Week 2: <u>Equivalency</u> **Sub-Skills: Fraction, Decimal, Percent**				
Monday, September 5	Tuesday, September 6, Day #10	Wednesday, September 7, Day #11	Thursday, September 8, Day #12	Friday, September 9, Day #13
LABOR DAY: NO SCHOOL	**<u>State Standard</u>** **NSO-N.1** **Compare and Order, Equivalency** **<u>Sub-Skill 1:</u>** SWBAT translate fractions, with denominators up to 12, into decimals **<u>Sub-Skill 2:</u>** SWBAT to convert common repeating decimals into fractions (3^{rds}, 6^{ths}, 7^{ths}, 9^{ths}, 11^{ths}, 12^{ths}) SWBAT translate any non-repeating decimal into a fraction	**<u>State Standard</u>** **NSO-N.1** **Compare and Order, Equivalency** **<u>Sub-Skill 1:</u>** SWBAT translate fractions and decimals into percents (including less than 1 and over 100) **<u>Sub-Skill 2:</u>** SWBAT translate percents into fractions and decimals (including less than 1 and over 100)	**<u>State Standard</u>** **NSO-N.1** **Compare and Order, Equivalency** **<u>Sub-Skill 1:</u>** SWBAT convert fractions to decimals to find the equivalent percent	**<u>State Standard</u>** **NSO-N.1** **Compare and Order, Equivalency** **<u>Sub-Skill 1:</u>** SWBAT convert mixed numbers into decimals **<u>Sub-Skill 2:</u>** SWBAT convert decimals into mixed numbers
Focus for Week 3: **Sub-Skills: Compare and Order, Equivalency**				
Monday, September 12, Day #14	Tuesday, September 13, Day #15	Wednesday, September 14, Day #16	Thursday, September 15, Day #17	Friday, September 16, Day #18
<u>State Standard</u> **NSO-N.1** **Compare and Order, Equivalency** **<u>Sub-Skill 1:</u>** SWBAT compare and order fractions, decimals and percents using <,>, and = **<u>Sub-Skill 2:</u>** SWBAT order fractions, decimals and percents from least to greatest in list form	**<u>State Standard</u>** **NSO-N.1** **Compare and Order, Equivalency** **<u>Sub-Skill 1:</u>** SWBAT place fractions, decimals and percents on a number line **<u>Sub-Skill 2:</u>** SWBAT order fractions, decimals and percents on a number line	**<u>State Standard</u>** **NSO-N.1** **Compare and Order, Equivalency** **<u>Sub-Skill 1:</u>** SWBAT compare and order integers using <,>, and = SWBAT place and order integers using a number line **<u>Sub-Skill 2:</u>** SWBAT order integers from least to greatest and greatest to least in list form SWBAT recognize how the terms fastest and slowest effect order in terms of least to greatest	**<u>State Standard</u>** **7.NSO-C.10** **Add and Subtract Decimals** **7.NSO-C.10** **Multiply and Divide Decimals** **<u>Sub-Skill 1:</u>** SWBAT add and subtract with decimals **<u>Sub-Skill 2:</u>** SWBAT multiply with decimals SWBAT divide with decimals up to the thousandths place	**<u>State Standard</u>** **7.NSO-N.7** **Number Theory** **<u>Sub-Skill 1:</u>** SWBAT define prime numbers and find all prime factor of any number up to 3 digits **<u>Sub-Skill 2:</u>** SWBAT write the prime factors of any number into exponent form SWBAT define relatively prime and determine if two numbers are relatively prime in comparison to each other
Focus for Week 4: **Sub-Skills:**				

Monday, September 19, Day #19	Tuesday, September 20, Day #20	Wednesday, September 21, Day #21	Thursday, September 22, Day #22	Friday, September 23, Day #23
State Standard 7.NSO-C.12 Select Appropriate Operations (taught strictly on this day; to be spiraled throughout) **Sub-Skill 1:** SWBAT recognize and solve problems where addition and/or subtraction is needed to solve **Sub-Skill 2:** SWBAT recognize and solve problems where multiplication and/or division is needed to solve SWBAT recognize and solve problems where a combination of any 4 operations is needed to solve	**State Standard** 7.NSO-C.17 & C.18 Inverse Relationships **Sub-Skill 1:** SWBAT describe adding by a number is the same as subtracting by the negative of a number SWBAT describe subtracting a number is the same as adding the negative **Sub-Skill 2:** SWBAT describe that dividing by a whole number is the same as multiplying by its inverse and multiplying a number is the same as dividing by the inverse	**State Standard** 7.NSO-N.9 Square Roots **Sub-Skill 1:** SWBAT define square root SWBAT define the square root as a square with that area and the answer as the length of the sides **Sub-Skill 2:** SWBAT find square roots up to the square root of 400	**State Standard** 7.DASP.1 Data and Central Tendency **Sub-Skill 1:** SWBAT determine the mean, median, mode and range in a set of numbers, chart, or graph **Sub-Skill 2:** SWBAT determine missing number, when presented with a requested mean, median, mode or range	**State Standard** 7.DASP.1 Data and Central Tendency 7.DASP.2 Data in Plots, Tables, and Graphs **Sub-Skill 1:** SWBAT determine missing number, when presented with a requested mean, median, mode or range (cont.) **Sub-Skill 2:** SWBAT identify appropriate, inappropriate and misleading scales for showing tabular data on charts and graphs. SWBAT create tables and charts

Focus for Week 5: Data in Plots, Tables, and Graphs
Sub-Skills:

Monday, September 26, Day #24	Tuesday, September 27, Day #25	Wednesday, September 28, Day #26	Thursday, September 29, Day #27	Friday, September 30, Day #28
State Standard 7.DASP.2 Data in Plots, Tables, and Graphs **Sub-Skill 1:** SWBAT recognize that circle graphs are used to display percentages and that the percentages displayed in a circle graph must add up to 100%. SWBAT match circle graphs to the data set used to create them. SWBAT solve problems with circle graphs, including those that involve percentages and fractions **Sub-Skill 2:** SWBAT create circle graphs using proportions and protractors	**State Standard** 7.DASP.2 Data in Plots, Tables, and Graphs **Sub-Skill 1:** SWBAT create a two and three circle Venn diagram **Sub-Skill 2:** SWBAT create a stem and leaf plot SWBAT create a histogram	**State Standard** 7.DASP.2 Data in Plots, Tables, and Graphs **Sub-Skill 1:** SWBAT interpret, analyze, and draw conclusions from circle, venn, stem, histogram, tables, and charts	**INTERIM #1 MATH**	**State Standard** 7.NSO.N-6 **Sub-Skill 1:** SWBAT solve order of operations problems with fractions and mixed numbers

Interim Cycle 2
Teacher:
Subject: MATH
Grade: 7

Focus for Week 1: Fractions and Mixed Numbers (+, -, x, divide)
Sub-Skills: simplifying

Monday, October 3, Day #29	Tuesday, October 4, Day #30	Wednesday, October 5, Day #31	Thursday, October 6, Day #32	Friday, October 7, Day #33 ½ Day – one hour block

State Standard 7.NSO.N-3 Absolute Value **Sub-Skill 1:** SWBAT define absolute value in terms of spatial relationship on a number line SWBAT determine the absolute value of ANY number **Sub-Skill 2:** SWBAT solve math expressions involving absolute value SWBAT solve math expressions involving absolute value with the negative on the outside of the AB bars	**State Standard** 7.NSO.C.10.c Add and Subtract Fractions **Sub-Skill 1:** SWBAT simplify fractions, find a common denominator between fractions, and enlarge fractions. **Sub-Skill 2:** SWBAT add and subtract fractions and mixed numbers with like and unlike denominators	**State Standard** 7.NSO.C.10.c Add and Subtract Fractions **Sub-Skill 1:** SWBAT add and subtract mixed numbers with borrowing and carrying	**State Standard** 7.NSO.C.10.d Multiply and Divide Fractions **Sub-Skill 1:** SWBAT to multiply and divide fractions **Sub-Skill 2:** SWBAT multiply and divide mixed numbers	**State Standard** 7.NSO.C.10.d Multiply and Divide Fractions **Sub-Skill 1:** SWBAT to multiply and divide fractions **Sub-Skill 2:** SWBAT multiply and divide mixed numbers
Focus for Week 2: Compute with Integers **Sub-Skills: Percents**				
Monday, October 10, Day #34	Tuesday, October 11, Day #35	Wednesday, October 12, Day #36	Thursday, October 13, Day #37	Friday, October 14, Day #38
State Standard 7.NSO.C.10.e Compute with Integers **Sub-Skill 1:** SWBAT subtract negative integers (0-50) SWBAT solve order of operations problems with negative integers	**State Standard** 7.NSO.C.10.e Compute with Integers **Sub-Skill 1:** SWBAT add negative integers (0-50) **Sub-Skill 2:** SWBAT subtract negative integers (0-50) SWBAT solve order of operations problems with negative integers (spiraled)	**State Standard** 7.NSO.C.10.e Compute with Integers **Sub-Skill 1:** SWBAT multiply and divide negative integers **Sub-Skill 2:** SWBAT operate with negative fractions up to the tenths place (spiraled) SWBAT solve order of operations problems with negative integers	**State Standard** 7.NSO.C.10/13 Compute with Percents **Sub-Skill 1:** SWBAT convert from a percent to a decimal and vice versa. SWBAT calculate percentages in real-world situations such as tax, tips and commissions. **Sub-Skill 2:** SWBAT find the sale price of an item given the original price and the percent discount.	**State Standard** 7.NSO.C.10/13 Compute with Percents **Sub-Skill 1:** SWBAT calculate actual values using percentages from a circle graph. **Sub-Skill 2:** SWBAT calculate percent change
Focus for Week 3: Exponents and Scientific Notation **Sub-Skills:**				
Monday, October 17, Day #39	Tuesday, October 18, Day #40	Wednesday, October 19, Day #41	Thursday, October 20, Day #42	Friday, October 21, Day #43 ½ Day – one hour block
State Standard 7.NSO.C.16 Exponents **Sub-Skill 1:** SWBAT define positive powers as repeated multiplication SWBAT define powers of 2 and 3 as the area of a square and the volume of a cube **Sub-Skill 2:** SWBAT define negative powers as repeated division SWBAT define negative powers as the multiplicative inverse	**State Standard** 7.NSO.C.16 Exponents **Sub-Skill 1:** SWBAT simplify positive exponents into standard form (up to power of 6) SWBAT simplify negative exponents into standard form (up to the power of -6) **Sub-Skill 2:** SWBAT multiply and divide positive powers	**State Standard** 7.NSO.C.16 Exponents **Sub-Skill 1:** SWBAT multiply and divide negative numbers **Sub-Skill 2:** SWBAT represent the inverse of a positive or negative exponent	**State Standard** 7.NSO-N.4 Scientific Notation **Sub-Skill 1:** SWBAT define scientific notation SWBAT take a number up to the trillions place and convert it to scientific notation SWBAT scientifically noted number and write it in standard form **Sub-Skill 2:** SWBAT add and subtract numbers in scientifically notated form	**State Standard** 7.NSO-N.4 Scientific Notation **Sub-Skill 1:** SWBAT add and subtract numbers in scientifically notated form **Sub-Skill 2:** SWBAT multiply and divide numbers in scientifically notated form
Focus for Week 4: Data **Sub-Skills:**				
Monday, October 24, Day #44	Tuesday, October 25, Day #45	Wednesday, October 26, Day #46	Thursday, October 27, Day #47	Friday, October 28, Day #48

State Standard 7.PRA-2 Evaluate Expressions Given Variables **Sub-Skill 1:** SWBAT replace variables with given values **Sub-Skill 2:** SWBAT evaluate expressions given values for variables	**State Standard** 7.PRA-2 Evaluate Expressions Given Variables **Sub-Skill 1:** SWBAT replace variables with given values **Sub-Skill 2:** SWBAT evaluate expressions given values for variables	**State Standard** 7.DASP.1 Data and Central Tendency **Sub-Skill 1:** SWBAT define measures of central tendency and effectively use them to analyze data in problem solving situations	**State Standard** 7.DASP.3 Data Sampling **Sub-Skill 1:** SWBAT identify various sampling methods and recognize biased samples	**State Standard** 7.DASP.3 Data Sampling **Sub-Skill 1:** SWBAT identify and correct biased questions
Focus for Week 5: IA2 REVIEW, Algebra **Sub-Skills:**				
Monday, October 31, Day #49	Tuesday, November 1, Day #50	Wednesday, November 2, Day #51	Thursday, November 3, Day #52	Friday, November 4, Day #53 End of Quarter 1
State Standard **Sub-Skill 1:** SWBAT review standards covered in IA2	**State Standard** **Sub-Skill 1:** SWBAT review standards covered in IA2	**INTERIM #2 MATH**	**State Standard** 7.PRA.2 **Sub-Skill 1:** SWBAT define expressions and equations and tell the difference SWBAT explain he purpose of a variable in a given expression or equation **Sub-Skill 2:** SWBAT solve algebraic equations for a variable on the other side of the equal sign when given all other variables in the expression	**State Standard** 7.PRA.2 **Sub-Skill 1:** SWBAT solve algebraic equations for the variable on the expression side of the equal sign when given all other variables in the equation

Interim Cycle 3

Teacher:

Subject: MATH

Grade: 7

Focus for Week 1: Algebra **Sub-Skills:**				
Monday, November 7, Day #54	Tuesday, November 8, Day #55	Wednesday, November 9, Day #56	Thursday, November 10, Day #57 ½ Day – one hour block	Friday, November 11, Day #58
State Standard 7.PRA.2 **Sub-Skill 1:** SWBAT calculate simple interest **Sub-Skill 2:** SWBAT solve problems relating to calculating simple interest	**State Standard** 7.PRA.4/10 **Sub-Skill 1:** SWBAT solve equations sharing a common variable **Sub-Skill 2:** SWBAT define variable, equation, term, inequality, expression, constant, and coefficient	**State Standard** 7.PRA.4 **Sub-Skill 1:** SWBAT write an equation from an xy or input/output graph	**State Standard** 7.PRA.4 **Sub-Skill 1:** SWBAT write an expression from a simple variable statement	**VETERANS DAY: NO SCHOOL**
Focus for Week 2: Algebraic Equations and Inequalities **Sub-Skills:**				
Monday, November 14, Day #58	Tuesday, November 15, Day #59	Wednesday, November 16, Day #60	Thursday, November 17, Day #61	Friday, November 18, Day #62

State Standard 7.PRA.4 **Sub-Skill 1:** SWBAT write an equation from a statement **Sub-Skill 2:** SWBAT write an equation from a graph	**State Standard** 7.PRA.4 **Sub-Skill 1:** SWBAT write an equation from a word problem **Sub-Skill 2:** SWBAT write an equation from a statement and a graph	**State Standard** 7.PRA.5 **Sub-Skill 1:** SWBAT represent an equation on a number line	**State Standard** 7.PRA.5 **Sub-Skill 1:** SWBAT write an inequality to represent a situation on a number line	**State Standard** 7.PRA.5 **Sub-Skill 1:** SWBAT write an inequality to represent a verbal statement
Focus for Week 3: Patterns (Arithmetic and Geometric) **Sub-Skills:**				
Monday, November 21, Day #63	Tuesday, November 22, Day #64	Wednesday, November 23	Thursday, November 24	Friday, November 25
State Standard 7.PRA.1 **Sub-Skill 1:** SWBAT recognize arithmetic patterns and find the next three terms	**State Standard** 7.PRA.1 **Sub-Skill 1:** SWBAT recognize geometric patterns and find the next three terms	**THANKSGIVING BREAK: NO SCHOOL (PD DAY FOR TEACHERS)**	**THANKSGIVING BREAK: NO SCHOOL**	**THANKSGIVING BREAK: NO SCHOOL**
Focus for Week 4: Algebraic Properties **Sub-Skills:**				
Monday, November 28, Day #65	Tuesday, November 29, Day #66	Wednesday, November 30, Day #67	Thursday, December 1, Day #68	Friday, December 2, Day #69
State Standard 7.PRA.5 **Sub-Skill 1:** SWBAT solve for expressions when the answer to a variable is given **Sub-Skill 2:** SWBAT solve for one step equations and show how to check answers	**State Standard** 7.PRA.5 **Sub-Skill 1:** SWBAT solve for two step equations and show how to check answers	**State Standard** 7.NSO.C.18 **Sub-Skill 1:** SWBAT solve algebraic problems using the associative, commutative, and distributive properties **Sub-Skill 2:** SWBAT demonstrate different ways to use the distributive property	**State Standard** 7.PRA.9 **Sub-Skill 1:** SWBAT recognize which property to use to solve an algebraic equation **Sub-Skill 2:** SWBAT solve an algebraic equation using identity, inverse, distributive, associative, and communicative properties	**State Standard** 7.PRA.9 **Sub-Skill 1:** SWBAT explain why using the identity, inverse, distributive, associative, and communicative properties works to solve given problems (Review) **Sub-Skill 2** Algebraic Properties QUIZ
Focus for Week 5: Ratios and Proportions **Sub-Skills:**				
Monday, December 5, Day #70	Tuesday, December 6, Day #71	Wednesday, December 7, Day #72	Thursday, December 8, Day #73	Friday, December 9, Day #74 ½ Day – one hour block
State Standard 7.NSO.N.8 **Sub-Skill 1:** SWBAT define ratios SWBAT write ratios in the 3 standard methods **Sub-Skill 2:** SWBAT recognize and produce ratios in the correct order when presented	**State Standard** 7.NSO.C.14 **Sub-Skill 1:** SWBAT reduce ratios up to 3 digits **Sub-Skill 2:** SWBAT use a ratio to solve a word problem by reducing and enlarging	**State Standard** 7.NSO.C.14 **Sub-Skill 1:** SWBAT define proportions **Sub-Skill 2:** SWBAT recognize equivalent ratios using proportions	**State Standard** 7.NSO.C.14 **Sub-Skill 1:** SWBAT use 3 ways to solve for x in a proportion **Sub-Skill 2:** SWBAT setup and solve a proportion from a word problem	**State Standard** 7.NSO.C.14 **Sub-Skill 1:** SWBAT setup and solve a proportion involving rates relating to money and time or quantity
Focus for Week 6: Proportion and Rates **Sub-Skills:**				
Monday, December 12, Day #75	Tuesday, December 13, Day #76	Wednesday, December 14, Day #77	Thursday, December 15, Day #78	Friday, December 16, Day #79
State Standard 7.NSO.C.14	**State Standard** 7.NSO.C.14	**State Standard** 7.M.5	**State Standard** 7.M.4	**State Standard** 7.M.4

Sub-Skill 1: SWBAT setup and solve a proportion involving rates relating to time and distance **Sub-Skill 2:** SWBAT setup and solve a proportion involving rates relating to distance and quantity	**Sub-Skill 1:** SWBAT setup and solve a proportion involving rates relating to distance on a scale map **Sub-Skill 2:** SWBAT setup and solve proportions of similar figures	**Sub-Skill 1:** SWBAT solve problems relating to scale factor **Sub-Skill 2:** SWBAT dilate a polygon on a coordinate grid using scale factor	**Sub-Skill 1:** SWBAT read or interpret information contained in drawings and models made to scale **Sub-Skill 2:** SWBAT construct a scale drawing using rates	**Sub-Skill 1:** SWBAT solve for missing figures on scale drawing and maps **Sub-Skill 2:** Proportion and Rates (scale factor) REVIEW & QUIZ
Focus for Week 7: Ratios and Proportions **Sub-Skills: Scale Factor**				
Monday, December 19, Day #80	Tuesday, December 20, Day #81	Wednesday, December 21, Day #82	Thursday, December 22, Day #83	Friday, December 23
State Standard 7.M.1 **Sub-Skill 1:** SWBAT recognize units of measurement in the US and Metric systems **Sub-Skill 2:** SWBAT recognize units of measurement that relate to volume (capacity), mass (weight), and length (distance)	**State Standard** 7.M.1 **Sub-Skill 1:** SWBAT convert within metric measurements **Sub-Skill 2:** SWBAT convert within US measurements	**State Standard** 7.M.1 **Sub-Skill 1:** SWBAT convert between US and metric measurements	**State Standard** 7.M.1 **Sub-Skill 1:** SWBAT convert cubed units into another form of cubed units **Sub-Skill 2:** SWBAT convert square units into another form of square units Mini Review & QUIZ	**WINTER BREAK: NO SCHOOL (PD DAY FOR TEACHERS)**
Focus for Week 8: Culture Reset **Sub-Skills:**				
Monday, January 2	Tuesday, January 3	Wednesday, January 4, Day #85	Thursday, January 5, Day #86	Friday, January 6, Day #87
WINTER BREAK: NO SCHOOL)	**WINTER BREAK: NO SCHOOL (PD DAY FOR TEACHERS)**	**CULTURE RESET (NO ACADEMIC CLASSES)**	**CULTURE RESET**	**CULTURE RESET**
Focus for Week 9: Proportions **Sub-Skills: Rate of Change**				
Monday, January 9, Day #87	Tuesday, January 10, Day #88	Wednesday, January 11, Day #89	Thursday, January 12, Day #90	Friday, January 13, Day #91
State Standard 7.PRA.7 **Sub-Skill 1:** SWBAT recognize a positive rate of change and graph it appropriately **Sub-Skill 2:** SWBAT recognize and negative rate of change and graph it appropriately	**State Standard** 7.PRA.7 **Sub-Skill 1:** SWBAT compare two rates of change in written format	**State Standard** 7.PRA.8 **Sub-Skill 1:** SWBAT determine the value of a variable given other proportional values, and use it to solve for other parts of the equation	**State Standard** 7.PRA.11 **Sub-Skill 1:** SWBAT graph ratio equivalencies to a quadrant grid **Sub-Skill 2:** SWBAT answer problems relating to comparing two equations on a quadrant grid	**State Standard** 7.PRA.7 **Sub-Skill 1:** SWBAT plot equations to a quadrant grid **Sub-Skill 2:** REVIEW & QUIZ
Focus for Week 10: Rate Problems **Sub-Skills: 3D Figures**				
Monday, January 16	Tuesday, January 17, Day #92	Wednesday, January 18, Day #93	Thursday, January 19, Day #94	Friday, January 20, Day #95
MLK DAY: NO SCHOOL	**State Standard** 7.M.3 **Sub-Skill 1:** SWBAT define slope SWBAT solve rate problems using models	**State Standard** 7.M.3 **Sub-Skill 1:** SWBAT solve rate problems using a formula	**State Standard** 7.M.3 **Sub-Skill 1:** SWBAT solve problems about density and velocity using graphs and formulas	**State Standard** 7.G.1 **Sub-Skill 1:** SWBAT identify a 3D figure by using its name SWBAT determine the net of a 3D figure

	Sub-Skill 2: SWBAT solve rate problems using a graph		**Sub-Skill 2:** SWBAT check the reasonableness of an answer and explain the process of doing so	**Sub-Skill 2:** SWBAT determine how many parallel faces a 3D figure has
Focus for Week 11: **Sub-Skills:**				
Monday, January 23, Day #96	Tuesday, January 24, Day #97	Wednesday, January 25, Day #98	Thursday, January 26, Day #99	Friday, January 27, Day #100 End of Quarter 2
State Standard **Sub-Skill 1:** SWBAT review standards covered in IA3	**State Standard** **Sub-Skill 1:** SWBAT review standards covered in IA3	**Interim #3 Math**	**State Standard** 7.M.2 **Sub-Skill 1:** SWBAT determine an understanding of area in terms of number of squares	**State Standard** 7.M.2 **Sub-Skill 1:** SWBAT determine an understanding of surface area in terms of number of squares on the outside of a 3D figure

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Interim Cycle 4

Teacher:

Subject: MATH

Grade: 7

Focus for Week 1: **Sub-Skills:**				
Monday, January 30, Day #101	Tuesday, January 31, Day #102	Wednesday, February 1, Day #103	Thursday, February 2, Day #104 ½ Day – one hour block	Friday, February 3, Day #105 ½ Day – one hour block
State Standard 7.M.2 **Sub-Skill 1:** SWBAT determine an understanding of volume in terms of number of cubes	**State Standard** 7.M.2 **Sub-Skill 1:** SWBAT find circumference of circles	**State Standard** 7.M.2 **Sub-Skill 1:** SWBAT find area of circles	**State Standard** 7.M.2 **Sub-Skill 1:** SWBAT answer challenge problems that require them to compare and manipulate answers involving the area and circumference of circles	**State Standard** 7.M.2 **Sub-Skill 1:** SWBAT determine the perimeter of any polygon
Focus for Week 2: Geometry **Sub-Skills: Congruency and Similarity**				
Monday, February 6, Day #106	Tuesday, February 7, Day #107	Wednesday, February 8, Day #108	Thursday, February 9, Day #109	Friday, February 10, Day #110
State Standard 7.M.2 **Sub-Skill 1:** SWBAT determine the volume of regular 3D shapes	**State Standard** 7.M.2 **Sub-Skill 1:** SWBAT determine the area of regular polygons	**State Standard** 7.G.2 **Sub-Skill 1:** SWBAT define congruence SWBAT define similar **Sub-Skill 2:** SWBAT describe that congruent figures have the exact	**State Standard** 7.G.2 **Sub-Skill 1:** SWBAT determine triangle congruency using SSS, SAS< or ASA	**State Standard** 7.G.3 **Sub-Skill 1:** SWBAT solve find missing sides and angles problems through knowing properties of congruence and similarity
Focus for Week 3: Geometry **Sub-Skills: Pythagorean Theorem**				
Monday, February 13, Day #111	Tuesday, February 14, Day #112	Wednesday, February 15, Day #113	Thursday, February 16, Day #114	Friday, February 17
State Standard	**State Standard**	**State Standard**	**State Standard**	**NO SCHOOL (PD DAY FOR**

7.G.4 **Sub-Skill 1:** SWBAT derive the Pythagorean theorem	7.G.4 **Sub-Skill 1:** SWBAT solve for C on the Pythagorean theorem	7.G.4 **Sub-Skill 1:** SWBAT solve for A and B on the Pythagorean theorem	7.G.4 **Sub-Skill 1:** SWBAT solve for missing distances using the Pythagorean theorem	**TEACHERS)**
Focus for Week 4: **Sub-Skills:**				
Monday, February 20	Tuesday, February 21, Day #115	Wednesday, February 22, Day #116	Thursday, February 23, Day #117	Friday, February 24, Day #118
PRESIDENT'S DAY: NO SCHOOL	**State Standard** 7.G.5 **Sub-Skill 1:** SWBAT construct and midpoint and a bisector using a protractor **Sub-Skill 2:** SWBAT construct an angle using a protractor	**State Standard** 7.G.5 **Sub-Skill 1:** SWBAT construct various triangles using a protractor and determine what kinds of triangles are possible	**State Standard** 7.G.6 **Sub-Skill 1:** SWBAT plot simple figures on a coordinate grid	**State Standard** 7.G.6 **Sub-Skill 1:** SWBAT determine/estimate lengths and area of polygons on a coordinate grid
Focus for Week 5: **Sub-Skills:**				
Monday, February 27, Day #119	Tuesday, February 28, Day #120	Wednesday, February 29, Day #121	Thursday, March 1, Day #122	Friday, March 2, Day #123
State Standard 7.G.6 **Sub-Skill 1:** SWBAT translate polygons on a coordinate grid	**State Standard** 7.G.6 **Sub-Skill 1:** SWBAT reflect polygons on a coordinate grid	**State Standard** 7.G.6 **Sub-Skill 1:** SWBAT rotate polygons on a coordinate grid	**State Standard** 7.G.6 **Sub-Skill 1:** SWBAT define tessellation **Sub-Skill 2:** SWBAT predict how a tessellation will transform under translations, reflections, and rotations	**State Standard** 7.DASP.4 **Sub-Skill 1:** SWBAT use tree diagrams to solve for compound probability
Focus for Week 6: **Sub-Skills:**				
Monday, March 5, Day #124	Tuesday, March 6, Day #125	Wednesday, March 7, Day #126	Thursday, March 8, Day #127	Friday, March 9, Day #128
State Standard 7.DASP.4 **Sub-Skill 1:** SWBAT mathematically solve for compound probability	**State Standard** 7.DASP.5 **Sub-Skill 1:** SWBAT define disjointed events **Sub-Skill 2:** SWBAT find the probability of a disjoint event	**State Standard** 7.DASP.5 **Sub-Skill 1:** SWBAT define dependent events **Sub-Skill 2:** SWBAT find dependent probability	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**
Focus for Week 7: **Sub-Skills:**				
Monday, March 12, Day #129	Tuesday, March 13, Day #130	Wednesday, March 14, Day #131	Thursday, March 15, Day #132	Friday, March 16
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**NO SCHOOL (PD DAY FOR TEACHERS)**

Focus for Week 8: **Sub-Skills:**				
Monday, March 19, Day #133	Tuesday, March 20, Day #134	Wednesday, March 21, Day #135	Thursday, March 22, Day #136	Friday, March 23, Day #137
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**
Focus for Week 9: **Sub-Skills:**				
Monday, March 26, Day #138	Tuesday, March 27, Day #139	Wednesday, March 28, Day #140	Thursday, March 29, Day #141	Friday, March 30, Day #142
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**
Focus for Week 10: **Sub-Skills:**				
Monday, April 2, Day #143	Tuesday, April 3, Day #144	Wednesday, April 4, Day #145	Thursday, April 5, Day #146	Friday, April 6
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**SPRING BREAK: NO SCHOOL**
Focus for Week 11: **Sub-Skills:**				
Monday, April 16, Day #147	Tuesday, April 17, Day #148	Wednesday, April 18, Day #149	Thursday, April 19, Day #150	Friday, April 20, Day #151 End of Quarter 3
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**INTERIM #4 MATH**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

(Post-Interims) Review; DCAS Testing Period
Teacher:
Subject: MATH
Grade: 7

Focus for Week 1: **Sub-Skills:**				
Monday, April 23, Day #152	Tuesday, April 24, Day #153	Wednesday, April 25, Day #154	Thursday, April 26, Day #155	Friday, April 27, Day #156 ½ Day – one hour block
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**
Focus for Week 2: **Sub-Skills:**				
Monday, April 30, Day #157	Tuesday, May 1, Day #158	Wednesday, May 2, Day #159	Thursday, May 3, Day #160	Friday, May 4, Day #161
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**
Focus for Week 3: **Sub-Skills:**				
Monday, May 7, Day #162	Tuesday, May 8, Day #163	Wednesday, May 9, Day #164	Thursday, May 10, Day #165	Friday, May 11, Day #166
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**
Focus for Week 4: **Sub-Skills:**				
Monday, May 14, Day #167	Tuesday, May 15, Day #168	Wednesday, May 16, Day #169	Thursday, May 17, Day #170	Friday, May 18, Day #171
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**
Focus for Week 5: **Sub-Skills:**				
Monday, May 21, Day #172	Tuesday, May 22, Day #173	Wednesday, May 23, Day #174	Thursday, May 24, Day #175	Friday, May 25, Day #176 ½ Day – one hour block
State Standard **Sub-Skill 1:**	**State Standard** **Sub-Skill 1:**	**State Standard** **Sub-Skill 1:**	**State Standard** **Sub-Skill 1:**	**State Standard** **Sub-Skill 1:**

Sub-Skill 2:	**Sub-Skill 2:**	**Sub-Skill 2:**	**Sub-Skill 2:**	**Sub-Skill 2:**
Focus for Week 6: **Sub-Skills:**				
Monday, May 28	Tuesday, May 29, Day #177	Wednesday, May 30, Day #178	Thursday, May 31, Day #179	Friday, June 1, Day #180
MEMORIAL DAY: NO SCHOOL	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**
Focus for Week 7: **Sub-Skills:**				
Monday, June 4, Day #181	Tuesday, June 5, Day #182	Wednesday, June 6, Day #183	Thursday, June 7, Day #184	Friday, June 8, Day #185
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**
Focus for Week 8: **Sub-Skills:**				
Monday, June 11, Day #186	Tuesday, June 12, Day #187	Wednesday, June 13, Day #188 ½ Day - Finals	Thursday, June 14, Day #189 ½ Day – Finals	Friday, June 15, Day #190 ½ Day - Finals
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**MATH FINALS**	**ELA FINALS**	**SCIENCE/SS FINALS**

Prestige Academy Charter School

Unit Title: Percents

Grade Level(s): 7

Subject/Topic Areas: Pre-Algebra

Key Vocabulary: Percent, percent of change, percent of increase, percent of decrease, markup, discount, tax, tip.

Designed By:

Time Frame: 12 to 15 hours
Date:

SUMMARY OF PURPOSE: In this 7th grade Math unit, students will learn about Percents. Students will form a solid base of percents that will be vital in future Math classes, as well as everyday life. Students will learn how percents relate to real life situations and use their skills to solve problems.

Stage 1: Desired Results

Common Core/ Delaware Standards

Primary: Numeric Reasoning (Standard 1)

- Identify how percents are related to fractions
- Solve percent problems
- Apply the percent equation

Secondary: Problem Solving (Standard 5)

- Build a base for Pre-Algebra and Algebra.
- Use this new mathematical knowledge to solve problems involving percents
- Be able to communicate how to calculate tip
- Use all integral vocabulary associated with this unit
- Develop mathematical arguments.
  Communication (Standard 7)

Key Concepts/Big Ideas

Percents are used every day and in real life.

Enduring Understandings

Students will understand that…
Percents will be an integral part of their lives inside and out of school.

Essential Questions

- How do you set up a percent proportion?
- How do you write a percent equation?
- How do you solve percent problems in real life?

Real World Context

- Real world situations and problems
- Multiple and purposeful opportunities for students to participate and make new connections

Learning Targets/Goals
Students will know… • Relate percents to fractions. • Write percent proportions and solve them • Write percent equations *Students will be able to…* (21^{st} century skills) • Solve percent problems in real life. • Be able to calculate tip, discount and markup in real life.

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task
To evaluate percent proportions. Students will first appropriately set-up, then solve the percent proportion.

Rubrics for Transfer Tasks

Performance Task

	4	3	2	1
Percent and proportion set-up	Show correct set-up. Cross multiplication is correct. Answer is circled.	Show correct set-up. Cross multiplication is correct. There may be one calculation error. Answer is circled.	Proportion is not set up correctly, but student has attempted to correctly place values. Answer is circled.	No work is shown. An answer may or may not be circled.

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.

Summative Assessments:
Comprehensive exams
Aligned to standards

Student Self-Assessment and Reflection

Pairs Communication Activity

Directions:

Students will work on a team-building assignment. Students will calculate discounts from advertisements and decide what items they can purchase. Students will also write in complete sentences how they can figure out the proper tip to leave at a restaurant, without using a calculator.

Reflection:

1. Which of the percent calculations were most difficult for you? Why?
2. Can you determine the amount for a tip, given the bill total, without a calculator?

- BE SURE TO INCLUDE A COLLABORATIVE LEARNING ACTIVITY

Instructional Resources

Achievement Network
Class zone website
Various websites
Various Pre-Algebra textbooks

Differentiation

Students will pair up with a classmate to solve problems with a team approach.
Students will get one-on-one time with teacher.

Enrichment

Students will pair up with a classmate to solve problems with a team approach.
Students will receive the most difficult skill based problems as well as real-life word problems.

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

- **Set up and solve percent proportions.**
- **Calculate tax, tip, discount and markup without a calculator.**

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Lesson 1

General Topics: Percents and Fractions
Key Vocabulary: percent,
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Explore that the word percent means per hundred. A percent is a ratio whose denominator is 100.
4. Have students brainstorm for as many items in the world that are based on a percent.

Check for Understanding:

Lesson 2

General Topics: Percents and Proportions
Key Vocabulary: proportions
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Explore how to solve a percent problem.
4. Develop the idea of percent of a bill for a tip.

Check for Understanding:

Lesson 3

General Topics: Percent Equations
Key Vocabulary: prior vocabulary
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Develop the concept of the percent equation.
4. Student may also write a percent proportion or percent equation to solve a percent problem.

Check for Understanding:

Lesson 4

General Topics: Percent Applications
Key Vocabulary: markup, wholesale, discount, tax, tip
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Solve many and various percent problems in real-life, including markup, whole-sale and discount problems, as well as tax and tip.

Check for Understanding:

Prestige Academy Charter School

Score____
50

Name___________________________ Pre-Algebra

Date_______________________

Show all work. Simplify all answers completely. Circle your answers.

1. Write 92% as a fraction in simplest form.
2. Write $\frac{3}{4}$ as a percent.
3. What percent of 5 is 2?

4. What number is 12% of 60?

5. 6 is 75% of what number?

6. What number is 75% of 44?

7. What is 3%, as a decimal?

8. What is 120% as a decimal?

9. What is .65 as a percent?

10. You earn a monthly salary of $1000 plus a 2% commission on your total sales for the month. Your total sales for this month were $10,500. What were your total earnings for this month?

Prestige Academy Charter School

Score____
100

Name______________________________ Pre-Algebra

Date__________________________

Show all work and set-ups wherever possible! Simplify answers completely. Circle all answers.

1. Write the fraction as a percent.

$$\frac{3}{10}$$

2. Use the given information to find the new amount.

Original price: $14.01

Markup percent: 45%

New price:__________

3. Identify the percent of change as an *increase* or a *decrease*. Then find the percent of change. Round your answer to the nearest tenth if necessary.

Original: 30

New: 50

Percent of change:__________

Increase or Decrease?

4. For an account that earns simple interest, find the balance of the account.

$P = \$175,\ r = 6\%,\ t = 7$ years

5. Use the simple interest formula to find the unknown quantity.

$I = \$90$
$P = \underline{\ ?\ }$
$r = 4\%$
$t = 3$ years

6. In 1991, the circulation of a local newspaper was 2780. In 1992, its circulation was 2480. Find the percent of change in the newspaper's circulation. Is this a percent of increase or decrease? Round your answer to the nearest whole percent.

7. Write the percent as a fraction.

92%

8. What percent of 25 is 64?

9. A jewelry store keeps track of the number of different types of jewelry it sells. Last week 31% of the jewelry sold were necklaces and $\frac{3}{10}$ of the jewelry sold were earrings. Which type represents a larger percent of the jewelry sold last week?

10. Write the decimal as a percent.

0.03

11. Write a proportion and answer the question. Your answer should contain two decimal places.

46% of 47 is what number?

12. Write the percent as a decimal.

66.2%

13. Faye scored 26 points in her basketball game. This score accounts for 13% of the total points she has scored during the season. How many points has Faye scored during the season?

14. Write the decimal as a percent.

2.3

15. At the end of the summer, lawn furniture selling at a market price of \$474 is on sale for 21% off. What is the discount?

16. Write a proportion and answer the question.

10% of what number is 46?

Reference: [7.1.4]
[1] 30%

Reference: [7.6.57]
[2] $20.31

Reference: [7.5.46]
[3] [D]

Reference: [7.7.72]
[4] $263.14

Reference: [7.7.67]
[5] [D]

Reference: [7.5.54]
[6] [D]

Reference: [7.1.2]
[7] $\frac{23}{25}$

Reference: [7.2.13]
[8] [D]

Reference: [7.1.8]
[9] necklaces

Reference: [7.3.25]
[10] 3%

Reference: [7.2.12]
[11] [B]

Reference: [7.3.27]
[12] [A]

Reference: [7.2.20]
[13] [D]

Reference: [7.3.24]
[14] 230%

Reference: [7.6.65]
[15] $99.54

Reference: [7.2.14]
[16] $\frac{46}{b} = \frac{10}{100}$

***This lesson is typically taught in February, usually near Valentine's Day.

7.2 Percents and Proportions

There are several different ways to solve percent problems. In this section, we will learn to solve percent equations using proportions

Warm Up

$200 \times 28 =$ ________

$400 \times 42 =$ ________

$300 \times \frac{16}{100} =$ ________

$200 \times \frac{72}{100} =$ ________

The pecent problems in section 2 take the form:

______is ______ % of _________

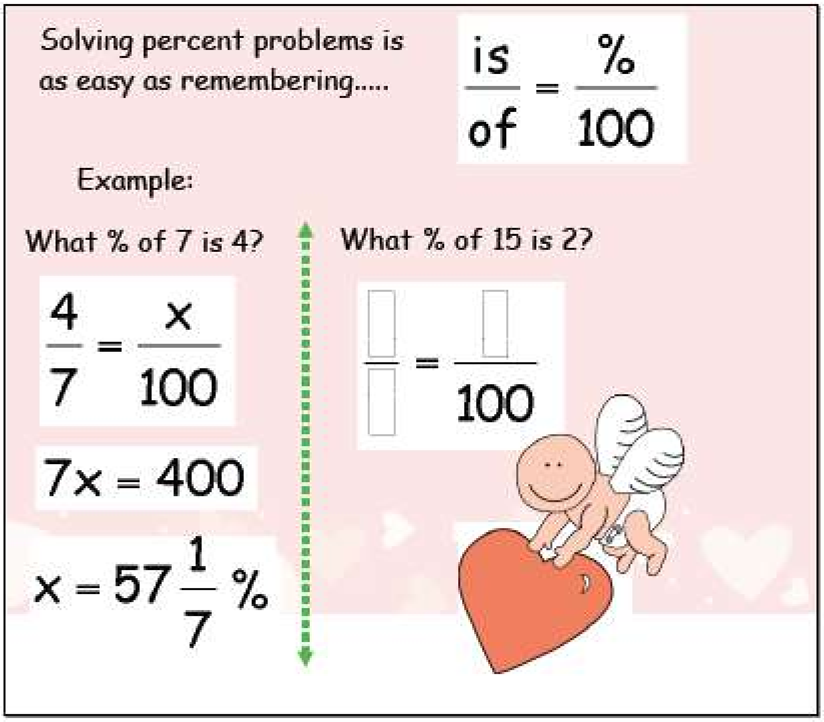
The form above is made out of three parts:

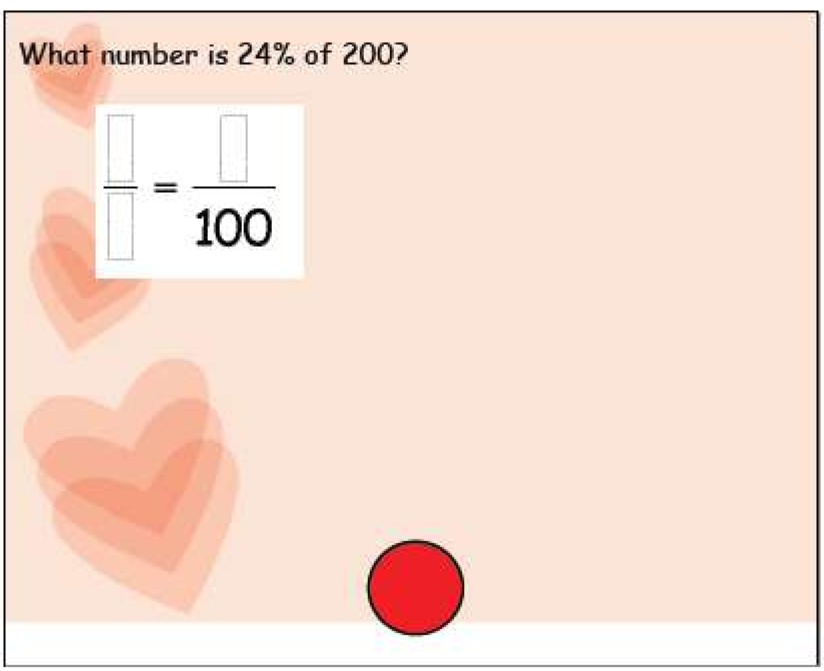
percent, base, and part of the base

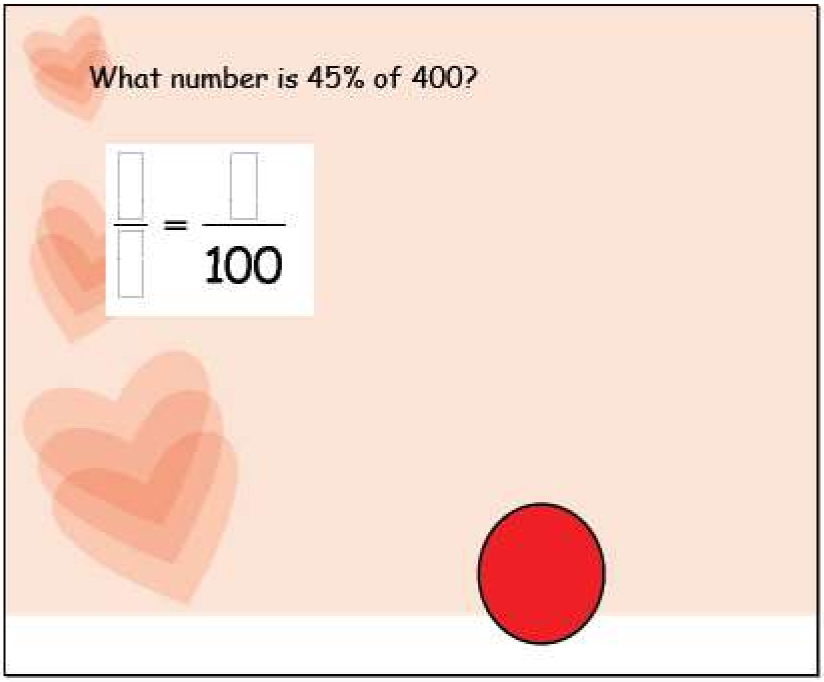
(drag words to correct line)

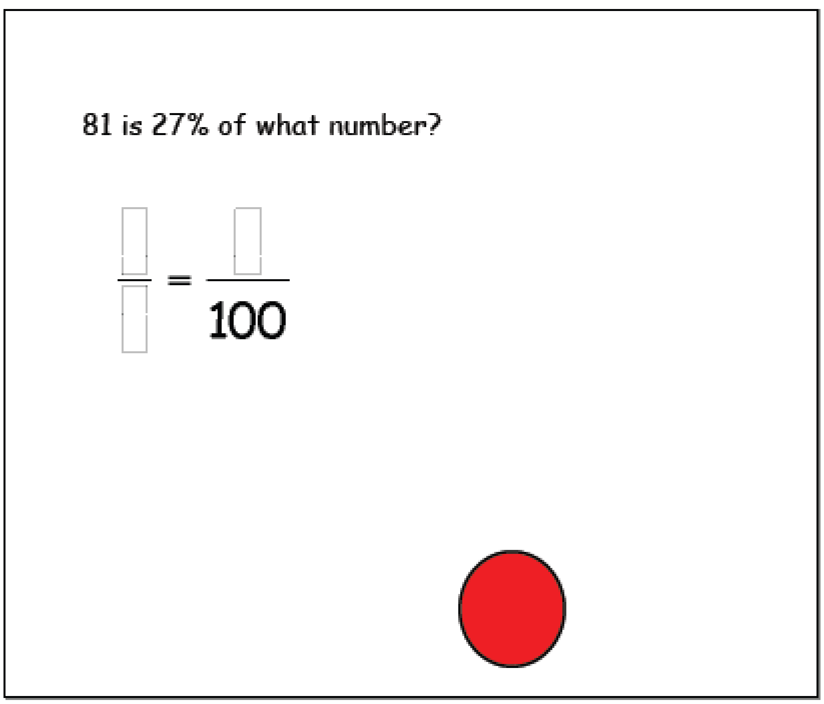
_______is _______ % of ___________

part of base — percent — base


Solving percent problems is as easy as remembering.....
$\frac{is}{of} = \frac{\%}{100}$
Example:
What % of 7 is 4?
$\frac{4}{7} = \frac{x}{100}$
$7x = 400$
$x = 57\frac{1}{7}\%$
What % of 15 is 2?
100

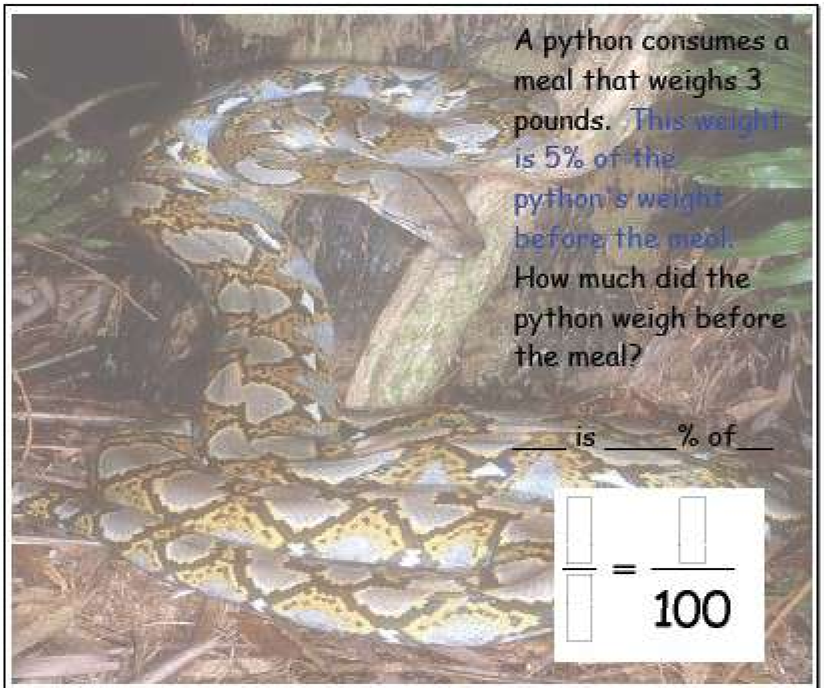

What number is 24% of 200?
100


What number is 45% of 400?
=
100


81 is 27% of what number?
=
100

A baseball player gets 152 hits in 570 times at bat. What % of the times at bat were hits?

$$\frac{\square}{\square} = \frac{\square}{100}$$



Unit Title: Solving Equations

Grade Level(s): 7

Subject/Topic Areas: Pre-Algebra

Key Vocabulary: additive identity, multiplicative identity, equivalent numerical expressions, equivalent variable expressions, term, coefficient, constant term, like terms, equation, solution of an equation, solving an equation, inverse operations, equivalent equations.

Designed By:

Time Frame: 12 to 15 hours

Date:

SUMMARY OF PURPOSE: In this 7th grade Math unit, students will learn how to solve equations. Students will form a solid base that is important for future study in Pre-Algebra and Algebra. Students will learn how solving equations can relate to real life situations and use their skills to solve problems. Students will start with one-step equations involving adding and subtracting, then work up to solving equations with multiplication and division.

Stage 1: Desired Results

Common Core/ Delaware Standards

Primary: Algebraic Reasoning (Standard 2)

- Solve an equation using addition and subtraction
- Solve an equation using multiplication and division
- Solve an equation with decimals and fractions

Secondary: Problem Solving (Standard 5)

- Build a base for Pre-Algebra and Algebra.
- Use this new mathematical knowledge to write and solve problems using equations
- Apply the distributive
- Use all integral vocabulary associated with this unit
- Develop mathematical arguments.
  Communication (Standard 7)

Key Concepts/Big Ideas

Solving equations is an essential building block to Algebra.

Enduring Understandings

Students will understand that…

Solving equations are the basis for a solid Algebra knowledge.

Essential Questions

- What is a one-step equation?
- How do you solve a one-step equation?

- How do you know which operation to use to solve an equation?
- What are inverse operations?

Real World Context

- Real world situations and problems
- Multiple and purposeful opportunities for students to participate and make new connections

Learning Targets/Goals

Students will know…

- How to identify inverse operations.
- Understand how to solve equations
- Identify the distributive property and apply it
- Identify how to simplify variable expressions

Students will be able to… (21st century skills)

- Understand equations in real-life situations.
- Understand that equations can be used to solve problems like balancing a checkbook.

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task
To solve equations, the student will use the funnel method, also known as the inverted triangle method.

Rubrics for Transfer Tasks

Performance Task

	4	3	2	1
Funnel or inverted triangle method to solve an equation	Show step-by-step correct work. Funneled work and circle answer.	Step-by-step work is shown, but there may be one calculation error. An answer is circled.	Step-by-step work has been attempted but there are some conceptual errors. An answer is circled.	No work is shown. An answer may or may not be circled.

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.

Summative Assessments:
Comprehensive exams
Aligned to standards

Student Self-Assessment and Reflection

Pairs Communication Activity

Directions:

Students will participate in a cooperative learning activity in this unit. Students will translate words to an equation, and then take turns solving the equation, while checking each other's work. Students will also participate in math equation scrabble and form as many equations as they can.

Reflection:

1. Was it more difficult for you to translate or to solve? Why?
2. Can you identify the inverse operation used to solve an equation?
3. Was it difficult for you to model an equation in equation scrabble? Why?

- BE SURE TO INCLUDE A COLLABORATIVE LEARNING ACTIVITY

Instructional Resources

Achievement Network
Class zone website
Various websites
Various Pre-Algebra textbooks
Equation Scrabble

Differentiation

Students will pair up with a classmate to solve problems with a team approach.
Students will get one-on-one time with teacher.
Students will attempt to play a game of scrabble involving balancing equations.

Enrichment

Students will pair up with a classmate to solve problems with a team approach.
Students will receive the most difficult skill based problems as well as real-life word problems.
Students will assist a struggling classmate during independent practice.

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

- **Solve equations using addition, subtraction, multiplication and divion.**
- **Relate solving equations to real life situations.**

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Lesson 1

General Topics: Properties and Operations
Key Vocabulary: additive identity, multiplicative identity
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Explore the commutative and associative properties.
4. Develop the concept of substituting a value in for a variable.

Check for Understanding:

Lesson 2

General Topics: Distributive Property
Key Vocabulary: equivalent numerical expressions, equivalent variable expressions
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Explore the definition of the distributive property and how it works.
4. Identify that doing the reverse of distributing is something called factoring

Check for Understanding:

Lesson 3

General Topics: Simplify Variable Expressions
Key Vocabulary: terms, coefficients, constant term, like terms
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Develop the concept of simplifying an expression.
4. Simplify a variable expression after applying the distributive property.

Check for Understanding:

Lesson 4

General Topics: Variables and Equations
Key Vocabulary: equations, solution, solving equations
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Develop how to take words and translate them into math.
4. Substitute values in for variables and evaluate.

Check for Understanding:

Lesson 5

General Topics: Solving Equations using Addition and Subtraction
Key Vocabulary: inverse operations, equivalent equations
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Explore the procedure of how to solve an equation using addition and subtraction.

Check for Understanding:

Lesson 6

General Topics: Solving Equations using Multiplication and Division
Key Vocabulary: prior vocabulary
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Explore the procedure of how to solve an equation using multiplication and division.

Check for Understanding:

Lesson 7

General Topics: Solving Equations using Decimals and Fractions
Key Vocabulary: prior vocabulary

1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Model that the rules and procedures for solving an equation with decimals or fractions is the same procedure for solving equations using integers.
4. Have students explore that it is possible to wipe out fractions by multiplying by the lcm.
5. Have students explore that it is possible to wipe out the decimals by multiplying by a power of ten.

Check for Understanding:

Solve One-Step Equations

If you open the window, when you're finished ___________ the window.

If you open the door, when you're finished ___________ the door.

If you turn on the t.v., when you're finished ___________ the t.v.

Inverse operations undo each other!!!

In Pre Algebra class, a sentence may look like this:

$12 - y = 15$ $-54 = -9g$

An equation is a mathematical sentence formed by placing an equal sign between two expressions.

A solution of an equation with a variable is a number that produces a true statement when it is substituted for the variable. Find the solutions above!

An animal shelter charges $75 to adopt a puppy. One week, they collected $1500. How many puppies were adopted that week?

1. $x + 7 = 4$

$x + 9 = 3$

$x = 6$ $x = -6$

2. $x - 12 = 3$

$x - 2 = 11$

$x = 2$ $x = 13$

3. $-6x = 48$

$-4x = -28$

$x = -8$ $x = 7$

4. $\frac{x}{4} = 5$

$\frac{x}{3} = 7$

$x = 20$ $x = 21$

5. $-\frac{2}{7}x - 4$

$\frac{3}{5}x = -9$

x = - 14

x = - 15

What Happened to Ray Floob After He Fell Off the Empire State Building?

Simplify each expression below. Circle the letter of each answer. Then rearrange the circled letters in each section to make a word. Write the words in order in the boxes at the bottom of the page. You will find the answer to the title question.

1. $3x + 2(5x - 7)$ 2. $9 - 3(2x - 4)$ 3. $8x - 6(3 - 2x)$ 4. $-5 + 5(x + 4)$	S $20x - 3$ E $13x - 14$ T $5x + 15$	Y $20x - 18$ N $5x + 11$ H $-6x + 21$
5. $4(6n + 9) - 10n$ 6. $14 - 3(4n - 1)$ 7. $-8n - 8(-4 - 2n)$	O $14n + 36$ E $-12n + 13$ W $8n + 32$	S $19n + 36$ N $-12n + 17$ T $8n - 1$
8. $7k - 2(3k + 1) - 9$ 9. $-6 + 5(8 - k) - 8k$ 10. $k + 1 - 4(2k - 9)$ 11. $-10k - 3 + 2(5 + 6k)$	L $2k + 7$ A $-7k + 37$ K $2k - 4$	C $-13k + 34$ I $-7k + 30$ L $k - 11$
12. $8 + 9x + 4(11 - 2x)$ 13. $-4(-2x - 7) + 6x - 7$ 14. $9 - 3(-4 + 3x) + 12x$	A $14x + 30$ H $3x + 21$ T $3x + 6$	R $6x + 52$ M $x + 52$ I $14x + 21$
15. $5(2y - 4) + 2(y + 9)$	A $12y - 4$	X $12y - 2$
16. $-4(3u - 1) + 7(3 - 2u)$ 17. $6(-5u + 1) - 3(4u - 12)$ 18. $3(-u - 5) + 8(2u + 1)$	W $-42u + 9$ S $13u - 12$ R $13u - 7$	Y $-42u + 42$ D $-5u + 25$ A $-26u + 25$

> *"Taking or sharing information in any form about the material on this quiz/test before, during, or after the assessment is **cheating**. Presenting another's ideas, words, or analyses as one's own is*

Score____
100

Name________________________

Test Ch. 2

Date____________________

Simplify all answers. Show all work. No work, no credit!

1. Write an equation equivalent to the verbal statement "three times the sum of a number n and 7 is 16."

1.________________________

2. $5(- 11) + 8(- 6($

2.______________

3. $-2 - 6(+ x) - 9x$

3.______________

Use the distributive property to write an equivalent variable expression.

4. $3(4x - 7y)$

4.______________

Solve the equation. Be sure to check your solution.

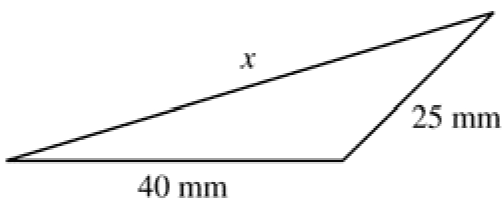
5. $164 = x - 59$

5.______________

6. $17 + e = 7$

6.______________

7. The perimeter of the triangle is 115 millimeters. Which equation could be used to find the side length labeled x?



a.	25☎0✆= x
b.	$115 = x + 40 + 25$
c.	$x = 25 + 40 - 50$
d.	$x = 40 + 25$

7.______________

8. $4b + 7 - 5b - 19$

Do not combine like terms yet!

How many terms?_________

What are the constants?____________

What are the coefficients?___________________

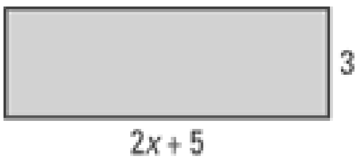
Now simplify or combine like terms:________________

Evaluate the expression when $x = 20$ and $y = -3$.

9. y^2☎x(

9.______________

10. Consider the rectangle shown. Find the Area and Perimeter!



Area:________________ Perimeter:_______________

Solve the equation.

11. $14x = -728$

11.______________

12. $\dfrac{t}{3} = 9$

12.______________

Identify the property illustrated in the statement.

13. $5b$☎ℑ= $5b$

a.	Identity property of addition

b.	Identity property of multiplication
c.	Commutative property of multiplication
d.	Commutative property of addition

13.______________

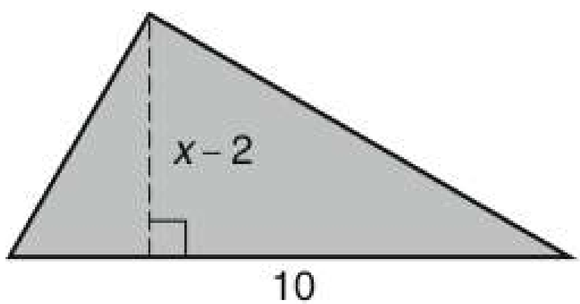
14. The students in Mrs. Krager's class are holding a car wash to raise money for their end-of-year field trip. They washed 45 cars by noon, and their goal is to wash 110 cars by the end of the day. Write and solve an addition equation to find *c*, the number of cars they still need to wash to meet their goal.

14.__________________________

____

Find the area of the triangle.

15.



15.______________

16. $-4\,(x - 4)$

16. _______________

17. $$-\frac{4}{5}x = 20$$

17. _______________

18. 2x = -28

18. _______________

19. $$-16 = \frac{8}{9}x$$

19. _______________

20. 10 = -22 + x

20. _______________

Prestige Academy Charter School

tpalgch2

Answer Section

1. ANS:
$3(n + 7) = 16$

PTS: 1 DIF: Level B REF: MHT10018
TOP: Lesson 2.4 Variables and Equations KEY: variable | translate | word | symbol
BLM: comprehension NOT: 978-0-618-79813-1

2. ANS: A PTS: 1 DIF: Level B REF: MLPA0073
NAT: NCTM 6-8.ALG.2.d STA: DE 8.2.3.1 | DE 8.2.3.4
TOP: Lesson 2.3 Simplifying Variable Expressions
KEY: simplify | variable | property | expression | distributive | distribute
BLM: comprehension NOT: 978-0-618-79813-1

3. ANS:
$-15x - 50$

PTS: 1 DIF: Level B REF: MLPA0076 NAT: NCTM 6-8.ALG.2.d
STA: DE 8.2.3.1 | DE 8.2.3.4 TOP: Lesson 2.3 Simplifying Variable Expressions
KEY: simplify | distribute | combine | like terms BLM: comprehension
NOT: 978-0-618-79813-1

4. ANS: A PTS: 1 DIF: Level B REF: MALG0305
TOP: Lesson 2.2 The Distributive Property
KEY: property | parentheses | distributive BLM: knowledge
NOT: 978-0-618-79813-1

5. ANS:
223

PTS: 1 DIF: Level B REF: MLPA0093 NAT: NCTM 6-8.ALG.2.d
STA: DE 8.2.3.6 | DE K-11.5.4
TOP: Lesson 2.5 Solving Equations Using Addition or Subtraction
KEY: solve | equation | add | subtraction BLM: comprehension
NOT: 978-0-618-79813-1

6. ANS: B PTS: 1 DIF: Level B REF: MLPA0091
NAT: NCTM 6-8.ALG.2.d STA: DE K-11.5.4 | DE 8.2.3.6
TOP: Lesson 2.5 Solving Equations Using Addition or Subtraction
KEY: solve | equation | addition BLM: comprehension
NOT: 978-0-618-79813-1

7. ANS: B PTS: 1 DIF: Level B REF: MLPA0085
NAT: NCTM 6-8.ALG.2.c
TOP: Lesson 2.5 Solving Equations Using Addition or Subtraction
KEY: solve | variable | triangle | perimeter BLM: comprehension
NOT: 978-0-618-79813-1

8. ANS: D PTS: 1 DIF: Level A REF: MLPA0071
NAT: NCTM 6-8.ALG.2.d STA: DE 8.2.3.4 | DE 8.2.3.1
TOP: Lesson 2.3 Simplifying Variable Expressions
KEY: identify | coefficient | constant | like term BLM: knowledge
NOT: 978-0-618-79813-1

9. ANS: C PTS: 1 DIF: Level B REF: MLPA0063

STA: DE 8.1.2.1 TOP: Lesson 2.1 Properties and Operations
KEY: evaluate | expression BLM: knowledge NOT: 978-0-618-79813-1

10. ANS:
a. $6x + 15$
b. 27 square units

PTS: 1 DIF: Level A REF: PA.02.02.MS.02
NAT: NCTM 6-8.MEA.1.c | NCTM 6-8.ALG.2.d | NCTM 6-8.MEA.2.c
STA: DE 8.1.2.4 TOP: Lesson 2.2 The Distributive Property
KEY: area | evaluate | algebraic | variable | expression | distributive property
BLM: comprehension NOT: 978-0-618-79813-1

11. ANS: D PTS: 1 DIF: Level B REF: MLPA0100
NAT: NCTM 6-8.ALG.2.d STA: DE 8.2.3.6
TOP: Lesson 2.6 Solving Equations Using Multiplication or Division
KEY: solve | equation | division | multiplication BLM: comprehension
NOT: 978-0-618-79813-1

12. ANS:
27

PTS: 1 DIF: Level B REF: MLPA0785 NAT: NCTM 6-8.ALG.2.d
STA: DE 8.2.3.6 TOP: Lesson 2.6 Solving Equations Using Multiplication or Division
KEY: solve | equation | multiply BLM: comprehension
NOT: 978-0-618-79813-1

13. ANS: B PTS: 1 DIF: Level B REF: MLPA0061
TOP: Lesson 2.1 Properties and Operations KEY: identify | property | multiplication
BLM: knowledge NOT: 978-0-618-79813-1

14. ANS:
$c + 45 = 110$, 65 cars

PTS: 1 DIF: Level B REF: MLPA0084
NAT: NCTM 6-8.ALG.2.d | NCTM 6-8.ALG.2.c STA: DE 8.2.3.6
TOP: Lesson 2.4 Variables and Equations
KEY: solve | equation | word | add | addition BLM: application
NOT: 978-0-618-79813-1

15. ANS:
$5x - 10$

PTS: 1 DIF: Level B REF: 7fad4dab-cdbb-11db-b502-0011258082f7
TOP: Lesson 2.2 The Distributive Property KEY: Area | distributive property
BLM: Knowledge NOT: 978-0-618-79813-1

16. ANS: D PTS: 1 DIF: Level B REF: MALG0308
TOP: Lesson 2.2 The Distributive Property KEY: distributive
BLM: knowledge NOT: 978-0-618-79813-1

Prestige Academy Charter School

Unit Title: Variables, Expressions, and Integers

Grade Level(s): 7

Subject/Topic Areas: Pre-Algebra

Key Vocabulary: Numerical expression, variable, variable expression, evaluate, verbal model, power, exponent, base, order of operations, integer, negative integer, positive integer, absolute value, opposite, additive inverse, coordinate plane, x-axis, y-axis, origin, quadrant, ordered pair, x-coordinate, y-coordinate, scatter plot.

Designed By:

Time Frame: 12 to 15 hours

Date:

SUMMARY OF PURPOSE: In this 7th grade Math unit, students will learn about Variables, Expressions and Integers. Students will form a solid base that is important for future study in Pre-Algebra and Algebra. Students will learn how integers relate to real life situations and use their skills to solve problems.

Stage 1: Desired Results

Common Core/ Delaware Standards

Primary: Numeric Reasoning (Standard 1)

- Identify expressions and variables, calculate powers and exponents and use correct order of operations.
- Add, subtract, multiply and divide integers.
- Explore and comprehend the coordinate plane and the method for locating points.

Secondary: Problem Solving (Standard 5)

- Build a base for Pre-Algebra and Algebra.
- Use this new mathematical knowledge to solve problems involving integers, exponents, order of operations and integers.
- Be able to communicate how to locate points verbally and on the coordinate plane.
- Use all integral vocabulary associated with this unit
- Develop mathematical arguments.
  Communication (Standard 7)

Key Concepts/Big Ideas

Variables, expressions and integers are an essential building block to Algebra.

Enduring Understandings

Students will understand that…

Variables, expressions and integers are the basis for a solid Algebra basis.

Essential Questions

- How do you evaluate expressions and number sentences?
- What are the methods or rules used to add, subtract, multiply and divide integers?
- How do you locate points in the coordinate plane?

Real World Context

- Real world situations and problems
- Multiple and purposeful opportunities for students to participate and make new connections

Learning Targets/Goals

Students will know…

- How to add, subtract, multiply and divide integers.
- Understand how to evaluate powers, order of operations
- Identify expressions and variables
- How to locate points on a coordinate plane

Students will be able to… (21st century skills)

- Understand integers in real-life situations.
- Understand that the coordinate plane is really just a method to locate something

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task
To evaluate order of operations, powers and exponents and compute with integers, the student will use the funnel method, also known as the inverted triangle method.

Rubrics for Transfer Tasks

Performance Task

	4	3	2	1
Funnel or inverted triangle method	Show step-by-step correct work. Funneled work and circle answer.	Step-by-step work is shown, but there may be one calculation error. An answer is circled.	Step-by-step work has been attempted but there are some conceptual errors. An answer is circled.	No work is shown. An answer may or may not be circled.

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.

Summative Assessments:
Comprehensive exams
Aligned to standards

Student Self-Assessment and Reflection

Pairs Communication Activity

Directions:

Students will participate in two cooperative learning games in this unit. Students will play "integer dice" where a set of green and red dice are thrown. Red dice represent negative numbers and green dice represent positive numbers. Students will combine the dice to get an answer. Students will start with two dice and then work their way up. Students will participate in integer war using a deck of cards. Students will each flip their card over. Student with the highest absolute value card will begin. Students will add or subtract the cards and the winner will keep the cards.

Reflection:

1. Which of the integer games were most difficult for you? Why?
2. Which of the integer games did you feel you were strong? Why?

- BE SURE TO INCLUDE A COLLABORATIVE LEARNING ACTIVITY

Instructional Resources

Achievement Network
Class zone website
Various websites
Various Pre-Algebra textbooks
Dice and Cards

Differentiation

Students will pair up with a classmate to solve problems with a team approach.
Students will get one-on-one time with teacher.
Students will get their own dice to use in attacking problems.

Enrichment

Students will pair up with a classmate to solve problems with a team approach.
Students will receive the most difficult skill based problems as well as real-life word problems.

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

- **Use number lines and manipulatives to explore integers.**
- **Comprehend all rules to calculate powers, order of operations and integer operations.**

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Lesson 1

General Topics: Expressions and Variables
Key Vocabulary: numerical expression, variable, variable expression, evaluate, verbal model
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Explore the definition of a numerical expression, variable, variable expression and what it means to evaluate a variable expression.
4. Have students brainstorm for as many words as they can, related to the four operations.

Check for Understanding:

Lesson 2

General Topics: Powers
Key Vocabulary: power, base, exponent
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Explore the definition of a power while delivering the concept of base and exponent. Substitute values in for a variable and then evaluate.
4. Have students list out the first 20 perfect squares.

Check for Understanding:

Lesson 3

General Topics: Order of operations
Key Vocabulary: order of operations
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Develop the concept of order of operations.
4. Present correct order of operations problems, then have students work independently or in a team setting.

Check for Understanding:

Lesson 4

General Topics: Adding Integers
Key Vocabulary: integers, negative integers, positive integers, additive inverse
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Develop the concept that adding integers can be visualized by movement on the number line.

Check for Understanding:

Lesson 5

General Topics: Subtracting Integers
Key Vocabulary: integers, negative integers, positive integers, additive inverse
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Explore the procedure of subtracting an integer by adding its opposite.

Check for Understanding:

Lesson 6

General Topics: Multiplying and Dividing Integers
Key Vocabulary: integers, negative integers, positive integers, additive inverse
1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Develop the rules for multiplying and dividing integers.
4. Have students explore that a double negative is in fact a positive.

Check for Understanding:

Lesson 6

General Topics: The Coordinate Plane
Key Vocabulary: x-axis, y-axis, origin, coordinates, ordered pair, quadrant I II III IV, x-coordinate, y-coordinate

1. Lessons will be formatted on a power point presentation, and then presented on the smart board.
2. Lessons will include, in this order: do-now, delivery of content, independent practice, exit slip, homework.
3. Develop all of the above listed vocabulary.
4. Have students explore the coordinate plane by identifying all pivotal points on their own coordinate plane.

Check for Understanding:

Prestige Academy Charter School

Name: ______________________________ Date: ______________________________

MATH Homeroom: ______________________________

Exit Slip: Mult/Div Integers

_________/_________ = ________%

1. 9(-11)

2. (-4)(-6)

3. (-2)(8)

4. (-1)(2)(-5)

5. (-10)(-10)

6. 24÷(-6)

7. -98÷2

8. (-22)÷(-11)

9. (-72)÷(36)

10. How is the statement: "I DON'T have NO money" an example of how two negatives make a positive?

Prestige Academy Charter School

Name: ____________________ **Date:** ____________________

MATH **Homeroom:** ____________________

Independent Practice

Countdown:

Why Did the Snail Have an "S" Painted on His VW?

Do each exercise below and find your answer in the corresponding set of answer boxes. Print the letter of that exercise in the box containing the answer.

Y $(-4)(3)$
E $(-5)(-8)$
O $-9 \cdot 7$
R $-12(-4)$
O $16(-3)$

E $(-10)(4)$
S $-12(-1)$
E $(8)(-8)$
N $(-5)20$
V $(-50)(-2)$

L $-3 \cdot 4 \cdot 2$
O $(-3)(-4)(2)$
U $5(-1)(12)$
D $5(-1)(-12)$
U $(-3)(-3)(-3)$

O $(-4)(-5)(-6)$
W $(-9)(4)(-10)$
S $(5)(3)(-11)$
T $(-15)(-2)4$
H $(-90)(-90)(0)$

12	−48	−64	100	−40	48	−12	−63	−100	40	360	24	−27	−24	60	−165	0	−120	−60	120

E $(-40)(60)$
T $(-80)(-20)$
O $2(-360)$
T $(-4)(-4)(-4)$
A $(8)(-1)(12)$

H $(-7)(6)(-2)$
L $3(-25)(-2)$
S $(-2)(-4)8$
O $-4 \cdot 7 \cdot 3$
K $(10)(10)(-16)$

A $(-5)(3)(-4)(10)$
O $(6)(-2)(-10)(-5)$
R $(3)(3)(-4)(20)$
C $(-5)(-40)(-4)(-1)$
G $(-80)(3)(-1)(3)$

150	−84	−720	−1600	−96	1600	−64	84	−2400	64	800	600	−720	720	−600

1800 OBJECTIVE 2–e: To multiply integers.

1800 A–21

Name:________________________________ Date:_________________

MATH

Homework # :

Parent Signature

What did ZORNA say when she married a 3~foot Pygmy?

Do any exercise below and find your answer in one of the boxes at the bottom of the page. Write the letter of the exercise in that box. The answers are arranged in order from smallest to largest. Keep working and you will discover the answer to the title question.

A $-12 \div 4 =$
E $60 \div 15 =$
T $45 \div -9 =$
A $-48 \div -4 =$
R $-49 \div -7 =$
A $-3 \div -3 =$
E $-60 \div 5 =$
O $-200 \div 4 =$
A $-90 \div 9 =$
H $0 \div -7 =$
D $77 \div -7 =$
E $-215 \div 1 =$
T $96 \div 12 =$
E $-75 \div -5 =$
O $56 \div -8 =$
A $750 \div 10 =$
E $-42 \div -7 =$
R $-150 \div 2 =$

E $-100 \div -2 =$
T $67 \div -1 =$
N $-80 \div -40 =$
H $150 \div -5 =$
R $-30 \div 5 =$
T $1700 \div -10 =$
V $100 \div 20 =$
T $13 \div -13 =$
V $120 \div 4 =$
M $-100 \div 25 =$
V $-42 \div 3 =$
L $80 \div 5 =$
E $\frac{36}{-2} =$
O $\frac{-50}{-2} =$
A $\frac{100}{-4} =$

D $\frac{-670}{-10} =$
E $\frac{9100}{-100} =$
O $\frac{-45}{3} =$
A $\frac{600}{4} =$
V $\frac{39}{3} =$
O $\frac{-54}{-6} =$
L $\frac{311}{1} =$
N $\frac{38}{-19} =$
V $\frac{-63}{3} =$

T $\frac{300}{-2} =$
H $\frac{1000}{100} =$
B $\frac{3110}{-10} =$
N $\frac{900}{300} =$
S $\frac{81}{-9} =$
L $\frac{-430}{-2} =$
H $\frac{-48}{6} =$
L $\frac{-48}{3} =$
T $\frac{-91}{-1} =$

−311	−215	−170	−150	−91	−75	−67	−50	−30	−25	−21	−18	−16	−15	−14	−12	−11	−10
−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	
8	9	10	12	13	15	16	25	30	50	67	75	91	150	215	311		

AA-29

1502

September 28, 2011

1.7 Multiplying and Dividing Integers

Circle one and cross out the other!!

1. Multiplication Rules

$(+) \cdot (+) =$ positive negative

$(+) \cdot (-) =$ positive negative

$(-) \cdot (-) =$ positive negative

2. Division Rules

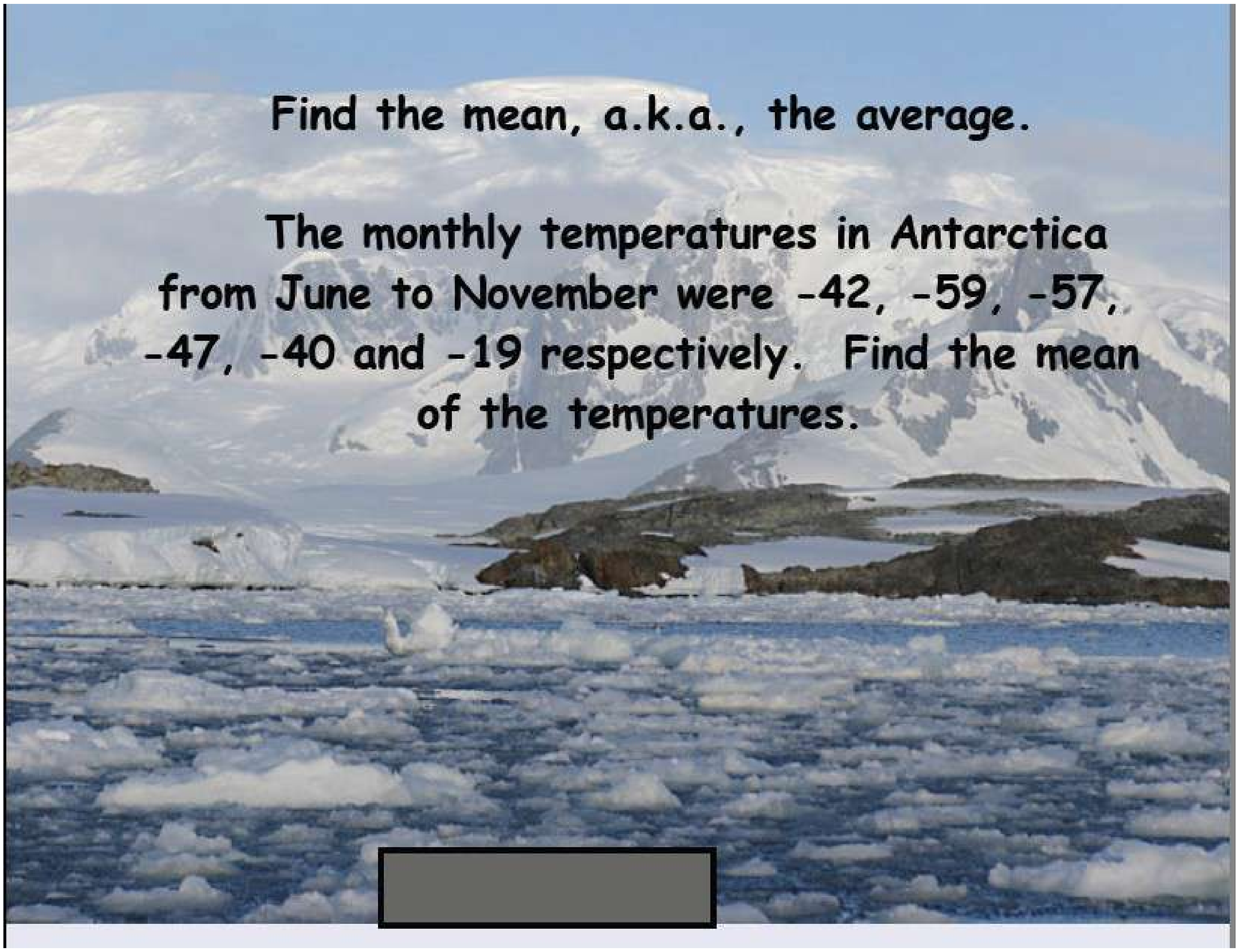
$(+) \div (+) =$ positive negative

$(+) \div (-) =$ positive negative

$(-) \div (-) =$ positive negative

Practice with these six problems!

$(-3)\times(-12)$	$-7(9)$	$(6)(5)$
$(-48)/(-6)$	$56/(-8)$	$\frac{-35}{7}$
-36	-63	30
8	-7	-5


Find the mean, a.k.a., the average.
The monthly temperatures in Antarctica from June to November were -42, -59, -57, -47, -40 and -19 respectively. Find the mean of the temperatures.

During the last Eagle's game, on first down, they gained 8 yards on a run, then lost 12 yards when McNabb was sacked on second down. On third down they completed a screen pass for a gain of 15 yards. Did they make a first down, or do they need to punt the ball?

(A first down is when a team has a net gain of 10 yards.)

FIRST DOWN!!!!!!!!!!!!!!

$8 \cdot (-2) =$	$8 \cdot (-8) =$
$-7 \cdot (3) =$	$(-1) \cdot (-1) \cdot 1 =$
$12 \cdot (-2) =$	$2 \cdot (-6) \cdot 4 =$
$(-1) \cdot (-1) \cdot (-1) =$	$-2 \cdot 2 \cdot 2 =$
$-3 \cdot (-2) =$	$(-1) \cdot (-2) \cdot (-3) =$
$-4 \cdot (-2) =$	$(-1) \cdot (-1) =$

Division

$-8 \div (-2) =$

$-7 \div (-1) =$

$-8 \div (-4) =$

$7 \div (-1) =$

$-9 \div 3 =$

$12 \div 4 =$

$-27 \div \frac{1}{3} =$

$22 \div (-11) =$

Mixed Review

$3 \cdot (-2) \div (-6)$

$12 \div (-6) \cdot (-3)$

Take a five question, online quiz!

Now play Multiplication Football with Dice!

Interim Cycle 1
Teacher: PATEL
Subject: SCI
Grade: 7 (W & R)

Focus for Week 1:

- **Re-orientation**
- **Set Class expectations**

Sub-Skills:

- **Basic day-to-day operations in the classroom**
- **Daily transitions, expectations**

Monday, August 29, Day #6	Tuesday, August 30, Day #7	Wednesday, August 31, Day #8	Thursday, September 1, Day #9	Friday, September 2
RE-ORIENTATION: NO ACADEMIC CLASSES	**RE-ORIENTATION: NO ACADEMIC CLASSES**	**RE-ORIENTATION: NO ACADEMIC CLASSES**	**State Standard**	**LABOR DAY: NO SCHOOL**

Focus for Week 2:

- **Standard 1: Nature and Application of Science and Technology**

Sub-Skills:

- **Scientific Method**

Monday, September 5	Tuesday, September 6, Day #10	Wednesday, September 7, Day #11	Thursday, September 8, Day #12	Friday, September 9, Day #13
LABOR DAY: NO SCHOOL	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** • State Hypothesis	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis **Sub-Skill 3:** • Make/Record Observations	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 3:

- **Standard 1 Nature & Application of Science & Technology**

Sub-Skills:

- **Scientific Method**

Monday, September 12, Day #14	Tuesday, September 13, Day #15	Wednesday, September 14, Day #16	Thursday, September 15, Day #17	Friday, September 16, Day #18
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis **Sub-Skill 3:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis **Sub-Skill 3:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

<table>
<tr><td></td><td></td><td>Make/Record Observations

<u>Sub-Skill 4:</u>
• Record Data</td><td>Make/Record Observation

<u>Sub-Skill 4:</u>
Record Data

<u>Sub-Skill 5:</u>
• Draw conclusions</td><td></td></tr>
<tr><td colspan="5">Focus for Week 4:

• Standard 1 Nature & Application of Science & Technology
Sub-Skills:
• Scientific Method</td></tr>
<tr><td>Monday, September 19, Day #19</td><td>Tuesday, September 20, Day #20</td><td>Wednesday, September 21, Day #21</td><td>Thursday, September 22, Day #22</td><td>Friday, September 23, Day #23</td></tr>
<tr><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry

Science, Technology, and History

Society & Context of Science

<u>Sub-Skill 1:</u>
Identify Purpose/Objective

<u>Sub-Skill 2:</u>
State Hypothesis

<u>Sub-Skill 3:</u>
Make/Record Observation

<u>Sub-Skill 4:</u>
Record Data

<u>Sub-Skill 5:</u>
Draw conclusions</td><td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry

Science, Technology, and History

Society & Context of Science

<u>Sub-Skill 1:</u>
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<u>Sub-Skill 3:</u>
Make/Record Observation

<u>Sub-Skill 4:</u>
Record Data

<u>Sub-Skill 5:</u>
Draw conclusions</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td></tr>
<tr><td colspan="5">Focus for Week 5:

• Standard 1 Nature & Application of Science & Technology
Sub-Skills:
• Scientific Method</td></tr>
<tr><td>Monday, September 26, Day #24</td><td>Tuesday, September 27, Day #25</td><td>Wednesday, September 28, Day #26</td><td>Thursday, September 29, Day #27</td><td>Friday, September 30, Day #28</td></tr>
<tr><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry

Science, Technology, and History

Society & Context of Science

<u>Sub-Skill 1:</u>
Identify Purpose/Objective

<u>Sub-Skill 2:</u>
State Hypothesis

<u>Sub-Skill 3:</u>
Make/Record Observation

<u>Sub-Skill 4:</u>
Record Data

<u>Sub-Skill 5:</u>
Draw conclusions</td><td>INTERIM #1 MATH</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td></tr>
</table>

Interim Cycle 2
Teacher:PATEL
Subject: SCI
Grade: 7

Focus for Week 1:

- **Standard 1: The Nature and Application of Science and Technology,**
- **Standard 6:Life Processes**
- **Standard 7: Diversity and Continuity of Living Things**

Sub-Skills:

- **Systems**- the human body has interrelated systems that are composed of related organs and other components. Systems and organs are part of the way people organize living systems from cells, to tissues, organs, to organ systems to organisms. (Discuss further).
- **Investigations** – There are multiple methods of solving problems in science. There are trade-offs associated with various methods of collecting data.
- **Evidence**- People use observations and data to support scientific explanations.
- **Models-** Models are used to study body systems and understand how they function.
- **Structure and function**- The structure of body systems and organs is related to the function in a complementary manner.

Monday, October 3, Day #29	Tuesday, October 4, Day #30	Wednesday, October 5, Day #31	Thursday, October 6, Day #32	Friday, October 7, Day #33 ½ Day – one hour block
<u>State Standard</u> **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** • **Standard 1: The Nature and Application of Science and Technology,** • **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **<u>Sub-Skill 1:</u>** • Students will take comprehensive notes on Pellagra Story. These notes serve as evidence of student understanding of scientific problem solving (stating the problem being investigated, hypothesis, evidence, and conclusions).	**<u>State Standard</u>** • **Standard 1: The Nature and Application of Science and Technology,** • **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **<u>Sub-Skill 1:</u>** Collection of data on student worksheets provides formative evidence of student understanding of scientific data collection and graphing	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**

Focus for Week 2:

- **Standard 1: The Nature and Application of Science and Technology,**
- **Standard 6: Life Processes**
- **Standard 7: Diversity and Continuity of Living Things**

Sub-Skills:

- **Systems**- the human body has interrelated systems that are composed of related organs and other components. Systems and organs are part of the way people organize living systems from cells, to tissues, organs, to organ systems to organisms. (Discuss further).
- **Investigations** – There are multiple methods of solving problems in science. There are trade-offs associated with various methods of collecting data.
- **Evidence**- People use observations and data to support scientific explanations.
- **Models-** Models are used to study body systems and understand how they function.
- **Structure and function**- The structure of body systems and organs is related to the function in a complementary manner.

Monday, October 10, Day #34	Tuesday, October 11, Day #35	Wednesday, October 12, Day #36	Thursday, October 13, Day #37	Friday, October 14, Day #38
<u>State Standard</u>	**<u>State Standard</u>**	**<u>State Standard</u>** • **Standard 1: The Nature and Application of**	**<u>State Standard</u>** • **Standard 1: The Nature and Application of**	**<u>State Standard</u>**

<table>
<tr>
<td>Sub-Skill 1:

Sub-Skill 2:</td>
<td>Sub-Skill 1:

Sub-Skill 2:</td>
<td>Science and Technology,
• Standard 6:Life Processes
• Standard 7: Diversity and Continuity of Living Things

Sub-Skill 1:
Testing Medicines Scientifically-Students read about placebo-controlled testing and make decisions about complex issues often involving trade-offs (giving up one thing in favor of another)</td>
<td>Science and Technology,
• Standard 6:Life Processes
• Standard 7: Diversity and Continuity of Living Things

Sub-Skill 1:
Students are introduced to variables while conducting an exploratory investigation into human sensitivity to touch. This concept is expanded in Activity 7: Human Variation</td>
<td>Sub-Skill 1:

Sub-Skill 2:</td>
</tr>
<tr>
<td colspan="5">Focus for Week 3:

• Standard 1: The Nature and Application of Science and Technology,
• Standard 6: Life Processes
• Standard 7: Diversity and Continuity of Living Things

Sub-Skills:
• Systems- the human body has interrelated systems that are composed of related organs and other components. Systems and organs are part of the way people organize living systems from cells, to tissues, organs, to organ systems to organisms. (Discuss further).
• Investigations – There are multiple methods of solving problems in science. There are trade-offs associated with various methods of collecting data.
• Evidence- People use observations and data to support scientific explanations.
• Models- Models are used to study body systems and understand how they function.
• Structure and function- The structure of body systems and organs is related to the function in a complementary manner.</td>
</tr>
<tr>
<td>Monday, October 17, Day #39</td>
<td>Tuesday, October 18, Day #40</td>
<td>Wednesday, October 19, Day #41</td>
<td>Thursday, October 20, Day #42</td>
<td>Friday, October 21, Day #43
½ Day – one hour block</td>
</tr>
<tr>
<td>State Standard

Sub-Skill 1:

Sub-Skill 2:</td>
<td>State Standard

Sub-Skill 1:

Sub-Skill 2:</td>
<td>State Standard
• Standard 1: The Nature and Application of Science and Technology,
• Standard 6:Life Processes
• Standard 7: Diversity and Continuity of Living Things

Sub-Skill 1:
• Students will read about how qualitative and quantitative data are used to study people
Sub-Skill 2:
• Students will understand how this data is important in providing a complete description of an experiment and its results. Data Toss reinforces the idea of collecting both quantitative and qualitative data using an activity testing student’s ability to catch a ball with one vs. two hands.</td>
<td>State Standard
• Standard 1: The Nature and Application of Science and Technology,
• Standard 6:Life Processes
• Standard 7: Diversity and Continuity of Living Things

Sub-Skill 1:
• Students create a 3 D model of the human body system to expose their misconceptions about the sizes and locations of human organs.</td>
<td>State Standard

Sub-Skill 1:

Sub-Skill 2:</td>
</tr>
<tr>
<td colspan="5">Focus for Week 4:

• Standard 1: The Nature and Application of Science and Technology,
• Standard 6: Life Processes</td>
</tr>
</table>

- **Standard 7: Diversity and Continuity of Living Things**

Sub-Skills:

- **Systems**- the human body has interrelated systems that are composed of related organs and other components. Systems and organs are part of the way people organize living systems from cells, to tissues, organs, to organ systems to organisms. (Discuss further).
- **Investigations –** There are multiple methods of solving problems in science. There are trade-offs associated with various methods of collecting data.
- **Evidence**- People use observations and data to support scientific explanations.
- **Models-** Models are used to study body systems and understand how they function.
- **Structure and function**- The structure of body systems and organs is related to the function in a complementary manner.

Monday, October 24, Day #44	Tuesday, October 25, Day #45	Wednesday, October 26, Day #46	Thursday, October 27, Day #47	Friday, October 28, Day #48
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Standard 1: The Nature and Application of Science and Technology,** • **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **Sub-Skill 1:** • Reinforce the idea of systems in the body and how they help regulate the internal environment.	**State Standard** • **Standard 1: The Nature and Application of Science and Technology,** • **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **Sub-Skill 1:** • Reinforce the idea of systems in the body and how they help regulate the internal environment.	**State Standard**

Focus for Week 5:

- **Standard 1: The Nature and Application of Science and Technology,**
- **Standard 6: Life Processes**
- **Standard 7: Diversity and Continuity of Living Things**

Sub-Skills:

- **Systems**- the human body has interrelated systems that are composed of related organs and other components. Systems and organs are part of the way people organize living systems from cells, to tissues, organs, to organ systems to organisms. (Discuss further).
- **Investigations –** There are multiple methods of solving problems in science. There are trade-offs associated with various methods of collecting data.
- **Evidence**- People use observations and data to support scientific explanations.
- **Models-** Models are used to study body systems and understand how they function.
- **Structure and function**- The structure of body systems and organs is related to the function in a complementary manner.

Monday, October 31, Day #49	Tuesday, November 1, Day #50	Wednesday, November 2, Day #51	Thursday, November 3, Day #52	Friday, November 4, Day #53 End of Quarter 1
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**INTERIM #2 MATH**	**State Standard** • **Standard 1: The Nature and Application of Science and Technology,** • **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **Sub-Skill 1:** Reinforce the idea of systems in the body and how they help regulate the internal environment.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Interim Cycle 3
Teacher: PATEL
Subject: SCI
Grade: 7

Focus for Week 1:

- **Standard 1: The Nature and Application of Science and Technology,**
- **Standard 6: Life Processes**
- **Standard 7: Diversity and Continuity of Living Things**

Sub-Skills:

- **Systems**- the human body has interrelated systems that are composed of related organs and other components. Systems and organs are part of the way people organize living systems from cells, to tissues, organs, to organ systems to organisms. (Discuss further).
- **Investigations –** There are multiple methods of solving problems in science. There are trade-offs associated with various methods of collecting data.
- **Evidence**- People use observations and data to support scientific explanations.
- **Models-** Models are used to study body systems and understand how they function.
- **Structure and function**- The structure of body systems and organs is related to the function in a complementary manner.

Monday, November 7, Day #54	Tuesday, November 8, Day #55	Wednesday, November 9, Day #56	Thursday, November 10, Day #57 ½ Day – one hour block	Friday, November 11, Day #58
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Standard 1: The Nature and Application of Science and Technology,** • **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **Sub-Skill 1:** • Students use a class modeling game to demonstrate the path of blood as it travels through the human circulatory system.	**State Standard** • **Standard 1: The Nature and Application of Science and Technology,** • **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **Sub-Skill 1:** • Students use a class modeling game to demonstrate the path of blood as it travels through the human circulatory system.	**VETERANS DAY: NO SCHOOL**

Focus for Week 2:

- **Standard 1: The Nature and Application of Science and Technology,**
- **Standard 6: Life Processes**
- **Standard 7: Diversity and Continuity of Living Things**

Sub-Skills:

- **Systems**- the human body has interrelated systems that are composed of related organs and other components. Systems and organs are part of the way people organize living systems from cells, to tissues, organs, to organ systems to organisms. (Discuss further).
- **Investigations –** There are multiple methods of solving problems in science. There are trade-offs associated with various methods of collecting data.
- **Evidence**- People use observations and data to support scientific explanations.
- **Models-** Models are used to study body systems and understand how they function.
- **Structure and function**- The structure of body systems and organs is related to the function in a complementary manner.

Monday, November 14, Day #58	Tuesday, November 15, Day #59	Wednesday, November 16, Day #60	Thursday, November 17, Day #61	Friday, November 18, Day #62
State Standard **Sub-Skill 1:**	**State Standard** **Sub-Skill 1:**	**State Standard** • **Standard 1: The Nature and Application of Science and Technology,**	**State Standard** • **Standard 1: The Nature and Application of Science and Technology,**	**State Standard** **Sub-Skill 1:**

Sub-Skill 2:	**Sub-Skill 2:**	• **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **Sub-Skill 1:** The Heart-A Muscle- mechanical pumps are used to serve as a model showing how the human heart pumps blood throughout the body	• **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **Sub-Skill 1:** Students listen to an audiotape of normal and abnormal heart sounds to introduce the idea of ways to diagnose heart problems.	**Sub-Skill 2:**

Focus for Week 3:
Sub-Skills:

Monday, November 21, Day #63	Tuesday, November 22, Day #64	Wednesday, November 23	Thursday, November 24	Friday, November 25
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**THANKSGIVING BREAK: NO SCHOOL (PD DAY FOR TEACHERS)**	**THANKSGIVING BREAK: NO SCHOOL**	**THANKSGIVING BREAK: NO SCHOOL**

Focus for Week 4:

- **Standard 1: The Nature and Application of Science and Technology,**
- **Standard 6: Life Processes**
- **Standard 7: Diversity and Continuity of Living Things**

Sub-Skills:

- **Systems**- the human body has interrelated systems that are composed of related organs and other components. Systems and organs are part of the way people organize living systems from cells, to tissues, organs, to organ systems to organisms. (Discuss further).
- **Investigations** – There are multiple methods of solving problems in science. There are trade-offs associated with various methods of collecting data.
- **Evidence**- People use observations and data to support scientific explanations.
- **Models-** Models are used to study body systems and understand how they function.
- **Structure and function**- The structure of body systems and organs is related to the function in a complementary manner.

Monday, November 28, Day #65	Tuesday, November 29, Day #66	Wednesday, November 30, Day #67	Thursday, December 1, Day #68	Friday, December 2, Day #69
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Standard 1: The Nature and Application of Science and Technology,** • **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **Sub-Skill 1:** • Students use models to demonstrate the effects of high blood pressure	**State Standard** • **Standard 1: The Nature and Application of Science and Technology,** • **Standard 6:Life Processes** • **Standard 7: Diversity and Continuity of Living Things** **Sub-Skill 1:** • Students use models to demonstrate the effects of high blood pressure	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 5:

- **Standard 1 The Nature & Application of Science & Technology**
- **Standard 2 Materials & their Properties**

Sub-Skills:

- Observation and Evidence- All living things need water, reproduce, require energy, ingest food, perform gas exchange, eliminate waste, respond to stimuli and are made up of cells.
- Structure Function- The structure of organelles and cells determine its Function The structure of flowers determine how it is pollinated
- Process Skills-Microscopes are used to observe various living organisms and develop of lab techniques with regard to microbial sampling

<table>
<tr><td colspan="5">

Classification- Organisms are classified according to set criteria based on structure and function
Investigation- The effects of changing conditions on living organisms can be observed and collected. Evidence can be represented and/or presented in the form of data tables, projects, or reports
Interactions-The behavior of single cells or multi-celled organisms within a given environment can be observed.
Adaptation-The structure of seeds and pollen determine how each are dispersed to help contribute to a species survival

</td></tr>
<tr><td>Monday, December 5, Day #70</td><td>Tuesday, December 6, Day #71</td><td>Wednesday, December 7, Day #72</td><td>Thursday, December 8, Day #73</td><td>Friday, December 9, Day #74
½ Day – one hour block</td></tr>
<tr>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties
<u>Sub-Skill 1:</u>
•Students observe a mystery substance in a Petri dish and use their observations to determine whether the contents of the dish are living or non-living.

<u>Sub-Skill 2:</u>
Upon completion of their discussions, students develop a rough list of criteria for evidence of life

<u>Sub-Sill 3:</u>
•Students observe 5 items in Ziploc bags and use their observations to determine which items may be living.
<u>Sub-Sill 4:</u>
•Students brainstorm how to test each of the five items to investigate whether any of them are living things.</td>
<td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties
<u>Sub-Skill 1:</u>
Students investigate the field of view by observing the letter “e”, a color photograph from newsprint and a feather

<u>Sub-Skill 2:</u>
•Students measure the field of view at 10, 20 and 40X magnification using a clear mm ruler.
<u>Sub-Sill 3:</u>
•Students measure netting without magnification using their rulers and then place the netting under 10X magnification for measurement.
<u>Sub-Sill 4:</u>
•This activity directly attacks the misconception that items that are under magnification are larger than they are when not magnified.
<u>Sub-Sill 5:</u>
•Students investigate Focal Plane by focusing one ribbons that are layered one atop the other.
<u>Sub-Sill 6:</u>
•A multimedia disk is used to illustrate correct procedures and the mechanism involved in focusing on individual focal planes.</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
</tr>
<tr><td colspan="5">
Focus for Week 6:

Standard 1 The Nature & Application of Science & Technology
Standard 2 Materials & their Properties

Sub-Skills:

Observation and Evidence- All living things need water, reproduce, require energy, ingest food, perform gas exchange, eliminate waste, respond to stimuli and are made up of cells.
Structure Function- The structure of organelles and cells determine its Function The structure of flowers determine how it is pollinated
Process Skills-Microscopes are used to observe various living organisms and develop of lab techniques with regard to microbial sampling
Classification- Organisms are classified according to set criteria based on structure and function
Investigation- The effects of changing conditions on living organisms can be observed and collected. Evidence can be represented and/or presented in the form of data tables, projects, or reports
Interactions-The behavior of single cells or multi-celled organisms within a given environment can be observed.

Adaptation-The structure of seeds and pollen determine how each are dispersed to help contribute to a species survival
</td></tr>
<tr><td>Monday, December 12, Day #75</td><td>Tuesday, December 13, Day #76</td><td>Wednesday, December 14, Day #77</td><td>Thursday, December 15, Day #78</td><td>Friday, December 16, Day #79</td></tr>
<tr>
<td><u>State Standard</u></td>
<td><u>State Standard</u></td>
<td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials &</td>
<td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials &</td>
<td><u>State Standard</u></td>
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<tr>
<td><u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td>their Properties
<u>Sub-Skill 1:</u>
•Students observe the response of brine shrimp to light.
<u>Sub-Skill 2:</u>
•Students continue to observe the brine shrimp under magnification. This activity includes providing dyed yeast for the shrimp to eat while under magnification.
<u>Sub-Skill 3:</u>
•Students are given a list of characteristics of life to check off for evidence that the brine shrimp is a living organism.</td>
<td>their Properties
<u>Sub-Skill 1:</u>
•Students discover cells and begin to understand their importance as the basic units of life.

—Part One: Discovering Cells
•Students observe Elodea cells. These observations include focusing through the focal plane and measuring cell size. Students are also introduced to movement within the cell as they observe cytoplasmic streaming.</td>
<td><u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
</tr>
<tr>
<td colspan="5">Focus for Week 7:
Standard 1 The Nature & Application of Science & Technology
Standard 2 Materials & their Properties
Sub-Skills:
Observation and Evidence- All living things need water, reproduce, require energy, ingest food, perform gas exchange, eliminate waste, respond to stimuli and are made up of cells.
Structure Function- The structure of organelles and cells determine its Function The structure of flowers determine how it is pollinated
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Interactions-The behavior of single cells or multi-celled organisms within a given environment can be observed.
Adaptation-The structure of seeds and pollen determine how each are dispersed to help contribute to a species survival</td>
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<tr>
<td>Monday, December 19, Day #80</td>
<td>Tuesday, December 20, Day #81</td>
<td>Wednesday, December 21, Day #82</td>
<td>Thursday, December 22, Day #83</td>
<td>Friday, December 23</td>
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<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
Standard 1 The Nature & Application of Science & Technology
Standard 2 Materials & their Properties
<u>Sub-Skill 1:</u>
Students observe paramecia under the microscope and record evidence that what they are observing is a living organism.

<u>Sub-Skill 2:</u>
•Students are challenged to compare single celled organisms to the cells in multi-cellular organisms. Students are introduced to the concept that multi-cellular organisms have cells that cannot live independent lives such as the lives of single celled organisms.</td>
<td><u>State Standard</u>
Standard 1 The Nature & Application of Science & Technology
Standard 2 Materials & their Properties
<u>Sub-Skill 1:</u>
•Students look at multiple single celled organisms including amoeba, euglena and other mixed flagellates.

<u>Sub-Skill 2:</u>
•After looking at organisms from pure cultures, students observe organisms living within mini-pond cultures that students created from sticks, soil, leaves and pond water.

<u>Sub-Skill 3:</u>
•This activity introduces students to the diversity of microscopic life, previously unknown to them.</td>
<td>WINTER BREAK: NO SCHOOL (PD DAY FOR TEACHERS)</td>
</tr>
<tr>
<td colspan="5">Focus for Week 8:
Sub-Skills:</td>
</tr>
<tr>
<td>Monday, January 2</td>
<td>Tuesday, January 3</td>
<td>Wednesday, January 4, Day #85</td>
<td>Thursday, January 5, Day #86</td>
<td>Friday, January 6, Day #87</td>
</tr>
<tr>
<td>WINTER BREAK: NO</td>
<td>WINTER BREAK: NO</td>
<td>CULTURE RESET (NO ACADEMIC</td>
<td>CULTURE RESET</td>
<td>CULTURE RESET</td>
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<tr><td>SCHOOL)</td><td>SCHOOL (PD DAY FOR TEACHERS)</td><td>CLASSES)</td><td></td><td></td></tr>
<tr><td colspan="5">Focus for Week 9:
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

Sub-Skills:
• Observation and Evidence- All living things need water, reproduce, require energy, ingest food, perform gas exchange, eliminate waste, respond to stimuli and are made up of cells.
• Structure Function- The structure of organelles and cells determine its Function The structure of flowers determine how it is pollinated
• Process Skills-Microscopes are used to observe various living organisms and develop of lab techniques with regard to microbial sampling
• Classification- Organisms are classified according to set criteria based on structure and function
• Investigation- The effects of changing conditions on living organisms can be observed and collected. Evidence can be represented and/or presented in the form of data tables, projects, or reports
• Interactions-The behavior of single cells or multi-celled organisms within a given environment can be observed.
• Adaptation-The structure of seeds and pollen determine how each are dispersed to help contribute to a species survival</td></tr>
<tr><td>Monday, January 9, Day #87</td><td>Tuesday, January 10, Day #88</td><td>Wednesday, January 11, Day #89</td><td>Thursday, January 12, Day #90</td><td>Friday, January 13, Day #91</td></tr>
<tr><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

<u>Sub-Skill 1</u>:
Students look at human cheek cells as a comparison of multi-cellular organisms (humans) to the myriad of single celled organisms they have observed</td><td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

<u>Sub-Skill 1</u>:
•Students use a multi-media program to investigate the complex organization of multi-cellular organisms (from cell to tissue, tissue to organ, organ to organ system, organ system to organism).

<u>Sub-Skill 2:</u>
•Students also compare prokaryotic and eukaryotic cell structures, and are able to compare plant and animal cells through the multi-media presentation.</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td></tr>
<tr><td colspan="5">Focus for Week 10:
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

Sub-Skills:
• Observation and Evidence- All living things need water, reproduce, require energy, ingest food, perform gas exchange, eliminate waste, respond to stimuli and are made up of cells.
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<tr><td>Monday, January 16</td><td>Tuesday, January 17, Day #92</td><td>Wednesday, January 18, Day #93</td><td>Thursday, January 19, Day #94</td><td>Friday, January 20, Day #95</td></tr>
<tr><td>MLK DAY: NO SCHOOL</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

<u>Sub-Skill 1</u>:
●Students see seeds as living organisms in a dormant state.</td><td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

<u>Sub-Skill 1</u>:
•Students observe rye grass seeds and radish seeds as they sprout. Students are directed to</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td></tr>
</table>

		They also observe and describe the first developmental stages of a plant (growth and development--cellular reproduction within a single organism that also reproduces at the organismic level). **Sub-Skill 2:** •As a direct tie to lessons learned in the Fourth grade "Structures of Life" unit, students dissect a lima bean to look at the seed coat, cotyledon, and the embryo. They add to their understanding of seeds by determining the conditions necessary for seeds to grow and develop into mature plants. (Understanding of dormancy)	notice the difference between the monocot and dicot development (diversity among plants). **Sub-Skill 2:** •Students notice that the dicotyledon seems to "lose" its cotyledons as they are pushed upward to capture sunlight while the cotyledon in the grass seed remains at "ground level" as it nourishes the plant as it grows above the ground.	

Focus for Week 11:

- **Standard 1 The Nature & Application of Science & Technology**
- **Standard 2 Materials & their Properties**

Sub-Skills:

- Observation and Evidence- All living things need water, reproduce, require energy, ingest food, perform gas exchange, eliminate waste, respond to stimuli and are made up of cells.
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Monday, January 23, Day #96	Tuesday, January 24, Day #97	Wednesday, January 25, Day #98	Thursday, January 26, Day #99	Friday, January 27, Day #100 End of Quarter 2
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**Interim #3 Math**	**State Standard** • **Standard 1 The Nature & Application of Science & Technology** • **Standard 2 Materials & their Properties** **Sub-Skill 1:** •Students are introduced to structure/function relationships as they observe root structures.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Interim Cycle 4
Teacher: PATEL
Subject: SCI
Grade: 7

Focus for Week 1:

- **Standard 1 The Nature & Application of Science & Technology**
- **Standard 2 Materials & their Properties**

Sub-Skills:

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<table>
<tr><td>Monday, January 30, Day #101</td><td>Tuesday, January 31, Day #102</td><td>Wednesday, February 1, Day #103</td><td>Thursday, February 2, Day #104
½ Day – one hour block</td><td>Friday, February 3, Day #105
½ Day – one hour block</td></tr>
<tr><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

<u>Sub-Skill 1:</u>
Students investigate the reproductive systems in flowers to understand the origin of seeds, and to explore plant adaptations for seed dispersal. This is an introduction to sexual reproduction as a source of diversity in organisms.

<u>Sub-Skill 2:</u>
•Students dissect the flower of a tulip, gladiolus or daffodil to observe the various organs involved in seed production.

<u>Sub-Skill 3:</u>
•After dissection is complete students are told how pollination occurs in plants and are referred to reading materials and visuals provided on the CD-ROM.</td><td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

<u>Sub-Skill 1:</u>
•This lesson is a nice introduction to sexual reproduction and the diversity of life that is covered in the genetics unit for seventh grade.

<u>Sub-Skill 2:</u>
•Students investigate their campus plants and look for seeds that may be around them. After observing various seeds and seed types, students are led in a discussion regarding the multiple seed dispersal techniques utilized by plants.</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td></tr>
<tr><td colspan="5">Focus for Week 2:
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

Sub-Skills:
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<tr><td>Monday, February 6, Day #106</td><td>Tuesday, February 7, Day #107</td><td>Wednesday, February 8, Day #108</td><td>Thursday, February 9, Day #109</td><td>Friday, February 10, Day #110</td></tr>
<tr><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

<u>Sub-Skill 1:</u>
•Students sample various surfaces and observe the microscopic life that is prolific in those areas after samples are incubated on agar.</td><td><u>State Standard</u>
• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties

<u>Sub-Skill 1:</u>
•While students wait to see what happens to their inoculated agar plates, they work through a mathematical lesson that illustrates exponential growth.</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td></tr>
<tr><td colspan="5">Focus for Week 3:

• Standard 1 The Nature & Application of Science & Technology
• Standard 2 Materials & their Properties</td></tr>
</table>

Sub-Skills:

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- Adaptation-The structure of seeds and pollen determine how each are dispersed to help contribute to a species survival

Monday, February 13, Day #111	Tuesday, February 14, Day #112	Wednesday, February 15, Day #113	Thursday, February 16, Day #114	Friday, February 17
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Standard 1 The Nature & Application of Science & Technology** • **Standard 2 Materials & their Properties** **Sub-Skill 1:** •Students taste samples of food that are created with ingredients including or created by organisms in various kingdoms.	**State Standard** • **Standard 1 The Nature & Application of Science & Technology** • **Standard 2 Materials & their Properties** **Sub-Skill 1:** •Students taste samples of food that are created with ingredients including or created by organisms in various kingdoms.	**NO SCHOOL (PD DAY FOR TEACHERS)**

Focus for Week 4:

- **Standard 1: Nature and Application of Science and Technology**
- **Standard 7: Diversity & continuity of Living Things**

Sub-Skills:

- **Observation and Evidence** (inherited traits are introduced and investigated)
- **Patterns** (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)
- **Models** (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
- **Reasoning and explanations** (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)
- **Structure and function** (students investigate the role of DNA, genes, and chromosomes in reproduction)

Monday, February 20	Tuesday, February 21, Day #115	Wednesday, February 22, Day #116	Thursday, February 23, Day #117	Friday, February 24, Day #118
PRESIDENT'S DAY: NO SCHOOL	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** Students investigate traits for six human characteristics as the beginning of an ongoing discussion of human variation and heredity. The idea of inherited traits is introduced.	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** Students germinate seeds that are the offspring of plants bred from true-breeding green and pale yellow strains of flowering tobacco. By predicting and then quantifying the colors of the offspring plants, students obtain genetic data for analysis.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 5:

- **Standard 1: Nature and Application of Science and Technology**
- **Standard 7: Diversity & continuity of Living Things**

<table>
<tr><td colspan="5">Sub-Skills:
Observation and Evidence (inherited traits are introduced and investigated)
Patterns (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)
Models (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
Reasoning and explanations (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)
Structure and function (students investigate the role of DNA, genes, and chromosomes in reproduction)</td></tr>
<tr><td>Monday, February 27, Day #119</td><td>Tuesday, February 28, Day #120</td><td>Wednesday, February 29, Day #121</td><td>Thursday, March 1, Day #122</td><td>Friday, March 2, Day #123</td></tr>
<tr>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology & Society
History & Context of Science
Reproduction, Heredity and development
<u>Sub-Skill 1:</u>
Students are introduced to the issue of genetic testing through a story about a student who suspects he may have inherited a genetic syndrome (the Marfan syndrome). Students generate questions they would have if they were in this situation, and make a preliminary decision of what they would do based on the limited information they have so far.</td>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology & Society
History & Context of Science
Reproduction, Heredity and development
<u>Sub-Skill 1:</u>
Asexual and sexual reproduction are introduced. Differences between the two prepare students to understand the mechanisms of heredity in sexually reproducing organisms.</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
</tr>
<tr><td colspan="5">Focus for Week 6:
Standard 1: Nature and Application of Science and Technology
Standard 7: Diversity & continuity of Living Things
Sub-Skills:
Observation and Evidence (inherited traits are introduced and investigated)
Patterns (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)
Models (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
Reasoning and explanations (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)
Structure and function (students investigate the role of DNA, genes, and chromosomes in reproduction)</td></tr>
<tr><td>Monday, March 5, Day #124</td><td>Tuesday, March 6, Day #125</td><td>Wednesday, March 7, Day #126</td><td>Thursday, March 8, Day #127</td><td>Friday, March 9, Day #128</td></tr>
<tr>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology & Society
History & Context of Science
Reproduction, Heredity and development
<u>Sub-Skill 1:</u>
Students develop hypotheses to explain the behavior of genes in a story about zoo scientists breeding imaginary creatures. They use models to evaluate how well the hypotheses fit additional evidence about the critter offspring.</td>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology & Society
History & Context of Science
Reproduction, Heredity and development
<u>Sub-Skill 1:</u>
Students use a coin tossing simulation to model the pattern of inheritance exhibited by many single-gene traits, including the critter tail-color characteristic. They relate this model to the hypothesis they developed</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
</tr>
<tr><td colspan="5">Focus for Week 7
Standard 1: Nature and Application of Science and Technology</td></tr>
</table>

- **Standard 7: Diversity & continuity of Living Things**

Sub-Skills:

- **Observation and Evidence** (inherited traits are introduced and investigated)
- **Patterns** (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)
- **Models** (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
- **Reasoning and explanations** (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)
- **Structure and function** (students investigate the role of DNA, genes, and chromosomes in reproduction)

Monday, March 12, Day #129	Tuesday, March 13, Day #130	Wednesday, March 14, Day #131	Thursday, March 15, Day #132	Friday, March 16
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** A reading describes Mendel's experiments with pea plants. Students relate the rules discovered by Mendel in his analysis of pea plant crosses to their findings about critter genes. The reading introduces the idea that basic concepts discovered in working with one type of organism (pea plants) can often be generalized to other organisms or groups (humans).	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** Students use Punnett squares to predict the approximate frequencies of traits among the offspring of specific critter crosses.	**NO SCHOOL (PD DAY FOR TEACHERS)**

Focus for Week 8:

- **Standard 1: Nature and Application of Science and Technology**
- **Standard 7: Diversity & continuity of Living Things**

Sub-Skills:

- **Observation and Evidence** (inherited traits are introduced and investigated)
- **Patterns** (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)
- **Models** (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
- **Reasoning and explanations** (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)
- **Structure and function** (students investigate the role of DNA, genes, and chromosomes in reproduction)

Monday, March 19, Day #133	Tuesday, March 20, Day #134	Wednesday, March 21, Day #135	Thursday, March 22, Day #136	Friday, March 23, Day #137
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** Students quantify the results of the seeds they germinated in Activity 55 "Plants have Genes	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** describes the behavior of chromosomes during sexual	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

		too" and compare their results to Mendel's results	reproduction and its consistency with basic patterns of inheritance. In addition, the function of DNA and the effects of randomly occurring mutations are introduced.	

Focus for Week 9:

- **Standard 1: Nature and Application of Science and Technology**
- **Standard 7: Diversity & continuity of Living Things**

Sub-Skills:

- **Observation and Evidence** (inherited traits are introduced and investigated)
- **Patterns** (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)
- **Models** (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
- **Reasoning and explanations** (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)
- **Structure and function** (students investigate the role of DNA, genes, and chromosomes in reproduction)

Monday, March 26, Day #138	Tuesday, March 27, Day #139	Wednesday, March 28, Day #140	Thursday, March 29, Day #141	Friday, March 30, Day #142
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** Students design an experiment to investigate the effect of the environment on the development of the green color trait in Nicotiana seedlings. This introduces the interplay of heredity (nature) and environmental (nurture factors in the development of an organisms traits.	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** Students model the diversity of offspring possible from two parents and discover patterns of inheritance other than strict dominant/recessive traits.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 10:

- **Standard 1: Nature and Application of Science and Technology**
- **Standard 7: Diversity & continuity of Living Things**

Sub-Skills:

- **Observation and Evidence** (inherited traits are introduced and investigated)
- **Patterns** (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)
- **Models** (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
- **Reasoning and explanations** (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)
- **Structure and function** (students investigate the role of DNA, genes, and chromosomes in reproduction)

Monday, April 2, Day #143	Tuesday, April 3, Day #144	Wednesday, April 4, Day #145	Thursday, April 5, Day #146	Friday, April 6
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science	**SPRING BREAK: NO SCHOOL**

		• Reproduction, Heredity and development **<u>Sub-Skill 1:</u>** Students investigate the behavior of genes for human traits. Pedigrees are introduced as another way to study genes. They are then used to analyze the patterns of transmission for recessive and dominant human traits	• Reproduction, Heredity and development **<u>Sub-Skill 1:</u>** Students return to Joe's dilemma and consider whether he should be tested for the Marfan syndrome. This activity provides more information about the Marfan syndrome and also allows students to consider further how a diagnosis of a genetic condition might affect a person.	

Focus for Week 11:

- **Standard 1: Nature and Application of Science and Technology**
- **Standard 7: Diversity & continuity of Living Things**

Sub-Skills:

- **Observation and Evidence** (inherited traits are introduced and investigated)
- **Patterns** (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)
- **Models** (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
- **Reasoning and explanations** (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)\
- **Structure and function** (students investigate the role of DNA, genes, and chromosomes in reproduction)

Monday, April 16, Day #147	Tuesday, April 17, Day #148	Wednesday, April 18, Day #149	Thursday, April 19, Day #150	Friday, April 20, Day #151 End of Quarter 3
<u>State Standard</u> **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **<u>Sub-Skill 1:</u>** Students are introduced to the problem of identifying people who cannot identify themselves. They read a story of some children lost during a war. Although the story is fictional, it is based on actual situations in recent times.	**<u>State Standard</u>** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **<u>Sub-Skill 1:</u>** Students learn how DNA fingerprinting is done by performing a simulation of the process used to generate different sized pieces of DNA. They compare their simulation to the actual procedures used by scientists to prepare DNA fingerprints.	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**

(Post-Interims) Review; DCAS Testing Period
Teacher: PATEL
Subject: SCI
Grade: 7

Focus for Week 1:

- **Standard 1: Nature and Application of Science and Technology**
- **Standard 7: Diversity & continuity of Living Things**

Sub-Skills:

- **Observation and Evidence** (inherited traits are introduced and investigated)
- **Patterns** (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)

- **Models** (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
- **Reasoning and explanations** (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)
- **Structure and function** (students investigate the role of DNA, genes, and chromosomes in reproduction)

Monday, April 23, Day #152	Tuesday, April 24, Day #153	Wednesday, April 25, Day #154	Thursday, April 26, Day #155	Friday, April 27, Day #156 ½ Day – one hour block
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** Students investigate the use of DNA fingerprints as evidence in establishing family relationships. They use DNA fingerprints to obtain additional evidence about the identities of the lost children of John and Belinda and of Mai and Paul.	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Reproduction, Heredity and development **Sub-Skill 1:** Students learn about the work of Dr. Mary-Claire King, who helped families in Argentina find their lost children. They then perform an ethical analysis to decide what should be done with the lost children of Namelia.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 2:
Standard 1: The Nature and Application of Science and Technology

Standard 2: Materials and their Properties

Sub-Skills:
- **Interactions**- The three states of phases of matter (solid, liquid, gas) are determined by the arrangement, motion, and interaction of molecules.
- **Models-** The Particle Model of matter is a conceptual tool useful in understanding the properties and behavior of matter that is of too small a scale to observe directly.
- **Observation & Evidence** - The observation and measurement of characteristic properties, such as density, boiling and melting points, and solubility, of pure substances are useful in distinguishing and separating one substance from another.
- **Changes**-An increase or decrease in energy alters the behavior of the particles and thus the material.
- **Constancy-**The law of conservation of matter applies to physical changes
- **Properties of Materials-**The properties of matter determine the reasonable use of materials.

Monday, April 30, Day #157	Tuesday, May 1, Day #158	Wednesday, May 2, Day #159	Thursday, May 3, Day #160	Friday, May 4, Day #161
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology **Sub-Skill 1:** Students explore, examine, and discuss their ideas about properties of matter.	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology **Sub-Skill 1:** Students explore, examine, and discuss their ideas about properties of matter.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 3:
Standard 1: The Nature and Application of Science and Technology

Standard 2: **Materials and their Properties**

Sub-Skills:

- **Interactions**- The three states of phases of matter (solid, liquid, gas) are determined by the arrangement, motion, and interaction of molecules.
- **Models-** The Particle Model of matter is a conceptual tool useful in understanding the properties and behavior of matter that is of too small a scale to observe directly.
- **Observation & Evidence** - The observation and measurement of characteristic properties, such as density, boiling and melting points, and solubility, of pure substances are useful in distinguishing and separating one substance from another.
- **Changes**-An increase or decrease in energy alters the behavior of the particles and thus the material.
- **Constancy-**The law of conservation of matter applies to physical changes
- **Properties of Materials-**The properties of matter determine the reasonable use of materials.

Monday, May 7, Day #162	Tuesday, May 8, Day #163	Wednesday, May 9, Day #164	Thursday, May 10, Day #165	Friday, May 11, Day #166
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Properties and Structure of Materials • Mixtures and Solutions • Conservation of Matter • Materials Technology **Sub-Skill 1:** While performing three inquiries, students explore the relationships between mass, volume, and density.	**State Standard** • **Understandings and Abilities of Scientific Inquiry** • Science Technology & Society • History & Context of Science • Properties and Structure of Materials • Mixtures and Solutions • Conservation of Matter • Materials Technology **Sub-Skill 1:** While performing three inquiries, students explore the relationships between mass, volume, and density.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 4:
Standard 1: The Nature and Application of Science and Technology

Standard 2: **Materials and their Properties**

Sub-Skills:

- **Interactions**- The three states of phases of matter (solid, liquid, gas) are determined by the arrangement, motion, and interaction of molecules.
- **Models-** The Particle Model of matter is a conceptual tool useful in understanding the properties and behavior of matter that is of too small a scale to observe directly.
- **Observation & Evidence** - The observation and measurement of characteristic properties, such as density, boiling and melting points, and solubility, of pure substances are useful in distinguishing and separating one substance from another.
- **Changes**-An increase or decrease in energy alters the behavior of the particles and thus the material.
- **Constancy-**The law of conservation of matter applies to physical changes
- **Properties of Materials-**The properties of matter determine the reasonable use of materials.

Monday, May 14, Day #167	Tuesday, May 15, Day #168	Wednesday, May 16, Day #169	Thursday, May 17, Day #170	Friday, May 18, Day #171
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

		Sub-Skill 1: While performing three inquiries, students explore the relationships between mass, volume, and density.	**Sub-Skill 1:** After examining floating and sinking, students predict the behavior of mixed substances and objects on the basis of their densities	

Focus for Week 5
Standard 1: The Nature and Application of Science and Technology

Standard 2: Materials and their Properties

Sub-Skills:

- **Interactions**- The three states of phases of matter (solid, liquid, gas) are determined by the arrangement, motion, and interaction of molecules.
- **Models-** The Particle Model of matter is a conceptual tool useful in understanding the properties and behavior of matter that is of too small a scale to observe directly.
- **Observation & Evidence** - The observation and measurement of characteristic properties, such as density, boiling and melting points, and solubility, of pure substances are useful in distinguishing and separating one substance from another.
- **Changes**-An increase or decrease in energy alters the behavior of the particles and thus the material.
- **Constancy-**The law of conservation of matter applies to physical changes
- **Properties of Materials-**The properties of matter determine the reasonable use of materials.

Monday, May 21, Day #172	Tuesday, May 22, Day #173	Wednesday, May 23, Day #174	Thursday, May 24, Day #175	Friday, May 25, Day #176 ½ Day – one hour block
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology **Sub-Skill 1:** After examining floating and sinking, students predict the behavior of mixed substances and objects on the basis of their densities	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology **Sub-Skill 1:** Students design an experimental procedure to determine the density of air and discuss the accuracies of their results.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 6:
Standard 1: The Nature and Application of Science and Technology

Standard 2: Materials and their Properties

Sub-Skills:

- **Interactions**- The three states of phases of matter (solid, liquid, gas) are determined by the arrangement, motion, and interaction of molecules.
- **Models-** The Particle Model of matter is a conceptual tool useful in understanding the properties and behavior of matter that is of too small a scale to observe directly.
- **Observation & Evidence** - The observation and measurement of characteristic properties, such as density, boiling and melting points, and solubility, of pure substances are useful in distinguishing and separating one substance from another.
- **Changes**-An increase or decrease in energy alters the behavior of the particles and thus the material.
- **Constancy-**The law of conservation of matter applies to physical changes
- **Properties of Materials-**The properties of matter determine the reasonable use of materials.

Monday, May 28	Tuesday, May 29, Day #177	Wednesday, May 30, Day #178	Thursday, May 31, Day #179	Friday, June 1, Day #180
		State Standard	**State Standard**	

MEMORIAL DAY: NO SCHOOL	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology **Sub-Skill 1:** Students construct liquid-and air-filled thermometers and discuss the effect of temperature on the volume of matter and the density of matter.	Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology **Sub-Skill 1:** Students construct liquid-and air-filled thermometers and discuss the effect of temperature on the volume of matter and the density of matter.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 7:
Standard 1: The Nature and Application of Science and Technology

Standard 2: Materials and their Properties

Sub-Skills:

- **Interactions**- The three states of phases of matter (solid, liquid, gas) are determined by the arrangement, motion, and interaction of molecules.
- **Models-** The Particle Model of matter is a conceptual tool useful in understanding the properties and behavior of matter that is of too small a scale to observe directly.
- **Observation & Evidence** - The observation and measurement of characteristic properties, such as density, boiling and melting points, and solubility, of pure substances are useful in distinguishing and separating one substance from another.
- **Changes**-An increase or decrease in energy alters the behavior of the particles and thus the material.
- **Constancy-**The law of conservation of matter applies to physical changes
- **Properties of Materials-**The properties of matter determine the reasonable use of materials.

Monday, June 4, Day #181	Tuesday, June 5, Day #182	Wednesday, June 6, Day #183	Thursday, June 7, Day #184	Friday, June 8, Day #185
State Standard **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology **Sub-Skill 1:** Students measure the temperature of ice/liquid water as it is heated. They graph their results and use the curve to discuss how heat affects the temperature and phase changes of water.	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Properties and Structure of Materials Mixtures and Solutions Conservation of Matter Materials Technology **Sub-Skill 1:** Students measure the temperature of ice/liquid water as it is heated. They graph their results and use the curve to discuss how heat affects the temperature and phase changes of water.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**

Focus for Week 8:				
Monday, June 11, Day #186	Tuesday, June 12, Day #187	Wednesday, June 13, Day #188 ½ Day - Finals	Thursday, June 14, Day #189 ½ Day – Finals	Friday, June 15, Day #190 ½ Day - Finals
<u>State Standard</u> **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**MATH FINALS**	**ELA FINALS**	**SCIENCE/SS FINALS**

Prestige Academy Charter School

Unit Title: Properties of Matter	**Grade Level(s): 7th**
Subject/Topic Areas: Properties and structure of Matter, Mixtures and solutions	
Key Vocabulary: Particle model, Density, Mass, Volume, Heat, Energy, Temperature, Kinetic energy, Solute, Solvent, Saturation, Mixture, Homogeneous, Heterogeneous, Solution	
Designed By: V Patel	**Time Frame: 23 class meetings** **Date: 09/30/2011**

SUMMARY OF PURPOSE:

The focus of this unit is the physical properties that characterize matter. Students examine characteristic properties including density, solubility, and melting and boiling points. The particle model is utilized to illustrate how materials behave under different conditions (changes in temperature and pressure). The link is made between the increase/decrease of energy and the behavior of the materials.

Stage 1: Desired Results

Common Core/ Delaware Standards

This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1 and 2 found on the following web site:
http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard One: The Nature and Application of Science and Technology

Understandings and Abilities of Scientific Inquiry:
Students should be able to:

1. Frame and refine questions that can be investigated scientifically, and generate testable hypotheses.
2. Design and conduct investigations with controlled variables to test hypotheses.
3. Accurately collect data through the selection and use of tools and techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students.
4. Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.
5. Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.
6. Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Science Technology and Society
Students should know that:

1. Advances in technology can expand the body of scientific knowledge. Technological tools allow people to observe objects and phenomena that otherwise would not be possible. Technology enhances the quality, accuracy, speed and analysis of data gathered.
2. Science and technology in society are driven by the following factors: economical, political,

cultural, social, and environmental. Increased scientific knowledge and technology create changes that can be beneficial or detrimental to individuals or society through impact on human health and the environment.

Students should be able to:

- Select a manufactured item and identify its component materials. Explain how the physical properties of the materials contribute to the function of the item.
- Discuss the social, economic, and/or environmental consequences of the production of new materials to meet human wants and needs.

History and Context of Science:

Students should know that:

1. Over the course of human history, contributions to science have been made by different people from different cultures. Studying some of these contributions and how they came about provides insight into the expansion of scientific knowledge.

Standard 2: Materials and their Properties

Properties and Structure of Materials

Students should know that:

1. All matter consists of particles too small to be seen with the naked eye. The arrangement, motion, and interaction of these particles determine the three states of matter (solid, liquid, and gas). Particles in all three states are in constant motion. In the solid state, tightly packed particles have a limited range of motion. In the liquid state, particles are loosely packed and move past each other. In the gaseous state, particles are free to move.

Students should be able to:

- Recognize that all matter consists of particles and how the particles are arranged determines the physical state. Use the particle model to describe solids, liquids, and gases in terms of the packing and motion of particles.

Students should know that:

2. A phase change may occur when a material absorbs or releases heat energy. Changes in phase do not change the particles but do change how they are arranged.

Students should be able to:

- Measure and record the temperature of ice water as it is heated. Plot the graph of measurements taken and interpret the change of phase graph using the particle model, identifying the states of matter.
- Analyze a standard change of phase graph of water. Using the particle model, identify where water is a solid, liquid or gas, is freezing/melting or evaporating/condensing. Relate the states of matter to the changes (increase, decrease) of energy in the system.
- Make a model or drawing of particles of the same material in solid, liquid, and gas state. Describe the arrangement, spacing and energy in each state.

Students should know that:

3. Some physical properties, such as mass and volume, depend upon the amount of material. Other physical properties, such as density and melting point, are independent of the quantity of material. Density and melting point are unique physical properties for a material. Tools such as microscopes, scales, beakers, graduated cylinders, Celsius thermometers, and metric rulers are used to measure physical properties.

Students should be able to:

- Distinguish between physical properties that are dependent upon mass (size, shape) and those physical properties such as boiling point, melting point, solubility, density, conduction of heat and pH of a substance or material that are not altered when the mass of the material is changed.

- Calculate the density of various solid materials. Use density to predict whether an object will sink or float in water. Given the density of various solids and liquids, create a density column and explain the arrangement in terms of density.
- Use physical properties to distinguish and separate one substance or material from another.

Students should know that:

4. Exposure to energy, such as light and heat, may change the physical properties of materials.

Mixtures and Solutions

Students should know that:

1. Mixtures can be homogeneous or heterogeneous. Mixtures may be solids, liquids, and/or gases. Most materials are physical mixtures consisting of different components in varying concentrations. The individual components can be separated using the components' unique physical properties.

Students should be able to:

- Distinguish between homogeneous and heterogeneous mixtures. Using their physical properties, design and conduct an investigation to separate the components of a homogeneous or heterogeneous mixture. Recognize that a homogeneous mixture is a solution.

Students should know that:

2. Solutions are homogenous mixtures of two or more components. The properties of a solution depend on the nature and concentration of the solute(s) and the nature of the solvent(s).

Students should be able to:

- Prepare solutions of different concentrations recognizing that the properties of the solution (color, density, boiling point) depend on the nature and concentration of the solute and solvent.

Students should know that:

3. The rate of solubility is influenced by temperature and the surface area of the solute.

Students should be able to:

- Conduct investigations to determine the effect of temperature and surface area of the solute on the rate of solubility. Describe the rate of solubility using the particle model.

Students should know that:

4. Temperature of the solvent can affect the saturation point of the solution.

Students should be able to:

- Conduct investigations to determine the effect of temperature on saturation point. Construct a solubility curve based on data collected. Describe solubility and saturation point using the particle model.

Conservation of Matter

Students should know that:

1. The total mass of the mixture is equal to the sum of the masses of the components. Total mass is conserved when different substances are mixed.

Students should be able to:

- Show that mass is conserved when adding a solute to a solvent (mass of solvent + mass of solute = total mass of solution).

Materials Technology
Students should know that:

1. Synthetic materials and/or modified natural materials are produced to make products used in everyday life.

Students should be able to:

- Select a manufactured item and identify its component materials. Explain how the physical properties of the materials contribute to the function of the item.
- Discuss the social, economic, and/or environmental consequences of the production of new materials to meet human wants and needs.

Key Concepts/Big Ideas

Interactions The three states of phases of matter (solid, liquid, gas) are determined by the arrangement, motion, and interaction of molecules.

Models The Particle Model of matter is a conceptual tool useful in understanding the properties and behavior of matter that is of too small a scale to observe directly.

Observation & Evidence The observation and measurement of characteristic properties, such as density, boiling and melting points, and solubility, of pure substances are useful in distinguishing and separating one substance from another.

Changes An increase or decrease in energy alters the behavior of the particles and thus the material.

Constancy The law of conservation of matter applies to physical changes.

Properties of Materials The properties of matter determine the reasonable use of materials.

Enduring Understandings

Students will understand that…

Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.

The structures of materials determine their properties. The properties of the mixture are based on the properties of its components.

When materials interact within a closed system, the total mass of the system remains the same.

Essential Questions

- What makes a question scientific? What constitutes evidence? When do you know you have enough evidence?
- Why is it necessary to justify and communicate an explanation?
- How have past scientific contributions influenced current scientific understanding of the world?
- How do the properties of materials determine their use?

- How can the properties of the components of a mixture be used to separate the mixture? How do the components determine the properties of mixtures?

- How does conservation of mass apply to the interaction of materials in a closed system?

Real World Context

- Design and conduct investigations with controlled variables to test hypotheses.
- Accurately collect data through the selection and use of tools and techniques appropriate to the investigation.
- Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data.
- Compare and question results with and from other students.
- Form explanations based on accurate and logical analysis of evidence.
- Communicate scientific procedures, data, and explanations to enable the replication of results.
- Analyze results and discuss nature and source of experimental error.
- Recognize that all matter consists of particles and how the particles are arranged determines the physical state. Use the particle model to describe solids, liquids, and gases in terms of the packing and motion of particles.
- Measure and record the temperature of ice water as it is heated. Plot the graph of measurements taken and interpret the change of phase graph using the particle model, identify where water is a solid, liquid or gas, is freezing/melting or evaporating/condensing. Relate the states of matter to the changes (increase, decrease) of energy in the system.
- Design an inquiry to test predictions about what happens to the mass of water when it freezes and discuss the results.
- Begin to distinguish between a “pure” substance and a mixture.
- Discuss that when a solution is made, the solute and solvent particles intermingle and that mass is conserved.
- Design and conduct an experiment to approximately measure solubility of two different substances.
- Design and conduct an experiment to determine how solubility is affected by changes in temperature.
- Describe solubility and saturation point using the particle model.
- Use terms such as dissolve, soluble, insoluble, solution, solvent, and solute to describe the process of dissolving.
- Determine whether a substance is soluble or insoluble.
- Discuss how solubility can be used to help identify substances.
- Determine the relationship between particle size and temperature of the solvent to the rate of solubility.
- Use physical properties to distinguish and separate one substance or material from another.
- Design and conduct an inquiry to obtain a clean sample of salt from crushed rock salt.
- Observe the effect of concentration on properties of solution (color, density, boiling point, melting point).
- Apply chromatography to perform a comparative analysis of solutions.
- Calculate the density of various solid materials. Use density to predict whether an object will sink or float in water. Given the density of various solids and liquids, create a density

column and explain the arrangement in terms of density.
- Select a manufactured item and identify its component materials. Explain how the physical properties of the materials contribute to the function of the item.

Learning Targets/Goals

Students will know…

- The amount of energy in a system determines the spacing and motion of matter particles within the system.
- Physical properties can be used to distinguish and separate one material from another.
- The properties of a mixture are based on the properties of its component parts.
- When materials interact within a closed system the total mass of the system remains the same.

Students will be able to… (21st century skills)

- Use the particle model to describe solids, liquids, and gases in terms of the packing and motion of particles.
- Relate a change in the phase of matter to the increase or decrease of energy in the system.
- Distinguish between physical properties that are extrinsic (color, size, shape) and thost that are intrinsic (density, boiling point, melting point).
- Investigate the effect of temperature and surface area on the rate of solubility of a substance.
- Design and conduct an investigation(s) to separate the components of a homogeneous or heterogeneous mixture.
- Show that mass is conserved when adding a solute to a solvent.

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task

Rubrics for Transfer Tasks

Performance Task
Rubrics/checklists for Performance Tasks:
http://www.doe.k12.de.us/programs/sci_assess/middle68/sum68/prop_mat.shtml
to get rubrics for end of unit summative assessment

Properties of Matter Unit Assessment
Teacher Instructions

Two or more days should be set aside for this assessment. One session should be used for the performance assessment questions where students will work together in groups to achieve their answers. Another session should be used for essay/open-ended questions where students will be expected to work individually to answer questions.

Performance assessment stations should be set up using the following materials:

Question #2. Flotation Devices

- **Do not provide water access for students for this activity**
- 3 rulers
- 2 regularly shaped objects (recommended: clear plastic block from kit and wooden block provided by teacher: one object should float and one should sink)
- 1 scale
- 1 calculator (optional)

Question #4. Mystery Objects

- 3 rulers
- 1 mystery object (recommended: aluminum cylinder)
- 1 scale
- 1 graduated cylinder
- Water
- 1 calculator (optional)

Question #5. Saturation

- 1 scale
- 1 calculator
- 1 cup salt

- 1 scoop
- 1 test tube
- Water
- 1 graduated cylinder
- 1 empty cup

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.

Formative assessment is found in each investigation and embedded throughout. Quick writes are used to determine what the students know prior to starting an investigation. Informal notes of students are also used formatively during the investigation. Teacher observations, student lab sheets, and student journals, response sheets, and student self-assessments are also used. \

Summative Assessments:

Go to http://www.doe.k12.de.us/programs/sci_assess/middle68/sum68/prop_mat.shtml to get the end of the unit summative assessment. The summative assessment consists of 7 items. These items are meant to flow conceptually while spanning different cognitive levels. The items measure the following student understandings and abilities:

- ability to describe the particle model and understand how it explains the differences of energy and space between particles in various phases of a substance.
- understanding of the concept of density and its relationship to floatation. It also measures their procedural knowledge of measurement and calculation of density.
- understanding of solutions and their ability to be separated by physical means. It also measures the student's understanding of phase change and evaporation.
- understanding that physical (ex. Color, mass, volume, shape) and characteristic (ex. Hardness, density, boiling point, melting point) properties are used to distinguish and separate one substance or material from another.
- understanding that saturation occurs when a solute no longer will dissolve and can be seen settling in the solution.
- ability to design, implement and plan for interpretation of a scientific experiment.
- ability to organize and interpret data.
- ability to determine from the graph that an increase in the temperature of solution increases solubility.
- understanding that the particles in matter are in constant motion.
- understanding of the conservation of matter.

Properties of Matter
Summative Assessment
7th Grade

1.a. Draw a diagram to show the difference in the amount of energy of the particles AND the spacing between the particles in a solid, a liquid, and a gas. You may use labels in your diagram.

This item measures the student's ability to describe the particle model and understand how it explains the differences of energy and space between particles in various phases of a substance.

Criteria for a complete Response:

1. Shows the correct relationship of spacing between particles and the phase of matter (e.g., least space–solid, some space–liquid, lots of space–gas).
2. Shows the correct relationship between energy in particles and phase (e.g., little energy–solid, some energy–liquid, lots of energy–gas). This may be shown with arrows, motion symbols, or by labeling the diagram.

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	Shows correct spatial relationships between particles but does not indicate movement of particles.
11	Meets criteria above, but particles are drawn in different sizes (shows particles "expanding" not necessarily space "expanding").
19	Any other partially correct response.
	Incorrect Response
70	Does not meet criteria above.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

1.b. Describe the difference in the amount of energy of the particles AND the spacing between the particles in a solid, a liquid, and a gas.

This item measures the student's ability to describe the particle model and understand how it explains the differences of energy and space between particles in various phases of a substance.

Criteria for a complete response:

1. Describes the correct relationship of spacing between particles and the phase of matter (e.g., least space–solid, some space–liquid, lots of space–gas).
2. Describes the correct relationship between energy in particles and phase (e.g., little energy–solid, some energy–liquid, lots of energy–gas).

Code	Response
	Correct Response

20	Meets criteria above.
21	Meets criteria above but student equates movement with energy.
22	Meets criteria above but student does not use the term particles.
29	Any other completely correct response.
	Partially Complete Response
10	Explains that solids, liquids, and gases each have comparatively increasing space between particles, but student does not include information about energy and/or movement.
11	Explains that solids, liquids and gases each have comparatively increasing energy and/or movement of particles, but student does not include information about spacing.
12	Meets criteria above except incorrectly describes the movement and/or energy of a solid's particles.
19	Any other partially correct response.
	Incorrect Response
70	Explanation does not incorporate space or energy but includes description of solid, liquid, and gas.
71	Equates particles with energy.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

2. Examine the two materials given to you. Using the tools provided, decide which material you would use as a floatation device in fresh water. Show all calculations, and explain why your choice is the best.

This item measures the student's understanding of the concept of density and its relationship to floatation. It also measures their procedural knowledge of measurement and calculation of density.

****NOTE** See teacher instructions sheet for preparation.**

Criteria for a complete response:

1. Shows calculation of densities for materials provided. (If calculators are used, a number given for density will suffice.)
2. Explains that a density less than water (1 g/cm^3) is needed for floatation in water.
3. Makes explicit connection between the density of the object and its relationship with the density of water that allows floatation.

Code	Response
	Complete Response
20	Meets criteria above and chooses material with least density.
21	Meets criteria above but chooses material with greater density and explains that, if molded correctly, combination of material with air or other substance will create a density less than 1 g/cm^3 but provides some

	benefit over less dense material.
29	Any other completely correct response.
	Partially Correct Response
10	Explains that a density less than 1 g/cm^3 is necessary for a substance to float but does not calculate or miscalculates the densities of the materials.
11	Chooses material with greater density. Explanation states that molding or combining with another material can reduce overall density and allow floatation in water.
12	Units are not used or are incorrect.
13	Shows correct calculations and chooses material with least density but does not relate floatation to the density of water.
19	Any other partially correct response.
	Incorrect Response
70	Calculations and/or measurements are incorrect and student logic for floatation is flawed (object is lighter, object is flatter, object has less volume etc.)
71	Calculation of densities is shown, but no choice of material or explanation of floatation is provided.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

3. Peter Piper needs to use salt to pickle his peppers. Unfortunately, he has no salt. Bo Peep tells him not to worry since he lives less than 200 meters from the ocean. Explain what steps Peter must perform to obtain the salt he needs from the ocean water.

This item measures the student's understanding of solutions and their ability to be separated by physical means. It also measures the student's understanding of phase change and evaporation.

Criterion for a complete response:

1. Explains that to separate the salt water solution the water must be evaporated leaving the salt behind.

Code	Response
	Complete Response
20	Meets criterion above.
23	Meets above criterion but includes filtration.
29	Any other completely correct response.
	Partially Correct Response
10	Explanation of separation (water and salt) is correct, but student distills

	and collects the water instead of the salt.
11	Student fails to mention the process of evaporation (e.g., contents "dried up").
19	Any other partially correct response.
	Incorrect Response
70	States that the ocean water (untouched) can be used for the pickling.
72	Uses filtration with no mention of evaporation.
76	Repeats the stem of the question.
79	Any other incorrect response
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

4. Carefully examine the mystery object provided. Using the data sheet of physical and characteristic properties for four different metals, determine what metal makes up your mystery object. Record your data and show density calculations.

This item measures the student's understanding that physical (e.g., color, mass, volume, shape) and characteristic (e.g., hardness, density, boiling point, melting point) properties are used to distinguish and separate one substance or material from another.

Criteria for a complete response:

1. Includes correctly computed data regarding the density of the mystery object.
2. States the identity of the mystery object.

Code	Response
	Complete Response
20	Meets above criteria.
29	Any other completely correct response.
	Partially Correct Response
10	Shows correct density calculations and/or hardness observations but incorrectly identifies the mystery object.
11	Meets the criteria above, but units are incorrect or missing.
19	Any other partially correct response.
	Incorrect Response
70	Shows density calculations that are incorrect.
71	Clearly identifies mystery object, but student does not provide appropriate evidence.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

5. Using the materials provided to you, determine how many grams of salt can be dissolved in 10 mL (10 grams) of water before saturation occurs. a. How will you know when saturation has occurred?

This item measures a student's understanding of saturation:

Criterion for a complete response:

1. Indicates that saturation occurs when a solute no longer will dissolve and can be seen settling in the solution.

Code	Response
	Complete Response
10	Meets above criterion.
19	Any other completely correct response.
	Incorrect Response
70	Does not indicate how saturation is observed with the salt.
71	Meets criterion but confuses vocabulary (e.g., reverses solute and solvent).
76	Repeats stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

5. Using the materials provided to you, determine how many grams of salt can be dissolved in 10 mL (10 grams) of water before saturation occurs. b. Describe your procedure for completing this task.

This item measures the student's ability to design, implement, and plan for interpretation of a scientific experiment.

Criteria for a complete response include the following:

1. Measurement procedures (must include measuring out 10 mL of water and measuring the mass of salt).
2. Instructions for interpretation of data, including when to stop adding the mix.

Code	Response
	Complete Response
20	Meets criteria above.
22	Meets criteria above and may include further procedures that are

	accurate and relevant to the experiment (such as multiple trials, heating to increase saturation point, etc.).
29	Any other completely correct response.
	Partially Correct Response
10	Does not include instructions for interpretation of data.
11	Does not include some procedures.
12	Design is vague and/or difficult to understand.
19	Any other partially correct response.
	Incorrect Response
70	Shows lack of understanding of determination of saturation point, and design is seriously flawed.
71	Does not show coherent structure of design or is VERY hard to understand.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

5. Using the materials provided to you, determine how many grams of salt can be dissolved in 10 mL (10 grams) of water before saturation occurs.
   c. Use the area below to organize your data and show any calculations. Circle your final answer.

This item measures a student's ability to organize and interpret data.

Criterion for a complete response:

1. Shows data, calculations, and a reasonable amount of salt needed to reach saturation.

Note: Usual class data ranges from about 2 grams to about 7 grams. Generally the best results are around 4 grams +/- 1 gram.

Code	Response
	Complete Response
10	Meets criterion above.
11	Meets criterion above and organizes data in a table format.
19	Any other completely correct response.
	Incorrect Response
70	Meets criteria above, but units are missing or incorrect.
71	Expresses final answer only (no data to support answer).
72	Data and calculations are present, but no final answer is given.
73	Organizes data and calculations, but final answer is not reasonable.
76	Repeats stem of the question.
79	Any other incorrect response.
	Non-Response

90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

6. The following graph shows the solubility of a sweetener in water. Point S on the graph represents a saturation point (at 40°C) of the sweetener in water.
   a. Using information from the graph, how could you get more of the sweetener to dissolve in water? Use specific data from the graph to support your suggestion.

This item measures the student's ability to determine from the graph that an increase in the temperature of solution increases solubility.

Criteria for a complete response include the following:

1. Indicates that increasing the temperature of the solution will increase solubility.
2. Uses specific data from the graph to illustrate criterion number one. For example: "At 22 degrees there was 1 gram of solute, but at 36 degrees there were 2 grams, and at 44 degrees there were 3.5 grams. Therefore I concluded that …."

Code	Response
	Complete Response
20	Meets criteria above.
21	Meets criteria above and relates saturation to energy and the particle model.
29	Any other completely correct response.
	Partially Correct Response
10	Indicates that increasing the temperature of the solution will increase solubility, but data is not used to support the answer.
11	Indicates that increasing the temperature of the solution will increase solubility, but data is incomplete or incorrect.
12	Meets all criteria, but units are absent or incorrect.
19	Any other partially correct response.
	Incorrect Response
70	Does not indicate that increased temperature is necessary to add more sweetener to the solution, or indicates that a lower temperature is necessary to add more sweetener to the solution.
72	Suggests that the addition of water will increase solubility.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

6. The following graph shows the solubility of a sweetener in water. Point S on the graph represents a saturation point (at 40°C) of the sweetener in water. Using information from the graph, how could you get more sweetener to dissolve in water? Use specific data from the graph to support your suggestion. b. What is happening to the particles and energy in the solution to allow a greater amount of solute to be added?

This item measures the student's understanding that the particles in matter are in constant motion.

Criterion for a complete response includes the following:

1. Explains that heating the solution increases energy (causing particles to move faster and/or spread farther apart) thereby allowing more solute to become dissolved in the solvent.

Code	Response
	Complete Response
10	Meets criterion above.
19	Any other completely correct response.
	Incorrect Response
70	Indicates that increasing temperature allows more solute to dissolve, but does not explain the mechanism involved.
71	Discusses movement and/or spacing of particles but does not discuss energy.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

7. A cube of ice with a mass of 18.6 grams is in a sealed container. The next day the ice is melted. What is the mass of the water in the container? Explain why.

This item measures student's understanding of the conservation of matter.

Criterion for a complete response includes the following:

1. Indicates that the mass of the water is the same because no matter is able to enter or leave the system.

Code	Response
	Complete Response
10	Meets criterion above.
11	Meets criterion above and specifically indicates conservation of matter/mass.

19	Any other completely correct response.
	Incorrect Response
70	Indicates the mass stays the same without explanation.
71	Indicates the mass of water increased.
72	Indicates the mass of water decreased.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

Student Self-Assessment and Reflection

Teachers are encouraged to have students keep journals.
Daily journal questions (bell ringers)
Pre and post assessment

Instructional Resources

- **What text/print/media/kit/web resources best support this unit?**

The STC Properties of Matter module includes resources and background information for both the teacher and student to use throughout the unit.

What tips to teachers of the unit can you offer about likely rough spots/student misunderstandings and performance weaknesses, and how to troubleshoot those issues?
The **Background** information provided in each lesson of STC Properties of Matter Teacher's Guide provides detailed information for the teacher regarding the science content of the lesson. It may also provide common student misconceptions that relate to that content. (See pages: 4, 15-17, 27-28, 39-40, 49-51, 79-81, 91-92, 125-127, 135-137, 143-145, 153-154, 161-162, 179-180)

Resources for Formative Assessments

1. Keeley, Page; Eberle, Francis; Farrin, Lynn. 2005. Uncovering Student Ideas in Science, 25 Formative Assessment Probes. Volume 1. Arlington, Virginia: NSTA Press.
2. Keeley, Page; Eberle, Francis; Tugel, Joyce. 2007. Uncovering Student Ideas in Science, 25 More Formative Assessment Probes. Volume 2. Arlington, Virginia: NSTA Press.

Volume 1 Formative Assessments:

Lesson 1: page 79. ***Is It Matter?*** This formative assessment provides a list of things that are and are not matter. Students are asked to check those that are matter then explain their thinking by providing a "rule" or reason for what is and is not defined as matter. The purpose of the assessment is to determine student level of understanding on what matter is as well as student ability to recognize forms of matter.

Lesson 7: page 73. ***Is It Melting?*** This formative assessment provides a list of melting and dissolving situations that cause changes in materials. Students are asked to check those that involve the melting of the materials and to explain their thinking by providing a "rule" or reason used to decide if something melts. This probe seeks to identify typical student confusions regarding melting and dissolving.

Lesson 8: page 49. ***Ice Cubes in a Bag.*** This formative assessment provides a scenario in which ice cubes are left to melt in a sealed bag. Given three choices, students are asked to predict what will happen to mass and to provide an explanation for their thinking. This assessment is useful in determining student ideas about conservation of matter in the context of change of state.

Lesson 14: page 55. ***Lemonade.*** This formative assessment provides a scenario in which a known quantity of sugar is stirred into a known quantity of lemonade. Given 5 specific choices, students are asked to make a prediction of the mass of the sweetened lemonade and to provide an explanation for their thinking. This assessment is useful in determining student ideas of conservation of matter in the context of dissolving.

Volume 2 Formative Assessments:

Lesson 2: page 19. ***Comparing Cubes.*** This formative assessment provides a list of statements about a very large and a very small cube of the same materials. Students are asked to identify the true statements. Students are asked to explain their thinking by developing a "rule" or reason for comparing the cubes. This assessment is useful in examining student understandings about characteristic properties of matter.

Lesson 2: page 41. ***Solids and Holes.*** This formative assessment provides a scenario in which a material that floats in water is taken from the water and has holes punched all the way though it. Students are asked to predict what will happen to the material when it is placed back into the water. This probe is useful for determining student understandings that when an object's mass relative to its volume remains unchanged, then its density remains constant.

Lesson 3: page 27. ***Floating Logs.*** This formative assessment provides a scenario in which two logs, whit different dimensions, cut from the same tree are placed in water. Students are asked to predict how the larger log will float compared with the smaller log. Students are asked to develop a "rule" to explain their reasoning. This probe is designed to determine if students think that changing an object's size will affect its density and how that object will float.

Lesson 7: page 47. ***Turning Up the Dial.*** This formative assessment provides a scenario in which the dial on the stove is turned up and then down during the boiling of water. Students are asked to determine if changing the dial changes the boiling temperature of water. Students are asked to determine if changing the dial changes the boiling temperature of water. Students are asked to develop a "rule" to explain their reasoning. This probe is useful in determining student ideas around the characteristic property of boiling point; that the temperature of a boiling liquid remains constant no matter how much heat is applied.

Lesson 7: page 53. ***Boiling Time and Temperature.*** This formative assessment provides a scenario in which temperature of a boiling liquid is taken when it starts to boil and again 20 minutes later. Students are asked to make a prediction regarding the temperature comparisons. Students are asked to develop a "rule" to explain their reasoning. This probe is useful in determining student ideas around the characteristic property of boiling point; that the temperature of a boiling liquid stays constant no matter how long heat is applied.

Lesson 7: page 59. ***Freezing Ice.*** This formative assessment provides a scenario in which students are asked to consider whether freezing temperature will be affected by the size of two different blocks of ice. Students are asked to make a prediction and to provide a "rule" to explain their reasoning. This probe is useful for identifying student ideas around the characteristic property of freezing point; that water freezes at the same temperature independent of volume.

Lesson 7: page 65. ***What's in the Bubbles?*** This formative assessment provides a scenario in which students are asked to speculate what is in the bubbles forming at the bottom of a boiling kettle of water. This probe is useful for identifying student understanding regarding the formation of water vapor as a result of boiling liquid water.

Differentiation

The use of group activities throughout this unit enables students with difficulty to gain insight from fellow classmates. Pair them with strong students.

Brainstorming is a useful way in opening a lesson and can be used by the teacher to determine what students already know.

The use of computers and internet are great tools to complete activities and gain additional insight on topics students may be uncomfortable with.

Encourage discussions within small groups and whole class.

Allow additional time to finish activities.

Use KWL to determine students' prior knowledge, interest, and content understandings.

Enrichment

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goal

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Part 1 Characteristic Properties of Matter

Lesson 1: Our Ideas About Matter : (2 Class Periods)
As an introduction to the unit, students explore, examine, and discuss their ideas about properties of matter.

- Inquiry 1.1 The Bottle and the Balloon
- Inquiry 1.2 Similar Objects
- Inquiry 1.3 The Burning Candle
- Inquiry 1.4 Describing Matter
- Inquiry 1.5 Adding Water
- Inquiry 1.6 Mixing Liquids
- Inquiry 1.7 Floating and Sinking

Lesson 2: Determining Density : (2-3 Class Periods)

While performing three inquiries, students explore the relationships between mass, volume, and density.

- Inquiry 2.1 Measuring the Mass and Volume of Water
- Inquiry 2.2 Comparing the Densities of Different Substances
- Inquiry 2.3 Measuring the Densities of Irregular Objects

Lesson 3: Density Predictions : (1 -2 Class Periods)

After examining floating and sinking, students predict the behavior of mixed substances and objects on the basis of their densities.

- Inquiry 3.1 Building a Density Column

Lesson 4: Do Gases Have Density? : (1- 2 Class Periods)

Students design an experimental procedure to determine the density of air and discuss the accuracies of their results.

- Inquiry 4.1 Finding the Density of Air

Lesson 5: Temperature and Density : (2 -3 Class Periods)

Students construct liquid-and air-filled thermometers and discuss the effect of temperature on the volume of matter and the density of matter.

- Inquiry 5.1 Building a Thermometer
- Inquiry 5.2 Replacing the Liquid with Air
- Inquiry 5.3 Heating the Metal Strip

NOTE: Lesson 6 from the publisher materials of STC/MS Properties of Matter is purposely eliminated from this unit template.

Lesson 7: Just a Phase : (2 Class Periods)

Students measure the temperature of ice/liquid water as it is heated. They graph their results and use the curve to discuss how heat affects the temperature and phase changes of water.

- Inquiry 7.1 Heating Ice Water

Lesson 8: Changing Matter and Mass : (1 Class Periods)

Students predict and investigate the effects of phase changes on the mass of a sample of ice and water.

- Inquiry 8.1 Investigating Mass and Melting
- Inquiry 8.2 Investigating Mass and Freezing

Lesson 9: The Mystery Object : (1 Class Periods)

Students are assessed on the first part of the module.

- Inquiry 9.1 What Substance Makes Up My Mystery Object?

Part 2 Mixtures and Solutions

Lesson 10: Starting the Anchor Activity : (3 - 4 Class Periods)

Students combine the knowledge they gained during previous lessons with additional research, to exhibit and present the function and history of a simple object to the properties of the materials used to make it.

Lesson 11: Pure Substance or Mixture? : (1 - 2 Class Periods)

While examining a number of samples, students decide whether several samples of matter are pure substances or mixtures. They discuss the difficulties in identifying solutions as mixtures.

- Inquiry 11.1 Determining Whether Substances Are Pure or Mixtures

Lesson 12: What Happens When Substances Are Mixed With Water? : (1 - 2 Class Periods)

While investigating the behavior of substances that are mixed together, students discuss the components and properties of a solution.

- Inquiry 12.1 Adding Water to Substances

Lesson 13: How Much Solute Dissolves in a Solvent? : (2 - 3 Class Periods)

Students investigate and measure the solubility of different substances and discuss solubility as a characteristic property of matter. In addition, students investigate how temperature of a solvent can affect the saturation point of the solution.

- Inquiry 13.1 Saturating a Solution
- Inquiry 13.2 Determining How Solubility is Affected by Temperature
- Inquiry 13.2b Saturating the Solution at a Higher Temperature (*This lesson is a Delaware Science Coalition lesson, developed to be inserted into the STC Properties of Matter in order to meet DE standards.)*
-

Lesson 13 b: How does temperature and surface area affect the rate of solubility? (1 Class Periods)

Students determine the affect of temperature changes and particle size on rate of solubility.

- Inquiry 13b Temperature/Surface area and rate of solubility *(This lesson is a Delaware Science Coalition lesson, developed to be inserted into the STC Properties of Matter in order to meet DE standards.)*

Lesson 14: Mass, Volume, Dissolving : (2 Class Periods)

Students again recognize that mass is conserved in a solution.

- Inquiry 14.1 Mixing Water and Alcohol
- Inquiry 14.2 Dissolving a Solid and Measuring Mass

Lesson 15: Separating a Soluble and an Insoluble Substance : (2 Class Periods)

Students use filtration to separate soluble and insoluble substances to clean a sample of rock salt.

- Inquiry 15.1 Filtering a Solution
- Inquiry 15.2 Cleaning Rock Salt

NOTE: Lesson 16 from the publisher materials of STC/MS Properties of Matter is purposely eliminated from this unit template.

Lesson 17: Separating Solutes : (2 Class Periods)

Students use paper chromatography to separate an ink solution that contains several dye solutes and they apply this technique to solve a mock crime.

- Inquiry 17.1 Analyzing Inks
- Inquiry 17.2 Comparing Inks
- Inquiry 17.3 Identifying Inks

Lesson 18: Changing Mixtures : (1 - 2 Class Periods)

Students add salt to ice and boiling water to investigate the effect of solutes on melting and boiling points. They compare the time it takes to melt different alloy samples and relate the concept of solutions to solids.

- Inquiry 18.1 Adding Salt to Ice
- Inquiry 18.2 Adding Salt to Boiling Water
- Inquiry 18.3 Investigating Solid Solutions

Lesson 19: Assessing Our Progress:
This is an assessment which consists of a performance assessment and a written assessment. Together it assesses the knowledge, concepts, and skills developed in parts 1 and 2 of the module.

- Inquiry 19.1 Describing the Components of a Mixture

Prestige Academy Charter School

Name: ________________________________ **Date:** ______________________

Properties of Matter
Summative Assessment
7th Grade

1.a. Draw a diagram to show the difference in the amount of energy of the particles AND the spacing between the particles in a solid, a liquid, and a gas. You may use labels in your diagram.

1.b. Describe the difference in the amount of energy of the particles AND the spacing between the particles in a solid, a liquid, and a gas.

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2. Examine the two materials given to you. Using the tools provided, decide which material you would use as a floatation device in fresh water. Show all calculations and explain why your choice is the best.

3. Peter Piper needs to use salt to pickle his peppers. Unfortunately he has no salt. Bo Peep tells him not to worry since he lives less than 200 meters from the ocean. Explain what steps Peter needs to perform to obtain the salt from the ocean water.

4. Carefully examine the mystery object provided. Using the data sheet of physical and characteristic properties for four different metals, determine which metal makes up your mystery object. Record your data and show density calculations.

Metals	Volume	Hardness	Color	Mass
Aluminum	10 cm^3	2-2.9	Silver	27.0 g
Copper	10 cm^3	2-5.3	Shiny brown	89.0 g
Lead	10 cm^3	1.5	Silver	114.0 g
Iron	10 cm^3	4-5	Silver	78.7 g

5. Using the materials provided to you, determine how many grams of salt can be dissolved in 10 mL (10 grams) of water before saturation occurs.

a. How will you know when saturation has occurred?

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b. Describe your procedure for completing this task.

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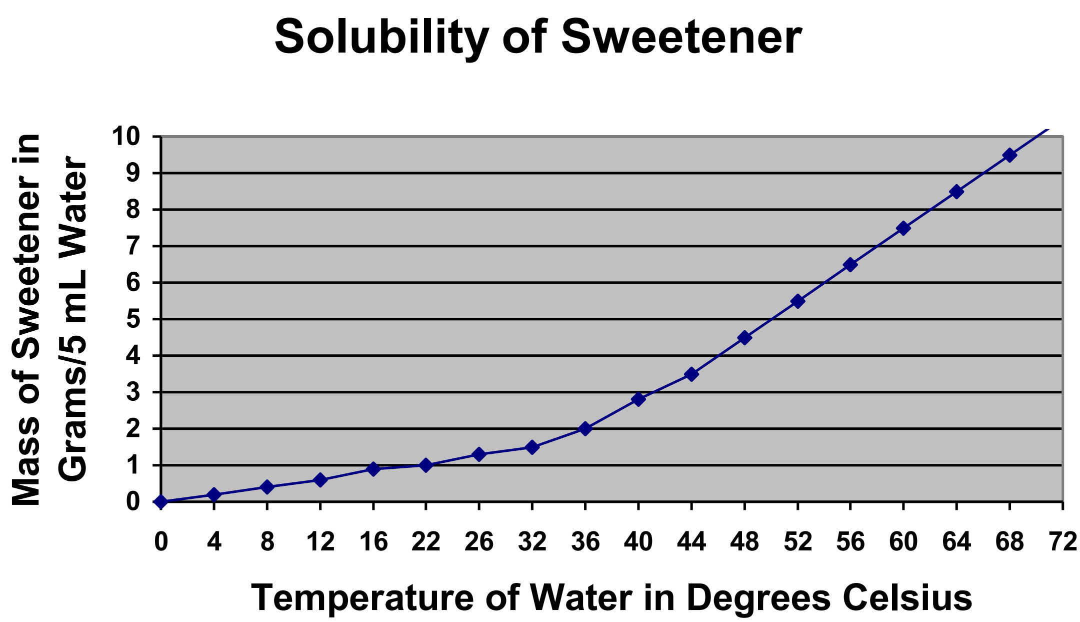
c. Use the area below to organize your data and show any calculations. Circle your final answer.

6. The following graph shows the solubility of a sweetener in water. Point S on the graph represents a saturation point (at 40°C) of the sweetener in water.



a. Using information from the graph, how could you get more sweetener to dissolve in the water? Use specific data from the graph to support your suggestion.

S

b. What is happening to the particles and energy in the solution to allow a greater amount of solute to be added?

7. A cube of ice with a mass of 18.6 grams is in a sealed container. The next day the ice is melted. What is the mass of the water in the container? Explain why.

Prestige Academy Charter School

Unit Title: Our Genes Ourselves **Grade Level(s): 7th**

Subject/Topic Areas: Reproduction, Patterns of Inheritance

Key Vocabulary: Chromosome, Allele, Gene, Sperm, Egg, Homozygous, Heterozygous, Phenotype, Genotype, Dominant, Recessive, Mendel, Punnett square, Pedigree

Designed By: V. Patel **Time Frame: 30 class meetings**
Date: 09/30/2011

SUMMARY OF PURPOSE: In this unit, students research and investigate genetics, genes, traits and heredity using data collected from various activities throughout the unit. Students use Punnett squares and pedigrees to analyze patterns of inheritance. The advantages and disadvantages of sexual and asexual reproduction are addressed. Students will be presented with real life genetic disorders through readings and videos and make decisions that model real life situations. DNA fingerprinting and blood typing are also introduced and used in a mock investigation to identify children separated from their parents as a result of war.

Stage 1: Desired Results

Common Core/ Delaware Standards

This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1 and 7 found on the following web site:
http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard 1: The Nature and Application of Science and Technology

Understandings and Abilities of Scientific Inquiry:
Students should be able to:

1. Frame and refine questions that can be investigated scientifically, and generate testable hypotheses.
2. Design and conduct investigations with controlled variables to test hypotheses.
3. Accurately collect data through the selection and use of tools and techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students.
4. Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.
5. Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.
6. Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Science Technology and Society:
Students should know that:

1. Advances in technology can expand the body of scientific knowledge. Technological tools allow people to observe objects and phenomena that otherwise would not be possible. Technology enhances the quality, accuracy, speed and analysis of data gathered.

2. Science and technology in society are driven by the following factors: economical, political, cultural, social, and environmental. Increased scientific knowledge and technology create changes that can be beneficial or detrimental to individuals or society through impact on human health and the environment.

History and Context of Science:
Students should know that:
1. Over the course of human history, contributions to science have been made by different people from different cultures. Studying some of these contributions and how they came about provides insight into the expansion of scientific knowledge.

Standard 7: Diversity and Continuity of Living Things

Reproduction, Heredity and Development
Students should know that:

1. Reproduction is a characteristic of all living systems and is essential to the continuation of every species.

Students should be able to:

- Recognize that reproduction is a process that occurs in all living systems and is essential to the continuation of the species. Use models or diagrams to identify the structures of a flowering plant that produce eggs and sperm and explain that plants, as well as, animals can reproduce sexually.

2. Some organisms reproduce asexually involving one parent. Asexual reproduction results in offspring that are genetically identical to the parent organism (clones). This process is advantageous in maintaining the genetic make-up of organisms that are successful in a specific environment.

Students should be able to:

- Make a simple labeled drawing of asexual reproduction as it occurs in sexually produced organisms at the cellular level. Indicate that resulting cells contain an identical copy of genetic information from the parent cell.

3. Some organisms reproduce sexually involving two parents. Sexual reproduction results in offspring that have greater genetic diversity than those resulting from asexual reproduction. One-half of the offspring's genetic information comes from the "male" parent and one-half comes from the "female" parent. These genetic differences help to ensure the survival of offspring in varied environments.

Students should be ale to:

- Given varied scenarios (including one or two parent reproduction, and having traits identical to or different than the parents), classify offspring as either sexually or asexually produced and justify your response.
- Compare and contrast asexual and sexual reproduction in terms of potential variation and adaptation to a static or changing environment. Relate advantages and/or disadvantages of each strategy.

4. In sexual reproduction after the egg is fertilized, each of the new cells in the developing organism receives an exact copy of the genetic information contained in the nucleus of a fertilized egg.

Students should be able to:

- Make a simple labeled drawing of human reproductive cells. Indicate that the sex cells (sperm and egg) each have half of the chromosomal number (23) as a fertilized egg (46). The fertilized egg has the same number of chromosomes as each of the body cells of the new organism. Recognize that different organisms may have different numbers of chromosomes and that the number of chromosomes does not relate to the complexity of the organism.

7. Chromosomes are found in the nucleus of the cell and contain genes that are made of DNA.

Students should be ale to:

- Describe the relationship between genes, chromosomes, and DNA in terms of location and relative size.

8. Chromosomes can be arranged in pairs (one-half of each pair from each parent). These pairs are approximately the same size and shape, and have similar sequences of genes. Humans have 23 pairs(46) of chromosomes. Other organisms may have different numbers of chromosomes. In humans, gender is determined by a pair of sex chromosomes. Females possess two X chromosomes; males an X and a Y chromosome. The sex of an embryo is determined by the sex chromosome found in the sperm cell.

Students should be ale to:

- Explain how the sex chromosomes inherited from each parent determines the gender of the offspring.

9. Alternative versions of genes (different alleles) account for variations in inherited characteristics (i.e., flower color). Pairs of chromosomes that have the same allele present on both chromosomes are homozygous. Pairs of chromosomes with different alleles are heterozygous.

Students should be able to:

- Model a random process (e.g., coin toss) that illustrates which alleles can be passed from parent to offspring.

10. A dominant trait will be expressed if the organism is heterozygous or homozygous for the trait. A recessive trait will only be expressed if the organism is homozygous for the trait.

Students should be able to:

- Use single trait Punnett squares to examine the genotypes of individuals and indicate which individuals will express dominant or recessive traits. Justify the indication by relating that dominant alleles appearing heterozygously or homozygously are expressed or that two recessive alleles (homozygous) are required for an offspring to express a recessive trait phenotypically.
- Use pedigrees to illustrate the heritability of dominant and recessive alleles over several generations.

11. Mendelian genetics can be used to predict genotypes and phenotypes of offspring resulting from sexual reproduction.

Students should be able to:

- Research and report on the contributions of Gregor Mendel and other genetic researchers and how their contributions altered the body of scientific knowledge.

Technology Application

Students should know that:

1. Selective breeding is used to cultivate plants and domesticated animals with desirable traits.

Students should be able to:

- Research and report on selective breeding. Select an organism (e.g., race horses, pedigree dogs, drought resistant plants) and trace its history of development and the traits of the plant or animal that were enhanced by selective breeding.

2. Knowledge gained from research in genetics is being applied to areas of human health. Geneticists and genetic counselors may use pedigrees and Punnett squares to help predict the

possibility of genetic disorders in future generations

Students should be able to:

- Recognize that the health profession uses pedigree charts to trace genetic disorders in past generations make predictions for future generations. Research and report on a chromosomal disorder. Complete a simulated pedigree for a fictional family based on your research

Key Concepts/Big Ideas

- **Observation and Evidence** (inherited traits are introduced and investigated)
- **Patterns** (Punnett squares are used to predict traits among offspring: pedigrees are used to track patterns across generations)
- **Models** (students perform simulated DNA fingerprinting to assess parentage; students design critter offspring to model patterns of inheritance, including dominance, recessiveness and inheritance of sex-linked traits)
- **Reasoning and explanations** (students use the Marfan scenario to make evidence based decisions regarding the benefits and tradeoffs of genetic testing)
- **Structure and function** (students investigate the role of DNA, genes, and chromosomes in reproduction)

Enduring Understandings

Students will understand that…

Enduring Understanding: Organisms reproduce, develop, have predictable life cycles, and pass on heritable traits to their offspring.

- All inherited traits are passed along by DNA
- There are inheritable traits and traits that are altered by environmental factors.
- Asexual and sexual reproduction is two successful strategies in reproduction.
- Punnett squares and pedigrees can be used to predict inherited traits

Enduring Understanding: The development of technology has allowed us to apply our knowledge of genetics, reproduction, development and evolution to meet human needs and wants.

Essential Questions

Essential Question: What are the advantages and disadvantages of different reproductive strategies?

- What is the difference between sexual and asexual reproduction?
- How are inherited traits passed down from generation to generation?
- What causes variation among humans? What are examples of inherited traits?
- How does the size of the sample data collected compare to the theoretical probability?
- How does a probability of inherited traits passing from generation to generation differ in a simulation versus the theoretical probability?
- How is a Punnett square useful in predicting patterns of inheritance?
- How is a pedigree useful in studying traits?
- Why is the work of Gregor Mendel important in the field of genetics?
- How are chromosomes related to inheritance of traits?
- Can the environment affect inherited traits?

Essential Question: How does the understanding and manipulation of genetics, reproduction, development and evolution affect the quality of human life?

- What trade-offs exist in knowing whether an individual carries a genetic abnormality? How are genetic diseases predicted?
- What are societal and ethical issues involved in genetic testing and genetic fingerprinting?

Real World Context

- There are a variety of human traits that are expressed.
- Some traits may be inherited and some diseases may be inherited. The probability of inheriting a genetic disease may be predicted.
- Asexual reproduction produces offspring genetically identical to the parent. Sexual reproduction produces offspring with a combination of traits from both parents.
- Trade-offs exist when using models to represent the real world.
- The nucleus of cells contains chromosomes. A chromosome is divided into regions called genes. Genes are part of a long molecule called DNA which encodes information for inherited traits. An allele is a variation of a gene.
- An individual has two copies of the alleles for each inherited trait. A dominant trait requires only one copy of the allele to be expressed. A recessive trait requires two copies of the allele to be expressed.
- An individual with two copies of the same allele for a trait is homozygous. An individual with two different alleles for a trait is heterozygous.
- In sexual reproduction, offspring inherit ½ of their genes from each parent. Which ½ they receive from each parent is a random process.
- Data observed in an investigation may be different than the predicted theoretical probability. The larger the sample size of data collected in an investigation, the more closely the data will fit the theoretical probability.
- Modern knowledge of genetics has come about through past contributions from individuals, such as Mendel.
- An organism' traits are determined by both genetics and the environment (nature versus nurture).
- In most organisms, gender is determined by the sex chromosomes (X and Y). In most mammals, XX represents a female and XY a male.
- In sexual reproduction, the diversity of offspring results primarily from the many possible combinations of pairs of alleles transferred from parents to offspring.
- A pedigree is a representation of expressed traits in multiple generations.
- Technology allows individuals to learn whether they have genetic abnormalities. Trade-offs exist in knowing this information. (Ex: Knowing if a gene is carried for Marfan syndrome.)
- Genetic testing can provide information about identity and family relationships.

Learning Targets/Goals

Students will know…

- Make observations.
- Collect and organize data. (Make and analyze a data table indicating class results of a observed traits.)
- Construct a bar graph.
- Conduct an investigation and make predictions. (Grow Nicotiana plants. Predict and investigate the inherited traits.)
- Given varied scenarios, classify offspring as sexually or asexually produced and justify your response.
- Compare and contrast sexual and asexual reproduction in terms of variation and adaptation to a static or changing environment.
- Make a simple labeled drawing of human reproductive cells, indicating the sex cells (sperm and egg) with half the chromosomal number (23) as the fertilized egg (46).
- Recognize that different organisms may have different numbers of chromosomes and that the number of chromosomes does not relate to the complexity of the organism.
- Make a simple labeled drawing of asexual reproduction as it occurs in sexually produced organisms (i.e., skin cells). Indicate that the resulting cells contain an identical copy of the genetic

information from the parent cell.
- Discuss the advantages and disadvantages to cloning.
- Describe the relationship between genes, chromosomes, and DNA in terms of location and size.
- Modeling the passing along of a simple trait from generation to generation.
- Discuss trade-offs that exist when modeling the passing of genes form one generation to the next.
- Simulate patterns of inheritance using a coin toss.
- Explain ratios of phenotypes in offspring using knowledge of genetics.
- Explain how the body of scientific information in genetics changes over time as critical review of results are investigated and new questions and technologies emerge.
- Use a single trait Punnett square to predict the outcome of a genetic cross when the parents' genotypes are known. Indicate which individuals will express a dominant or recessive trait. Justify the indication by relating that dominant alleles appearing heterozygously or homozygously are expressed or that two recessive alleles (homozygous) are required for an offspring to express a recessive trait.
- Use a pedigree to determine the pattern of inheritance of dominant and recessive alleles over several generations.
- Discuss the pros and cons of genetic testing.
- Use genetic information to match parents to offspring.
    - Research and report on selective breeding. Select an organisms (i.e., race horses, pedigree dogs) and trace its history of development and the traits of the animal (or plant) that were enhanced by selective breeding.

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task

- The traits of an organism are determined by genes. Genes are subunits of chromosomes. Chromosomes are found in cells, occur in pairs and carry hereditary information. Genes are made of the chemical DNA.
- Asexual reproduction results in offspring that are genetically identical to the parent. This process is advantageous in maintaining the genetic makeup of organisms that are successful in a specific environment.
- Sexual reproduction results from the combination of two gametes (egg and sperm). This process results in increased variability among offspring, which may increase the probability of survival in changing environments.
- Patterns of inheritance follow rules and are therefore predictable. Understanding these patterns can inform decisions about human health, predict the possibility of genetic disorders, and be used for selective breeding of animals and plants.

Rubrics for Transfer Tasks:
http://www.doe.k12.de.us/programs/sci_acsssess/default.shtml

Performance Task

	4	3	2	1
Description of work submitted in by student.	Each question of the lab packet is attempted and work is legible.	Work is submitted late. Each question is attempted and work is legible.	Work is submitted in on time/late and work is neat and legible however, much of the lab packet is left blank.	Work is sloppy, packet is in poor condition (unprofessional) and incomplete.

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.

Formative assessment is found in each activity. Quick writes to journal questions are used to determine what the student knows prior to starting the activity as well as what the student has learned throughout the activity. These are scored using a 4-point SEPUP system, as part of the curricular materials.

Summative Assessments:
http://www.doe.k12.de.us/programs/sci_acsssess/default.shtml

Student Self-Assessment and Reflection

Pairs Communication Activity
Students should keep a running journal that tracks their learning as they progress through the unit. This journal should be a combination of self reflection and data collected as a result of unit activities.

When students complete the lessons in this unit, they should be encouraged to make notes on their work that indicates growth in understanding. Not all worksheets should be officially graded, but all work should include opportunities for student reflection. Only those assignments that measure knowledge that should be solidified in the minds of the students should be graded. Learning experiences should not be graded as they are developed to draw out student misconceptions.

Instructional Resources

Our Genes Ourselves Science Education for Public Understanding Program. 2001. The Regents of the University of California. Published by Lab Aids. Ronkonkoma, NY.)

Differentiation

- The use of group activities throughout this unit enables students with difficulty to gain insight from fellow classmates. Pair students together to best make use of student strengths in different areas. For example, pair a good reader with someone who is good at tactile tasks.
- Provide extended time for students whose strength is not in the area of focus. For example, provide extra time for a writing assignment for a student who struggles with writing.
- Use a "K-W-L" chart to keep track of "what we know", "What we want to know" and "what we learned". Revise the chart often through out the unit as new questions arise and new knowledge is learned. This will also allow for pre-testing of student knowledge if completed in the student journal.
- Use a concept map chart to help students visually connect the concepts in the unit.
- Review the previous day's lesson and continuously reinforce concepts from the unit.
- Permit the apt student to accelerate their rate of progress and work independently on some content.
- Students may use graphic organizers, maps and diagrams to effectively facilitate differing levels of cognitive processing for students of different ability levels.

Enrichment

Tips:
The following are introduced in this unit but are not part of the assessed middle school standards. Class time should not be given to the issues below.

- Mutations are introduced in this unit but are not part of the middle school science standards and are not assessed at this time.
- Co-dominance is also introduced in this unit but is also not part of the middle school standards nor is assessed at this time.
- Learning about blood groups is not part of the middle school standards nor is it assessed.
- Learning about the nucleotides (A,C,T,and G) is not part of the middle school standards.
- Learning how enzymes are used to generate DNA fingerprints is not part of the middle school

standards.

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

The SEPUP *Our Genes, Our Selves* unit is used to meet the learning goals. The unit is divided into 17 short activities. A summary of each activity is listed below. Note that the activities begin with number 54 and end with number 71.

Resource: **SEPUP: Our Genes Ourselves** Science Education for Public Understanding Program. 2001. The Regents of the University of California. Published by Lab Aids. Ronkonkoma, NY.)

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Investigation 54: *Investigating Human Traits*- Students investigate traits for six human characteristics as the beginning of an ongoing discussion of human variation and heredity. The idea of inherited traits is introduced.

Investigation 55: *Plants Have Genes, Too!*- Students germinate seeds that are the offspring of plants bred from true-breeding green and pale yellow strains of flowering tobacco. By predicting and then quantifying the colors of the offspring plants, students obtain genetic data for analysis.

Investigation 56: *Joe's Dilemma*-Students are introduced to the issue of genetic testing through a story about a student who suspects he may have inherited a genetic syndrome (the Marfan syndrome). Students generate questions they would have if they were in this situation, and make a preliminary decision of what they would do based on the limited information they have so far.

Investigation 57: *Copycat*-Asexual and sexual reproduction are introduced. Differences between the two prepare students to understand the mechanisms of heredity in sexually reproducing organisms.

Investigation 58: *Creature Features*-Students develop hypotheses to explain the behavior of genes in a story about zoo scientists breeding imaginary creatures. They use models to evaluate how well the hypotheses fit additional evidence about the critter offspring.

Investigation 59: *Gene Combo*-Students use a coin tossing simulation to model the pattern of inheritance exhibited by many single-gene traits, including the critter tail-color characteristic. They relate this model to the hypothesis they developed in Activity 58.

Investigation 60: *Mendel, First Geneticist*- A reading describes Mendel's experiments with pea plants. Students relate the rules discovered by Mendel in his analysis of pea plant crosses to their findings about critter genes. The reading introduces the idea that basic concepts discovered in working with one type of organism (pea plants) can often be generalized to other organisms or groups (humans).

Investigation 61: *Gene Squares*-Students use Punnett squares to predict the approximate frequencies of traits among the offspring of specific critter crosses.

Investigation 62: *Analyzing Genetic Data*-Students quantify the results of the seeds they germinated in Activity 55 "Plants have Genes too" and compare their results to Mendel's results.

Investigation 63: *Show Me the Genes!*- A reading describes the behavior of chromosomes during sexual reproduction and its consistency with basic patterns of inheritance. In addition, the function of DNA and the effects of randomly occurring mutations are introduced.

Investigation 64: *Nature and Nurture*- Students design an experiment to investigate the effect of the environment on the development of the green color trait in Nicotiana seedlings. This introduces the interplay of heredity (nature) and environmental (nurture factors in the development of an organisms traits.

Investigation 65: *Breeding Critters*-More Traits- Students model the diversity of offspring possible from two parents and discover patterns of inheritance other than strict dominant/recessive traits.

Investigation 66: *Patterns in Pedigree*- Students investigate the behavior of genes for human traits. Pedigrees are introduced as another way to study genes. They are then used to analyze the patterns of transmission for recessive and dominant human traits.

Investigation 67: *What Would You Do?* - Students return to Joe's dilemma and consider whether he should be tested for the Marfan syndrome. This activity provides more information about the Marfan syndrome and also allows students to consider further how a diagnosis of a genetic condition might affect a person.

Investigation 68: *Searching for the Lost Children*- Students are introduced to the problem of identifying people who cannot identify themselves. They read a story of some children lost during a war. Although the story is fictional, it is based on actual situations in recent times.

Investigation 69: *Evidence from DNA*- Students learn how DNA fingerprinting is done by performing a simulation of the process used to generate different sized pieces of DNA. They compare their simulation to the actual procedures used by scientists to prepare DNA fingerprints.

Investigation 70: *Finding the Lost Children*- Students investigate the use of DNA fingerprints as evidence in establishing family relationships. They use DNA fingerprints to obtain additional evidence about the identities of the lost children of John and Belinda and of Mai and Paul.

Investigation 71: *Should We?* Students learn about the work of Dr. Mary-Claire King, who helped families in Argentina find their lost children. They then perform an ethical analysis to decide what should be done with the lost children of Namelia.

Potential Misunderstandings:

1. Students often think that, because an offspring looks similar to one or the other parent, that the offspring received more genetic material from one parent than the other. Students often think that girls receive more genetic makeup from their mother and boys more from their father.

2. Students may confuse the paring of genes and state that ½ the genetic makeup comes from each parent yet incorrectly state that all of the eye color, for example, comes from one parent while all of another trait comes from another. In other words, that more of one trait comes from one parent than the other.
3. Students often confuse the paring of alleles and will pair them incorrectly at random, often making the offspring directly identical to a parent.
4. Students often confuse genotype with phenotype.
5. Students often think that some of the offspring produced through sexual reproduction will be identical to each other and do not fully understand the variability of such an occurrence.
6. Students often confuse sexual with asexual reproduction and reverse the advantages of each.
7. Students often believe that the most commonly expressed traits are dominant and that the less commonly expressed traits are recessive.
8. While some students can correctly make a Punnett Square, they do not fully understand the information that the tool provides.
9. Students often incorrectly believe that the gender of offspring is dependent upon other offspring. For example, if a mother and father have four boys, students often think the chance of having another boy is not 50%.

This unit is meant to be taught in a 6 week format. Here is a suggested timeframe based on a regular 40-55 minute class period.

Monday	Tuesday	Wednesday	Thursday	Friday
Activity 54: Investigating Human traits	Activity 54: Investigating Human traits	Activity 55: Plants have Genes, Too!	Activity 56: Joe's Dilemma	Activity 56: Joe's Dilemma
Activity 57: Copycat	Activity 58: Creature Feature	Activity 58: Creature Feature	Activity 59: Gene Combo	Activity 59: Gene Combo
Activity 60: Mendel, First Geneticist	Activity 61: Gene Squares	Activity 61: Gene Squares	Activity 61: Gene Squares	Activity 62: Analyzing Genetic Data
Activity 63: Show me the Genes!	Activity 63: Show me the Genes!	Activity 64: Nature and Nurture	Activity 64: Nature and Nurture	Activity 65: Breeding Critters-More Traits
Activity 65: Breeding Critters-More Traits	Activity 66: Patterns in Pedigrees	Activity 66: Patterns in Pedigrees	Activity 68: Searching for the Lost Children	Activity 69: Evidence from DNA
Activity 70: Finding the Lost Children	Activity 71: Should We?	Activity 71: Should We?	Summative Assessment	Summative Assessment

Investigating Human Traits 54

1–2
40- to 50-minute sessions

INVESTIGATION

ACTIVITY OVERVIEW

SUMMARY

Students investigate traits for six human characteristics as the beginning of an ongoing discussion of human variation and heredity. The idea of inherited traits is introduced.

KEY CONCEPTS AND PROCESS SKILLS

1. Graphing data can reveal patterns that are not apparent from data tables.
2. Every person has unique characteristics, including physical characteristics and personality, that distinguish him or her from other people.
3. Related individuals often (but not always) display similar characteristics.
4. An organism's traits can be caused by a number of factors, including hereditary and environmental factors, that affect growth and development.
5. Genes are the units of information for inherited traits that parents transmit to their offspring.

KEY VOCABULARY

characteristic
inherited
gene, genetics
trait
heredity

MATERIALS AND ADVANCE PREPARATION

For the teacher

1 Transparency 54.1, "Human Traits: Class Results"
1 Transparency 54.2, "Bar Graph Grid"
* 1 overhead projector

For the class

* 6 sheets of chart paper (or transparencies with graph grids)
* several colors of markers (or transparency pens)

For each pair of students

* meter stick, tape measure, or height chart

For each student

1 Student Sheet 54.1, "Human Traits: Group Results"

1 Student Sheet 54.2, "Human Traits: Class Results"

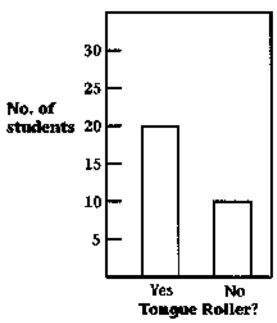
1 piece of PTC paper

1 piece of control paper

* 1 graph paper

**Not supplied in kit*

Prepare six charts (or six copies of Transparency 54.2, "Bar Graph Grid") for displaying sample graphs. While each pair of students will be asked to graph one of the six characteristics, only five of the student pairs need to copy their graphs to display in front of the entire class. (The graph for the PTC-tasting characteristic will serve as a demonstration.) In this way, the entire class can view all the graphs.



On each chart, label the y-axis of each graph as "Number of Students." Label the x-axis with the specific characteristic and its possible alternatives. For example, in the case of the PTC-tasting trait, the x-axis would be labeled as "PTC Taster?" and the alternatives listed as "Yes" or "No." A sample bar graph is shown to the left.

TEACHING SUMMARY

Getting Started

1. Introduce the unit and the activity.

Doing the Activity

2. Students collect data about six characteristics.
3. Each student prepares a graph of the class's traits for one of the characteristics.

Follow-Up

4. The class discusses their observations and the causes of variation among people.

Extension

Students gather data on ten more people who are not in the class and add the results to the totals.

BACKGROUND INFORMATION

The Genetic Basis of Selected Human Traits

The hereditary basis of some of the traits students investigate in this activity is fairly straightforward, while other traits are more complex.

■ **Teacher's Note:** Many fairly recent books and videos present incorrect information about some human traits. Almost no obvious physical characteristics of humans follow simple Mendelian inheritance patterns. (For background on Mendel and the Mendelian pattern of inheritance, see Activity 60, "Mendel, First Geneticist." However, do not introduce Mendel to students until Activity 60.) You will find materials that incorrectly indicate that eye color, tongue rolling, earlobe attachment, hitchhiker's thumb, dimples, widow's peak, and other traits can be explained by simple one-gene inheritance of dominant vs. recessive alleles. Twin studies have shown that earlier investigations into these traits came to incorrect conclusions.

Eye Color

Eye and hair color are the product of the action of several genes, interacting in a way that is not completely understood. Although brown eye color usually behaves as if dominant to blue eye color, it is possible for two blue-eyed parents to have brown-eyed children.

Tongue Rolling

For many years, textbooks have suggested that the ability to roll the tongue easily into a tube was a simple dominant Mendelian trait. However, studies of identical twins have provided convincing evidence against this type of inheritance pattern. Identical twins are no more likely than other siblings to display the same tongue-rolling behavior. The geneticist who originally published the report that this was a dominant trait has since published material indicating his concern that his incorrect results of many years ago still persist in textbooks. (Similarly, free earlobes were once considered to be a simple dominant trait, but analysis of identical twins indicates that the determination of free vs. attached earlobes is more complex than originally thought.)

Double-Jointed Fingers

This is also not a simple trait. However, as students will learn later in the course, it can be associated with a dominant trait, called the Marfan syndrome.

PTC Tasting

The only known human trait that is relatively easy to determine and based on simple, one-gene Mendelian inheritance patterns is the ability to taste PTC. PTC is a chemical called phenylthiocarbamide. The PTC papers have a very small amount of this chemical. Tasting is dominant over non-tasting. However, this dominance may be incomplete; individuals with two alleles for PTC tasting may tend to have a stronger tasting reaction than individuals with only one allele for PTC tasting. This difference is more easily detected with another chemical, called PROP, which is not available for classroom use. Recent investigations of the genetics and physiological basis of PTC and PROP tasting suggest that food preferences are correlated to the ability to taste these chemicals. Non-tasters tend to like spicy, flavorful foods, while strong tasters (especially when young) are less likely to like strong flavors. Even this trait, which has a strong genetic basis, can vary with age or environmental factors (such as what a person has recently eaten).

Height and Arm Span

Height and arm span are continuously variable characteristics determined by more than one gene and by environmental factors. For example, genetic factors determine the upper height an individual may reach, but environmental factors such as diet affect whether this potential height is actually reached.

REFERENCES

Blakeslee, S. "Chocolate Lover or Broccoli Hater: Answer's on the Tip of Your Tongue." *The New York Times.* C2 (February 18, 1997).

Jones, S.L. *The Language of Genes. Biology, History, and the Evolutionary Future.* London: Harper Collins Publishers, 1993.

McKusick, V.A. *Mendelian Inheritance In Man: Catalogs of Autosomal Dominant, Autosomal Recessive, and X-linked Phenotypes.* Baltimore: The Johns Hopkins University Press, 1992.

TEACHING SUGGESTIONS

■ GETTING STARTED

Introduce the unit and the activity.

Begin by asking students if they know of any families where some or all of the family members look a lot alike. Bring out the idea that biologically related members of a family often resemble each other more than members who are related by marriage or adoption. Students are likely to offer some examples, and also to mention examples of families with members who don't look alike. After a few examples, ask ***What causes family members to look alike?*** Students may bring up terms like *genes* or the idea of heredity, but if not, listen to their ideas and explain that they will be studying this question and related questions in this unit on genetics and heredity.

Explain that if a parent passes a trait, such as red hair, on to a child, we say that the child has **inherited** the trait from the parent. **Heredity** refers to the study of these traits that are passed on from parents to their children.

Then have students read the Introduction to the unit on page D-3 in the Student Book. Explain that **genetics** is the study of variation and heredity. Tell students that they will begin their study of genetics by gathering and discussing some information about people in the class. Emphasize that that there is nothing "right" or "wrong" about a particular trait.

The terms **characteristic** and **trait** are first used in the Introduction to the activity on page D-4 in the Student Book. Be sure to review the Introduction and to reinforce the use of these terms during the activity. A *trait,* such as round, describes a specific appearance of a *characteristic,* such as face shape. Explain to students that they will investigate human uniqueness and variability by collecting data about six different human characteristics. Distribute Student Sheet 54.1, "Human Traits: Group Results," to each student.

■ DOING THE ACTIVITY

Students collect data about six characteristics.

Have students follow the Procedure for the Investigation. You may wish to have a student read each step aloud to the class and then provide some clarification. For tongue rolling, refer to the picture and tell students to classify as positive only those students who can easily and fairly completely roll the tongue into a tube-like shape. If necessary, review how to use the meter sticks. Note: If you have any students who are extremely short or tall and you think this may lead to discomfort for these students, you can skip the collection of height and arm span data. In this case, you will not have data for any traits that show continuous variation within a range.

Tell students how you will distribute the PTC and control paper. It is best to distribute the paper yourself—have one student from each group first get a piece of control paper for everyone, and then return for PTC paper when everyone in the group is ready. Emphasize sanitary procedures for discarding the papers.

Allow the students about 15 minutes to collect their data and provide you with their results. Use the data they provide to complete Transparency 54.1, "Human Traits: Class Results."

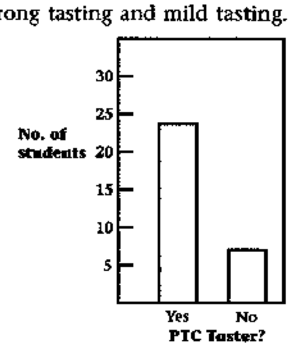
Each student prepares a graph of the class's traits for one of the characteristics.

Students' graphs may be used to assess the "Organizing Data" element of the DESIGNING AND CONDUCTING INVESTIGATIONS (DCI) variable. Ask students, ***Why should we prepare a bar graph to show the data you collected?*** and ***What should the bar graph look like?***

Because the data collected provide a frequency distribution for the various traits within the classroom population, bar graphs (histograms) are the most appropriate method for representing the data. The y-axis should always represent the number of students, while the x-axis should represent the traits.

A sample level 3 graph follows:

Demonstrate how to prepare a bar graph for the PTC tasting trait. There are likely to be two alternatives for this trait (tasting and not tasting), although you may have a third alternative if students decide to distinguish between strong tasting and mild tasting. Use chart paper or a copy of Transparency 54.2, "Bar Graph Grid," and the PTC data to show students how to prepare a bar graph of the results, as shown here.



Assign a trait (other than PTC tasting) for each student to graph for Step 10. For the height and arm span graphs, students should round their results to the nearest 5 cm. Each range can be used as a category on the horizontal axis of the bar graph, as shown on the right.

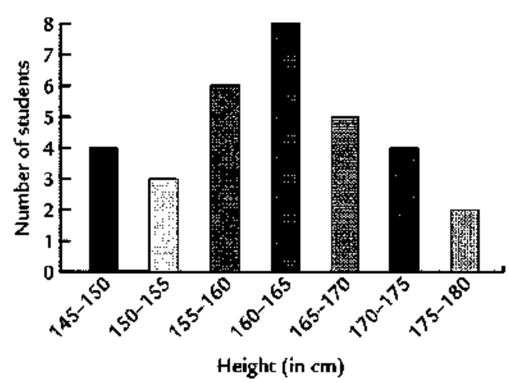
Selected students can transfer their graphs to a transparency or chart paper. Select a student to present each graph. These graphs can be saved for further discussion throughout the unit.

Discuss the results and student comments. Then have students proceed to the Analysis Questions. These questions are open-ended and are appropriate for group discussion.

■ FOLLOW-UP

4. The class discusses their observations and the causes of variation among people.

Ask students, ***What causes some of the variation among humans that you observed in this activity?*** Some of their suggestions are likely to refer to the idea that we get traits from our parents or grandparents. Others will refer to differences in the environment or during development and growth. You may wish to categorize their responses according to whether they are related to nature vs. nurture (that is, heredity vs. environment). Explain that the term *nature vs. nurture* is used to distinguish between traits that an individual is born with, either due to heredity or other factors, and traits that an individual



acquires as a result of experiences, such as family experience or education. One of the most controversial and interesting questions related to inheritance is the role of genes vs. the environment in determining intelligence. This is a complicated question, as it is very difficult to control all the relevant variables in human studies and intelligence is not a simple, easily categorized or quantified characteristic. This provides an opportunity to reflect back to some of the concepts presented in Unit A, "Studying People Scientifically," in *Science and Life Issues*.

Encourage students to think of examples of traits that are influenced by both environment and genetics. Skin coloring or height can be used as examples. Both have a basis in heredity, but skin coloring can be affected by the amount of sunlight to which a person is exposed, and height can be affected by dietary factors. Use these discussions as a springboard to find out what students think and know about heredity. Have students think about the role of heredity and the environment in some of the characteristics they have looked at in this activity. You might ask if they can think of any environmental factors that might affect whether a person can taste PTC, for example. Age and what a person has eaten recently are two factors that might affect this trait, which does have a genetic basis.

Tell students that in this part of the course they will be learning more about the field of heredity (or genetics), which is the study of how traits are passed from parents to their offspring and subsequent generations. You will return to evidence about the heredity of each trait after students learn more about genetics.

The Analysis Questions in this activity are generally intended for class discussion, although students can begin by thinking about them individually or in their groups of four. The genetic basis of heredity will make more sense when students have an understanding later in the course of how we know whether a trait is inherited. Each of the traits has a hereditary component, but other factors can affect many of the traits.

Additional questions to ask include, ***What patterns do you see in the data for the different characteristics? What characteristics are easiest to categorize?*** Students often begin by focusing on which variants are most common. You may need to ask some leading questions to get them to consider the differences among PTC tasting, which is an all-or-nothing trait; height, which shows continuous variation over a large range; and eye color, which shows four or five distinct color families, but variations of those colors as well. For tongue rolling, some students may be difficult to categorize. See the Background Information in this activity for the genetic basis of each of these traits.

Analysis Question 1 can be used as a springboard for a discussion of variation and of the idea that some traits can be quantified (height, arm span), while others are more qualitative (ear lobe connection, shape of nose, hair color, etc.). Some traits can be fairly easily categorized into separate categories (PTC tasting or eye color), while others are continuous or show so much variation that they can't be divided into simple categories (height, face shape, etc.).

Extension

Students gather data on ten more people who are not in the class and add the results to the totals.

You can have students compare the class data to data from the larger group, to reinforce the importance of sample size in investigations of humans.

Encourage students to think about the class as a sample of the community, which may or may not reflect the diversity of the community.

SUGGESTED ANSWERS TO ANALYSIS QUESTIONS

1. *For each of the six characteristics you studied, how many versions, or traits, are observed in your class? You can answer this question by completing the table below. (For example, if your class has people with brown and blue eyes only, then you would fill in the first column with "eye color," the second column with "brown and blue," and the third column with the number "2" to represent the two colors observed.)*

   Answers will depend on the variation in the class. Typical answers appear below.

2. *Which of the traits you investigated—for eye color, tongue rolling, PTC tasting, crossing all your fingers, height, and arm span—do you think people inherit from their biological parents? Explain.*

   Some students think everything is inherited, some think very few traits are inherited, and others will say that it depends on the trait. The goal is to get them to think about the question and for you to find out what they think, rather than for them to learn about each trait at this point in the course.

3. *If a trait is not inherited, what else might cause it? Explain, or give some examples.*

   The individual's environment and/or experience are factors that may affect a trait. For example, freckles are an example of a trait with genetic and environmental factors. Although a tendency to get freckles is inherited, exposure to the sunlight will greatly affect the degree to which an individual develops freckles. This is just one example; students are likely to come up with many others.

4. *If you studied more people in your community, would you expect to find more traits for each characteristic? Explain your answer.*

   Answers will depend on the degree to which students reflect their community. However, they are certainly likely to find more alternatives for height and arm span. Some classes will not have students representing all five eye colors. One obvious way in which students do not reflect the entire community is age.

Characteristic	Traits	Number of Traits
eye color	brown, blue, green, gray, hazel	5 (fewer if class does not have all alternatives)
tongue-rolling	Yes, No (There may be a few hard to classify.)	2
finger-crossing	Yes, No (There may be a few hard to classify.)	2
PTC tasting	Yes, No (There may be a few hard to classify.)	2
height	many	variable, up to # of students in class
arm span	many	variable, up to # of students in class

Human Traits: Class Results

Trait	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Class Totals
Eye Color:									
blue									
brown									
gray									
green									
hazel									
Tongue Rolling:									
yes									
no									
Finger Crossing:									
yes									
no									
Height (in cm)									
cm									
cm									
cm									
cm									
cm									
cm									
cm									
Armspan (in cm)									
cm									
cm									
cm									
cm									
cm									
cm									
PTC Tasting:									
yes									
no									

Bar Graph Grid

Name ______________________ Date ____________

Human Traits: Group Results

Trait	Name:	Name:	Name:	Name:	Group Totals
Eye Color:					
blue					
brown					
gray					
green					
hazel					
Tongue Rolling:					
yes					
no					
Finger Crossing:					
yes					
no					
Height (in cm)					
Armspan (in cm)					
PTC Tasting:					
yes					
no					

Name ______________________________ Date ____________

Human Traits: Class Results

Trait	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Class Totals
Eye Color:									
blue									
brown									
gray									
green									
hazel									
Tongue Rolling:									
yes									
no									
Finger Crossing:									
yes									
no									
Height (in cm)									
cm									
cm									
cm									
cm									
cm									
cm									
cm									
Armspan (in cm)									
cm									
cm									
cm									
cm									
cm									
cm									
PTC Tasting:									
yes									
no									

Name ______________________ Date __________

Human Traits: Group Results

Trait	Name:	Name:	Name:	Name:	Group Totals
Eye Color:					
blue					
brown					
gray					
green					
hazel					
Tongue Rolling:					
yes					
no					
Finger Crossing:					
yes					
no					
Height (in cm)					
Armspan (in cm)					
PTC Tasting:					
yes					
no					

Name ______________________ Date __________

Human Traits: Class Results

Trait	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Class Totals
Eye Color:									
blue									
brown									
gray									
green									
hazel									
Tongue Rolling:									
yes									
no									
Finger Crossing:									
yes									
no									
Height (in cm)									
cm									
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cm									
Armspan (in cm)									
cm									
cm									
cm									
cm									
cm									
cm									
PTC Tasting:									
yes									
no									

PRESTIGE ACADEMY

A COLLEGE PREPARATORY CHARTER SCHOOL
FOR BOYS
WILMINGTON, DELAWARE

GIVING BOYS A REAL CHANCE FOR A REAL FUTURE

October 2, 2011

Education Associate for Charter School Program
Delaware Department of Education
401 Federal Street, Suite 2
Dover, DE 19901

7th Grade Science

Units of Instruction

Overview:

Curriculum development is an important part of what every teacher does, and at Prestige Academy Charter School, we spend a lot of time and energy documenting this work in a consistent and useful format. Prestige Academy Charter School teachers must develop curriculum aligned with the Delaware State Science Standards and Delaware Science Coalition Standards. The Delaware Science Initiative was founded to improve the instruction and learning of science so that all students would have the opportunity to meet the challenging performance expectations in the Delaware Science Content Standards. From the initiative, the Delaware Science Coalition began in 1995 as a collaborative of Delaware's school districts and science communities. Today, the Coalition supports science education in grades K-12 and is a collaborative effort between Delaware's school districts and charter school, and Delaware Department of Education (DDOE), higher education, business and industry, and community-based science organization. The Coalition continues to exist to support the highest quality science instruction for students and Delaware Schools.

While the Delaware State learning standards, objectives, and skills are not all-encompassing, they must be the starting point for all teacher planning and course curriculum. Prestige Academy Charter School teachers must ensure that every unit addresses Delaware State Science Standards and that each and every standard receives sufficient attention during the school year.

All curricula is comprised of **clear** and **measurable** standards. Clear and measurable standards are those that clearly define what students should know and are easily assessable. At Prestige Academy Charter School, our teachers and instructional leaders approach curriculum and instruction with urgency and a focus on achievement while making our lessons and day-to-day activities fun and engaging as to create a lifelong love of learning for our scholars.

The following units of study for 7th Grade Science were chosen because they clearly illustrate Prestige Academy Charter School's commitment to rigorous, engaging, standards-based instruction. Furthermore, the units chosen, Our Genes, Ourselves, Properties of Matter, and Diversity of Life encompass numerous standards that are heavily assessed on future Delaware Comprehensive Assessment System (DCAS). Currently we have one master teacher serving boys in Grades 7 and 8, therefore creating a schedule whereby students in these grades receive more instruction in Math and ELA as a way to best prepare them for high school entrance exams. Some modifications to these units of study were made to accommodate our all-boys demographic including: more hands-on learning, collaborative partner work, and clearly communicated performance goals.

The following units of instruction reflect our commitment to science, with each 7th Grade student receiving 180- 200 minutes of science instruction per week. In closing, please note that our teachers are using a modified version of the Delaware Science Coalition recommended units for Science. The units we have submitted reflect a deep dive into the most essential skills and standards for our scholars.

Enclosures:

7th Grade Unit 1- Our Genes, Ourselves

7th Grade Unit 2- Properties of Matter

7th Grade Unit 3- Diversity of Life

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Education Associate for Charter School Program
Delaware Department of Education
401 Federal Street, Suite 2
Dover, DE 19901

8th Grade Mathematics

Units of Instruction

Overview:

Curriculum development is an important part of what every teacher does, and at Prestige Academy Charter School, we spend a lot of time and energy documenting this work in a consistent and useful format. Prestige Academy Charter School teachers must develop curriculum aligned with the Delaware State Standards and the National Common Core Standards. While State and Common Core learning standards, objectives and skills are not all-encompassing, they must be the starting point for all teacher planning and course curriculum. Prestige Academy Charter School teachers must ensure that every unit addresses Delaware and Common Core standards and that each and every standard receives sufficient attention during the school year.

All curricula is comprised of **clear** and **measurable** standards. Clear and measurable standards are those that clearly define what students should know and are easily assessable. At Prestige Academy Charter School, our teachers and instructional leaders approach curriculum and instruction with urgency and a focus on achievement while making our lessons and day-to-day activities fun and engaging as to create a lifelong love of learning for our scholars.

The following units of study for 8th Grade Mathematics were chosen because they clearly illustrate Prestige Academy Charter School's commitment to rigorous, engaging, standards-based instruction. Furthermore, the units chosen, Rational Number Operations, Foundations of Algebra, and Solving Linear Equations encompass numerous standards that are heavily assessed on the Delaware Comprehensive Assessment System (DCAS). Some modifications to these units of study were made to accommodate our all-boys demographic including: more hands-on learning, collaborative partner work, and clearly communicated performance goals.

The following units of instruction reflect our commitment to mathematics, with each 8th Grade student receiving 100-130 minutes of math instruction per day. In closing, please note that our teachers are using a modified version of the Delaware State Model Units for Math. The units we have submitted reflect a deep dive into the most essential skills and standards for our scholars.

Enclosures:

8th Grade Unit 1- Rational Number Operations

8th Grade Unit 2- Foundations of Algebra

8th Grade Unit 3- Solving Linear Equations

Interim Cycle 1
Teacher:
Subject: MATH
Grade: 8

Focus for Week 1:
Sub-Skills:

Monday, August 29, Day #6	Tuesday, August 30, Day #7	Wednesday, August 31, Day #8	Thursday, September 1, Day #9	Friday, September 2
RE-ORIENTATION: NO ACADEMIC CLASSES	**RE-ORIENTATION: NO ACADEMIC CLASSES**	**DIAGNOSTIC ASSESSMENT**	**Properties** **<u>SWBAT</u>** - apply and identify the application of the inverse properties of addition and multiplication, the identity properties of addition and multiplication, the zero property of multiplication, the distributive property, the associative property, and the commutative property	**LABOR DAY: NO SCHOOL**

Focus for Week 2:
Sub-Skills:

Monday, September 5	Tuesday, September 6, Day #10	Wednesday, September 7, Day #11	Thursday, September 8, Day #12	Friday, September 9, Day #13
LABOR DAY: NO SCHOOL	**Computation** <u>SWBAT</u> - add and subtract decimals -review properties -round and estimate with decimals -determine the reasonability of an answer	**Computation** <u>SWBAT</u> - multiply and divide decimals -round and estimate with decimals -determine the reasonability of an answer	**Computation** <u>SWBAT</u> - multiply and divide fractions with like and unlike denominators -round and estimate with fractions -determine the reasonability of an answer	**Computation** <u>SWBAT</u> - add and subtract fractions with like and unlike denominators -round and estimate with fractions -determine the reasonability of an answer

Focus for Week 3:
Sub-Skills:

Monday, September 12, Day #14	Tuesday, September 13, Day #15	Wednesday, September 14, Day #16	Thursday, September 15, Day #17	Friday, September 16, Day #18
Absolute Value and integers <u>SWBAT</u> - define absolute value - compare expressions using absolute value - simplify expressions involving absolute value - define integer - compare and order integers - place integers on a number line	**Computation** **<u>SWBAT</u>** - add, subtract, multiply, and divide integers	**Exponents** **<u>SWBAT</u>** - define exponent and base - apply the rule for adding exponents when multiplying exponential expressions with like bases (properties of exponents) compute the value of exponential expressions	**Exponents, Order of Operations** **<u>SWBAT</u>** - simplify expressions involving exponents (order of operations) -	**Irrational Numbers** **<u>SWBAT</u>** - define irrational numbers - differentiate between rational and irrational numbers - plot an irrational number on a number line - compare an irrational number to a rational number or another irrational number - order groups of numbers that include both rational and irrational numbers

Focus for Week 4:
Sub-Skills:

Monday, September 19, Day	Tuesday, September 20,	Wednesday, September 21,	Thursday, September 22, Day	Friday, September 23, Day

#19	Day #20	Day #21	#22	#23
Exponents/Irrational Numbers SWBAT - define square root and perfect square - find the square root of a perfect square - place the square root of a number that is not a perfect square between two integers - locate an irrational square root between two integers	**Scientific Notation** SWBAT - read and understand numbers written in scientific notation - convert between standard and scientific notation - convert between the verbal description of a number and scientific notation - understand the proper format for writing numbers in scientific notation	**Scientific Notation** SWBAT - solve problems involving numbers written in scientific notation - understand addition and subtraction rules for exponents when multiplying and dividing, respectively - multiply and divide two numbers expressed in scientific notation - multiply and divide a number in scientific notation by a number not in scientific notation	**REVIEW and Unit Assessment**	**Test Wrap Up**

Focus for Week 5: **Sub-Skills:**				
Monday, September 26, Day #24	Tuesday, September 27, Day #25	Wednesday, September 28, Day #26	Thursday, September 29, Day #27	Friday, September 30, Day #28
Express Linear Relationships SWBAT - define numeric and algebraic expressions, equations, and inequalities - distinguish between numeric and algebraic expressions, equations, and inequalities	**Linear Equations/Proportional Relationships** SWBAT - write linear equations to model and analyze proportional relationships (writing equations from word problems) - represent verbal mathematical situations using algebraic expressions	**Linear Relationships** SWBAT - review translating verbal situations to algebraic expressions	**INTERIM #1 MATH**	**One Variable Equations** SWBAT - solve one-step equations - solve two-step equations - use the distributive property to solve equations - combine like terms - graph solutions on number line and coordinate plane

Interim Cycle 2

Teacher:

Subject: MATH

Grade: 8

Focus for Week 1: **Sub-Skills:**				
Monday, October 3, Day #29	Tuesday, October 4, Day #30	Wednesday, October 5, Day #31	Thursday, October 6, Day #32	Friday, October 7, Day #33 ½ Day – one hour block
One Variable Equations SWBAT - solve one-step equations - solve two-step equations - use the distributive property to solve equations - combine like terms - graph solutions on number line and coordinate plane	**One Variable Equations** SWBAT - solve one-step equations - solve two-step equations - use the distributive property to solve equations - combine like terms - graph solutions on number line and coordinate plane	**Solutions** SWBAT Solve equations with one, no, or infinite solutions	**Solutions** SWBAT Solve equations with one, no, or infinite solutions	**Solutions** SWBAT Solve equations with one, no, or infinite solutions

-	-			
Focus for Week 2: **Sub-Skills:**				
Monday, October 10, Day #34	Tuesday, October 11, Day #35	Wednesday, October 12, Day #36	Thursday, October 13, Day #37	Friday, October 14, Day #38
Inequalities SBWAT - solve one step inequalities - solve multistep inequalities -represent graphical mathematical situations with inequalities	**Inequalities** SBWAT - solve one step inequalities - solve multistep inequalities -represent graphical mathematical situations with inequalities	**Inequalities** SBWAT - solve one step inequalities - solve multistep inequalities -represent graphical mathematical situations with inequalities	**Inequalities** SBWAT - solve one step inequalities - solve multistep inequalities -represent graphical mathematical situations with inequalities	**Inequalities** SBWAT - solve one step inequalities - solve multistep inequalities -represent graphical mathematical situations with inequalities
Focus for Week 3: **Sub-Skills:**				
Monday, October 17, Day #39	Tuesday, October 18, Day #40	Wednesday, October 19, Day #41	Thursday, October 20, Day #42	Friday, October 21, Day #43 ½ Day – one hour block
Intro to Linear Functions SWBAT - determine if functions increase/decrease - identify parts of y=mx+b - determine if functions are linear or non linear - determine behavior of functions by graphing -understand that slope of line equations the ratio of the - find slope from linear equation in y=mx+b -plot quantities whose ratios are always the same, like diameter to circumference or dollars per unit	**Linear Functions and Graphs** SWBAT -find m and b on a graph of a line on a coordinate plane -write linear equation in y=mx+b given a graph of a linear equation -represent graphical mathematical situations with algebraic equations -represent graphical mathematical situations with algebraic expressions -match graph with given growth pattern -match graph with given slope and y intercept	**Linear Functions and Graphs** SWBAT -find m and b on a graph of a line on a coordinate plane -write linear equation in y=mx+b given a graph of a linear equation -represent graphical mathematical situations with algebraic equations -represent graphical mathematical situations with algebraic expressions -match graph with given growth pattern -match graph with given slope and y intercept	**Finding Equations from a table** SWBAT -match table with given growth pattern - determine rate of change given a table or graph - determine initial value given a table or graph - determine behavior of functions by making tables - write function from table of values -represent tabular mathematical situations with algebraic equations - represent tabular mathematical situations with algebraic expressions -determine output given input -describe how to get from input value to output value	**Lines from points** SWBAT - fit lines to points - write a linear equation given two points
Focus for Week 4: **Sub-Skills:**				
Monday, October 24, Day #44	Tuesday, October 25, Day #45	Wednesday, October 26, Day #46	Thursday, October 27, Day #47	Friday, October 28, Day #48
SWBAT solve systems of equations by graphing	SWBAT solve systems of equations using elimination	SWBAT solve systems of equations using substitution	SWBAT solve systems of equations	SWBAT solve systems of equations
Focus for Week 5: **Sub-Skills:**				
Monday, October 31, Day #49	Tuesday, November 1, Day #50	Wednesday, November 2, Day #51	Thursday, November 3, Day #52	Friday, November 4, Day #53 End of Quarter 1
SWBAT solve systems of equations	SWBAT solve systems of equations	**INTERIM #2 MATH**	UNIT REVIEW AND ASSESSMENT	UNIT RETEACH REVOLUTION

Interim Cycle 3

Teacher:

Subject: MATH

Grade: 8

Focus for Week 1:

Sub-Skills:

Monday, November 7, Day #54	Tuesday, November 8, Day #55	Wednesday, November 9, Day #56	Thursday, November 10, Day #57 ½ Day – one hour block	Friday, November 11, Day #58
Data Sampling <u>SWBAT</u> - Define data sample. -Describe different methods of sampling including random, counting off, and convenience sampling. - Describe limitations of various sampling methods -Identify and explain sampling method used in a problem.	**Bias** <u>SWBAT</u> - Determine whether a given sample is representative of a population or biased. -Identify particular sources of bias in a data sample. - Identify and describe the source of bias in a particular data sample. - Explain potential consequences of using a biased data sample in an analysis. - Solve problems with misleading data samples and data representations.	**Mean, Median, and Mode** <u>SWBAT</u> -Define mean, median and mode. - Find the mean, median and mode of data sets presented in lists and data tables.	**Using Mean, Median and Mode** <u>SWBAT</u> -Describe data sets using mean, median and mode. - Interpret the meaning of mean, median and mode. - Compare data sets using mean, median and mode. - Choose which measure of central tendency best describes a data set.	 **VETERANS DAY: NO SCHOOL**

Focus for Week 2:

Sub-Skills:

Monday, November 14, Day #58	Tuesday, November 15, Day #59	Wednesday, November 16, Day #60	Thursday, November 17, Day #61	Friday, November 18, Day #62
Missing Values <u>SWBAT</u> -Use knowledge of data and mean, median and mode to work backwards and find a missing value.	**Range and Outliers** <u>SWBAT</u> -Describe the effect that including or excluding a particular data point has upon the mean, median and mode of a data set -Define "range." - Find the range of data sets including lists and data tables. - Describe data sets using range. - Compare data sets using range. - Solve problems involving range. - Interpret the meaning of the range of a data set. - Describe the effect that including or excluding a particular data point has upon the range of a data set. -Identify and describe factors, such as outliers, that would change measures of central tendency. -Describe the impact that outliers and the inclusion of additional data have on measures of central tendency	**Tables, Charts, and Stem and Leaf Plots** <u>SWBAT</u> -Create tables. - Describe data from tables. -Analyze and draw conclusions from tables. - Create frequency tables from raw data. - Analyze and draw conclusions from frequency tables. - Solve problems based on data in charts and tables -Construct stem-and-leaf plots. - Read and describe data in stem-and-leaf plots. -Analyze and draw conclusions from stem-and-leaf plots. - Solve problems with stem-and-leaf plots. - Connect stem-and-leaf plot to statistics including mean, median, mode and range	**Histograms** <u>SWBAT</u> -Construct histograms. - Read and describe data in histograms. - Analyze and draw conclusions from histograms. - Solve problems with histograms.	**Scatter Plots** <u>SWBAT</u> -Construct scatter plots. - Read and describe data in scatter plots. -Analyze and draw conclusions from scatter plots. - Determine whether a scatter plot shows a positive relationship, a negative relationship or no relationship between two variables. - Solve problems with scatter plots. - Use the words positive correlation, negative correlation and no correlation to describe data shown in scatter plots. - Describe patterns such as clustering and outliers.

Focus for Week 3:

Sub-Skills:

Monday, November 21, Day #63	Tuesday, November 22, Day #64	Wednesday, November 23	Thursday, November 24	Friday, November 25
Circle Graphs	**Venn Diagrams**	**THANKSGIVING BREAK: NO SCHOOL (PD DAY FOR**	**THANKSGIVING BREAK: NO SCHOOL**	**THANKSGIVING BREAK: NO SCHOOL**

SWBAT -Draw circle graphs. - Analyze and draw conclusions from circle graphs. - Recognize that circle graphs are used to display percentages and that the percentages displayed in a circle graph must add up to 100%. - Match circle graphs to the data set used to create them. - Solve problems with circle graphs, including those that involve percentages and fractions.	SWBAT -Read and interpret two-circle and three-circle Venn diagrams. -Describe two-circle and three-circle Venn diagrams. - Complete two-circle and three-circle Venn diagrams based on given data. -Solve problems with two- and three-circle Venn diagrams.	**TEACHERS)**		
Focus for Week 4: **Sub-Skills:**				
Monday, November 28, Day #65	Tuesday, November 29, Day #66	Wednesday, November 30, Day #67	Thursday, December 1, Day #68	Friday, December 2, Day #69
Review SWBAT -Review mean, median, mode and range -Review types of data and statistical representations	**Box and Whisker Plots** SWBAT -Construct box-and-whisker plots. - Read and describe data in box-and-whisker plots including minimum, median, maximum, upper quartile and lower quartile values. - Analyze and draw conclusions from box-and-whisker plots. - Solve problems with box-and-whisker plots. - Compare minima, maxima, medians, ranges and quartiles of two populations using side-by-side box-and-whisker plots. - Solve problems with box-and-whisker plots. - Recognize that the mean of a data set cannot be determined from a box-and-whisker plot.	**Displaying Data and Misleading Data** SWBAT - Select best method to display a given set of data. - Display data from observations, experiments, surveys, measurements using the most appropriate methods. - Identify misinterpretations and misuse of data in charts and tables. -Identify appropriate, inappropriate and misleading scales for showing tabular data on charts and graphs.	**Unit Review and Assessment**	**Unit Reteach Revolution**
Focus for Week 5: **Sub-Skills:**				
Monday, December 5, Day #70	Tuesday, December 6, Day #71	Wednesday, December 7, Day #72	Thursday, December 8, Day #73	Friday, December 9, Day #74 ½ Day – one hour block
Probability SWBAT Predict probability based on given information ung terms such as certain, impossible, likely and unlikely Order potential outcomes from most likely to least likely	**Theoretical Probability** SWBAT Use theoretical probability to predict the outcome a simple event Use theoretical probability to predict the frequency with which a given outcome will occur when an experiment is repeated multiple times State the probability of a single outcome as a fraction between 0 and 1	**Compound Events** SWBAT Define Fundamental Counting Principle and use it to solve problems Represent actual outcomes of compound events using tables, lists, and tree diagrams Analyze outcomes of compound events using tables, lists and tree diagrams Find the probability of up to	**Compound Events** SWBAT Define compound events as events consisting of two or more independent (not mutually exclusive) events Represent possible outcomes of compound events using tables, lists and trees	**Compound Events** SWBAT Define Fundamental Counting Principle and use it to solve problems Represent actual outcomes of compound events using tables, lists, and tree diagrams Analyze outcomes of compound events using tables, lists and tree diagrams

	Calculate experimental probability of simple events (test prediction)	three events occurring		Find the probability of up to three events occurring Define compound events as events consisting of two or more independent (not mutually exclusive) events Represent possible outcomes of compound events using tables, lists and trees
Focus for Week 6: **Sub-Skills:**				
Monday, December 12, Day #75	Tuesday, December 13, Day #76	Wednesday, December 14, Day #77	Thursday, December 15, Day #78	Friday, December 16, Day #79
And/OR Problems <u>SWBAT</u> Determine probability of either of two disjoint events occurring (OR problem—add two individual probabilities) Determine probability of two disjoint events occurring (AND problem—multiply two individual probabilities)	**And/Or Problems** <u>SWBAT</u> Distinguish between OR and AND types of problems	**Combinations** <u>SWBAT</u> Define combination List the number of combinations of items from 2 or 3 sets given as pictures, words, tables, Venn diagrams or in a tree diagram Count the number of items from 2 or 3 sets given as pictures, words, tables, Venn diagrams or in a tree diagram	**Permutation** <u>SWBAT</u> Define permutation Find the number of ways all of the items in a set can be arranged Calculate permutations with repetition Calculate permutations without repetition	**Combinations and Permutations** <u>SWBAT</u> Differentiate between combinations and permutations
Focus for Week 7: **Sub-Skills:**				
Monday, December 19, Day #80	Tuesday, December 20, Day #81	Wednesday, December 21, Day #82	Thursday, December 22, Day #83	Friday, December 23
<u>SWBAT</u> Identify dependent events Identify independent events Solve problems with dependent events and understand that problems "without replacement" describe dependent	<u>SWBAT</u> Solve problems with independents events and understand that problems "with replacement" describe independent events Differentiate between independent and dependent events	<u>Unit Review and Assessment</u>	<u>Unit Reteach</u>	**WINTER BREAK: NO SCHOOL (PD DAY FOR TEACHERS)**
Focus for Week 8: **Sub-Skills:**				
Monday, January 2	Tuesday, January 3	Wednesday, January 4, Day #85	Thursday, January 5, Day #86	Friday, January 6, Day #87
WINTER BREAK: NO SCHOOL)	**WINTER BREAK: NO SCHOOL (PD DAY FOR TEACHERS)**	**CULTURE RESET (NO ACADEMIC CLASSES)**	**CULTURE RESET**	**CULTURE RESET**
Focus for Week 9: Perimeter and Area of Polygons **Sub-Skills:**				
Monday, January 9, Day #87	Tuesday, January 10, Day #88	Wednesday, January 11, Day #89	Thursday, January 12, Day #90	Friday, January 13, Day #91
Perimeter of Polygons <u>SWBAT:</u> -Define Perimeter -Find perimeter of triangles,	**Perimeter of Irregular Shapes** <u>SWBAT</u> - Explore strategies to find perimeter of irregular shapes.	**Area of Polygons** <u>SWBAT</u> -Find area of polygons and using diagrams and grids	**Area and Perimeter Problem Solving** <u>SWBAT</u> -Find areas of irregular	**Surface Area and Volume of Rectangular Prisms** <u>SWBAT</u> - Develop formula for volume

quadrilaterals, and other polygons using formulas and mesauring - Solve problems involving perimeters of geometric shapes.	- Find perimeter of irregular shapes, use formulas as needed - Explore, analyze and explain changes in perimeter when side measures are changed (for example doubled or increased by 2).	including estimating grid squares that are partially shaded. - Find area of squares, rectangles, parallelograms, trapezoids using formulas. - Solve problems involving areas of geometric shapes.	shapes, use formulas as needed. - Explore strategies to find area of irregular shapes. - Explore, analyze and explain changes in area when side measures are changed (for example doubled or increased by 2). - Predict and test changes to perimeter and area when measurements are changed. -Compare perimeter and area when measures are changed.	of rectangular prism. -Find volume of rectangular prisms using formulas. - Solve problems with volumes of rectangular prisms. - Relate area to surface area. -Define surface area and how to find it. - Find surface area of rectangular prisms. - Solve problems with surface areas of rectangular prisms.
Focus for Week 10: Circles **Sub-Skills:**				
Monday, January 16	Tuesday, January 17, Day #92	Wednesday, January 18, Day #93	Thursday, January 19, Day #94	Friday, January 20, Day #95
MLK DAY: NO SCHOOL	**Intro to Circles** SWBAT -Define and apply the relationship between diameter and radius. - Find circumference of circles using formulas. -Find circumference of circles by measuring.	**Area of Circles** SWBAT -Find area of circles using diagrams and grids including estimating grid squares that are partially shaded. -Find area of circles using formulas	**Problem Solving with Circles** SWBAT -Explore, analyze and explain changes in circumference when radius and diameter are changed (for example doubled or increased by 2). - Predict and test changes to circumference and area when measurements are changed. -Compare circumference and area when measures are changed.	**Cylinders** SWBAT - Develop formula for volume of cylinders. - Find volume of cylinders using formulas. - Solve problems with volumes of cylinders.
Focus for Week 11: **Sub-Skills:**				
Monday, January 23, Day #96	Tuesday, January 24, Day #97	Wednesday, January 25, Day #98	Thursday, January 26, Day #99	Friday, January 27, Day #100 End of Quarter 2
Spheres SWBAT - Develop formula for volume of spheres. - Find volume of spheres using formula. - Solve problems with volume of spheres. - Develop formula for surface area of spheres. - Find surface area of spheres using formulas. -.Solve problems with surface area of spheres.	**Perimeter, Area, Volume, and Surface Area Review** SWBAT: -Calculate the perimeter and area of 2-D figures -Calculate the surface area and volume of 3-D figures	**Interim #3 Math**	**Converting Percents and Decimals** SWBAT Convert from a decimal to a percent and back	**Converting Percents and Decimals** SWBAT Convert from a decimal to a percent and back

Interim Cycle 4

Teacher:

Subject: MATH

Grade: 8

Focus for Week 1: **Sub-Skills:**				
Monday, January 30, Day #101	Tuesday, January 31, Day #102	Wednesday, February 1, Day #103	Thursday, February 2, Day #104 ½ Day – one hour block	Friday, February 3, Day #105 ½ Day – one hour block
Intro to Ratios <u>SWBAT</u> Define ratio Define proportion as equivalent fractions Find missing value in proportions Solve proportions by cross multiplying	**Percentages** <u>SWBAT</u> Calculate percentages in real world situations (tax, tips, commissions) Find the sale price of an item given the orginal price and percent discount Solve problems with proportions Set up ratios and proportions based on data given in word problems	**Percentages** <u>SWBAT</u> Calculate percentages in real world situations (tax, tips, commissions) Find the sale price of an item given the orginal price and percent discount Solve problems with proportions	**Percent Change** <u>SWBAT</u> Calculate percent change	**Units of Measurement** <u>SWBAT</u> Convert units between systems of measurement using proportions and given conversion factors
Focus for Week 2: **Sub-Skills:**				
Monday, February 6, Day #106	Tuesday, February 7, Day #107	Wednesday, February 8, Day #108	Thursday, February 9, Day #109	Friday, February 10, Day #110
Rates of Change <u>SWBAT</u> Calculate a unit rate Solve problems involving rates Calculate a rate, such as dollars per hour or miles per hour	**Scale Factors** <u>SWBAT</u> Find the scale factor relating similar figures Solve word problems involving scale drawings and rates of change Determine a rate of change from a graph	Unit Review/Assessment	Unit Reteach	**Representations of 3-D Shapes** <u>SWBAT</u> 1. Define, identify and draw top, bottom and side views of a 3-D object. 2. Define, identify and draw nets of 3-D shapes. 3. Define, identify and draw projections of 3-D shapes. 4. Define, identify and draw perspective drawings
Focus for Week 3: **Sub-Skills:**				
Monday, February 13, Day #111	Tuesday, February 14, Day #112	Wednesday, February 15, Day #113	Thursday, February 16, Day #114	Friday, February 17
Unit Review and Assessment	Unit Reteach	**Geometry Vocabulary** <u>SWBAT</u> -Define, identify, draw, name, classify and distinguish between points, lines, rays, segments, angles, and planes - Define and identify supplementary and	**Angles** <u>SWBAT</u> -Define and identify vertical angles - Describe properties of vertical angles. - Define and identify	**NO SCHOOL (PD DAY FOR TEACHERS)**

		complementary angles. -Define, identify, draw, name, classify, and distinguish between acute, right, obtuse, straight and reflex angles -Define, identify, draw, name, classify and distinguish between parallel, perpendicular, and intersecting lines	adjacent angles. - Define and identify parallel lines and transversals. - Identify supplementary angles when parallel lines are cut by transversal. - Define and identify alternate interior angles and their properties. - Define and identify alternate exterior angles and their properties. - Define and identify complementary angles	
Focus for Week 4: **Sub-Skills:**				
Monday, February 20	Tuesday, February 21, Day #115	Wednesday, February 22, Day #116	Thursday, February 23, Day #117	Friday, February 24, Day #118
PRESIDENT'S DAY: NO SCHOOL	**Problem Solving with Angles** <u>SWBAT</u> -Solve problems with parallel lines cut by a transversal and the angles formed. - Solve problems with vertical, adjacent, supplementary and complementary angles. - Solve problems with intersecting lines and the angles formed.	**Problem Solving with Angles** <u>SWBAT</u> -Solve problems with parallel lines cut by a transversal and the angles formed. - Solve problems with vertical, adjacent, supplementary and complementary angles. - Solve problems with intersecting lines and the angles formed.	**Interior and Exterior Angles** <u>SWBAT</u> -Analyze relationship between number of sides and sum of interior angle measures of polygons. -Explain relationship between number of sides and sum of interior angle measures of polygons. - Apply relationship between number of sides and sum of interior angle measures of polygons. - Analyze relationship between number of sides and sum of exterior angle measures of polygons. - Explain relationship between number of sides and sum of exterior angle measures of polygons. - Apply relationship between number of sides and sum of exterior angle measures of polygons.	**Interior and Exterior Angles** <u>SWBAT</u> -Analyze relationship between number of sides and sum of interior angle measures of polygons. -Explain relationship between number of sides and sum of interior angle measures of polygons. - Apply relationship between number of sides and sum of interior angle measures of polygons. - Analyze relationship between number of sides and sum of exterior angle measures of polygons. - Explain relationship between number of sides and sum of exterior angle measures of polygons. - Apply relationship between number of sides and sum of exterior angle measures of polygons.
Focus for Week 5: **Sub-Skills:**				
Monday, February 27, Day #119	Tuesday, February 28, Day #120	Wednesday, February 29, Day #121	Thursday, March 1, Day #122	Friday, March 2, Day #123
Congruency <u>SWBAT</u> 1. Define congruent shapes. 2. Identify congruent shapes by measuring angles/sides or from given information. 3. Solve problems involving congruent shapes.	**Similarity** <u>SWBAT</u> 4. Define similar figures. 5. Identify similar figures. 6. Solve problems involving similar figures	**Congruency and Similarity Problem Solving** <u>SWBAT</u> Solve problems involving congruency and similarity	**Congruency and Similarity Problem Solving** <u>SWBAT</u> Solve problems involving congruency and similarity	**Congruency and Similarity Problem Solving** <u>SWBAT</u> Solve problems involving congruency and similarity

Focus for Week 6: **Sub-Skills:**				
Monday, March 5, Day #124	Tuesday, March 6, Day #125	Wednesday, March 7, Day #126	Thursday, March 8, Day #127	Friday, March 9, Day #128
Intro to Triangles <u>SWBAT</u> -Define, differentiate between, and classify triangles by side length (scalene, isosceles, or equilateral) and angle (acute, obtuse or right) - Use informal arguments to establish facts about angle sum of triangles. -Use informal arguments to establish facts about angle-angle criterion for similarity of triangles.	**Pythagorean Theorem** <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	**Pythagorean Theorem** <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	**Pythagorean Theorem** <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	**Pythagorean Theorem** <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem
Focus for Week 7: **Sub-Skills:**				
Monday, March 12, Day #129	Tuesday, March 13, Day #130	Wednesday, March 14, Day #131	Thursday, March 15, Day #132	Friday, March 16
Pythagorean Theorem <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	**Pythagorean Theorem** <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	**Pythagorean Theorem** <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	**Pythagorean Theorem** <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	**NO SCHOOL (PD DAY FOR TEACHERS)**
Focus for Week 8: **Sub-Skills:**				
Monday, March 19, Day #133	Tuesday, March 20, Day #134	Wednesday, March 21, Day #135	Thursday, March 22, Day #136	Friday, March 23, Day #137
Pythagorean Theorem <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	**Pythagorean Theorem** <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	**Pythagorean Theorem** <u>SWBAT</u> -Define Pythagorean Theorem. - Solve problems with Pythagorean Theorem. - Find distance between two points on a coordinate plane using Pythagorean Theorem.	Unit Review /Unit assessment	Unit Reteach
Focus for Week 9: **Sub-Skills:**				
Monday, March 26, Day #138	Tuesday, March 27, Day #139	Wednesday, March 28, Day #140	Thursday, March 29, Day #141	Friday, March 30, Day #142
IA 4 Review	IA 4 Review	IA 4 Review	IA 4 Review	IA 4 Review
Focus for Week 10:				

Sub-Skills:				
Monday, April 2, Day #143	Tuesday, April 3, Day #144	Wednesday, April 4, Day #145	Thursday, April 5, Day #146	Friday, April 6
IA 4 Review	IA 4 Review	IA 4 Review	IA 4 Review	IA 4 Review
Focus for Week 11: **Sub-Skills:**				
Monday, April 16, Day #147	Tuesday, April 17, Day #148	Wednesday, April 18, Day #149	Thursday, April 19, Day #150	Friday, April 20, Day #151 End of Quarter 3
IA 4 Review	IA 4 Review	**INTERIM #4 MATH**	Start HS Math Ramp Up	HS Math Ramp Up

(Post-Interims) Review; DCAS Testing Period

Teacher:

Subject: MATH

Grade: 8

Focus for Week 1: **Sub-Skills:**				
Monday, April 23, Day #152	Tuesday, April 24, Day #153	Wednesday, April 25, Day #154	Thursday, April 26, Day #155	Friday, April 27, Day #156 ½ Day – one hour block
HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up
Focus for Week 2: **Sub-Skills:**				
Monday, April 30, Day #157	Tuesday, May 1, Day #158	Wednesday, May 2, Day #159	Thursday, May 3, Day #160	Friday, May 4, Day #161
HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up
Focus for Week 3: **Sub-Skills:**				
Monday, May 7, Day #162	Tuesday, May 8, Day #163	Wednesday, May 9, Day #164	Thursday, May 10, Day #165	Friday, May 11, Day #166
HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up
Focus for Week 4: **Sub-Skills:**				
Monday, May 14, Day #167	Tuesday, May 15, Day #168	Wednesday, May 16, Day #169	Thursday, May 17, Day #170	Friday, May 18, Day #171
HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up
Focus for Week 5: **Sub-Skills:**				
Monday, May 21, Day #172	Tuesday, May 22, Day #173	Wednesday, May 23, Day #174	Thursday, May 24, Day #175	Friday, May 25, Day #176 ½ Day – one hour block
HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up
Focus for Week 6: **Sub-Skills:**				
Monday, May 28	Tuesday, May 29, Day #177	Wednesday, May 30, Day #178	Thursday, May 31, Day #179	Friday, June 1, Day #180
MEMORIAL DAY: NO SCHOOL	HS Math Ramp Up	HS Math Ramp Up	HS Math Ramp Up review and assessment	HS Math Ramp Up Reteach
Focus for Week 7: **Sub-Skills:**				
Monday, June 4, Day #181	Tuesday, June 5, Day #182	Wednesday, June 6, Day #183	Thursday, June 7, Day #184	Friday, June 8, Day #185
FINAL REVIEW	FINAL REVIEW	FINAL REVIEW	FINAL REVIEW	FINAL REVIEW
Focus for Week 8: **Sub-Skills:**				
Monday, June 11, Day #186	Tuesday, June 12, Day #187	Wednesday, June 13, Day #188 ½ Day - Finals	Thursday, June 14, Day #189 ½ Day – Finals	Friday, June 15, Day #190 ½ Day - Finals

FINAL REVIEW	FINAL REVIEW	**MATH FINALS**	**ELA FINALS**	**SCIENCE/SS FINALS**

Prestige Academy Charter School

Unit Title: Operations with Rational Numbers **Grade Level(s):** 8

Subject/Topic Areas: Operations with whole numbers, decimals and fractions.

Key Vocabulary: Numerator, denominator, reciprocal, integer, absolute value

Designed By: Kacie Versaci **Time Frame:** 7 Days
Date: 9/7/2011 – 9/16/11

SUMMARY OF PURPOSE:
Unit 1: Operations was designed to familiarize scholars with basic arithmetic skills in order to prepare them for solving higher level problems. The majority of this unit is reviewing previously learned material and practicing said skils to mastery.

Stage 1: Desired Results

Common Core/ Delaware Standards

Primary: Numeric Reasoning (Standard 1)

- Select and use appropriate methods and tools for computing (e.g., mental computation, estimation, calculators, paper and pencil) depending on the context and nature of the computation
- Use meaningful relationships between addition, subtraction, multiplication, and division of **integers** to **justify** the rules of operations
- **Explain** how the distributive property is used to multiply (e.g., partial products, mixed numbers)
- Use **inverse operations** to "do and undo" mathematical operations with **rational number**s

Secondary:

- Demonstrate the reasonableness of an exact calculation by using an estimation or mental math strategy

Key Concepts/Big Ideas

Working with rational numbers requires following consistent rules.

Enduring Understandings

Students will understand that…

- Operations with rational numbers require commonality (ex: same denominators)

Essential Questions

- How do I add, subtract, multiply and divide decimals?
- How do I add, subtract, multiply and divide fractions?
- How do I add, subtract, multiply and divide integers?
- How do I estimate the solutions with basic computation problems?

Real World Context

- Real world situations including measurement, economics, and data all to be explored in word problems.

Learning Targets/Goals

Students will know…

- The basic rules for computing with decimals and fractions.
- The basic rules for computing with integers

Students will be able to… (21st century skills)

- Add, subtract, multiply and divide decimals, fractions, and integers
- Estimate solutions
- Determine the reasonability of a solution

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task

In small groups, students will be given chart paper and a set of markers. Their task to is make a poster "advertising" a specific property (must include: Property Name, Graphic, Definition, and a Numeric Example). Scholars will get a chance to post and view each other's posters, as well as explain their property to the class.

Rubrics for Transfer Tasks

Performance Task

	4	3	2	1	0
Property Name and Definition	Includes complete definition using mathematical vocabulary	Includes complete definition in plain English	Includes partial definition	Includes inaccurate definition	Definition missing
Graphic	Graphic is colorful, neat, and relevant	Graphic is in black and white or messy	Graphic is neat and colorful but irrelevant	Graphic is messy, black and white, and irrelevant	Graphic is missing
Numeric Example	Numeric example accurately illustrates property. Both addition and multiplication are included	Numeric example accurately illustrates property. Addition or multiplication is included	Numeric example contains one error	Numeric example contains two or more errors	Numeric example missing
Presentation	Group presentation is clear, accurate, comprehensive and uses technical math vocabulary.	Group presentation is clear, accurate, comprehensive and uses plain English	Group presentation contains no more than three errors but is still professional	Group presentation includes more than three errors or is unprofessional	Group presentation countains more than three errors and is unprofessional

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.

Summative Assessments:

Weekly quizzes
Unit Assessment
Daily Exit slips

Student Self-Assessment and Reflection

Pairs Communication Activity

Directions:

Upon completing summative assessments, scholars work in pairs to process and evaluate their assessment data.

Reflection:

1. What standards did you master?
2. What standards do you need more work on?

Scholars will complete an action plan to address how standards not mastered will be relearned and reassessed.

•

Instructional Resources

Achievement Network
Triand.com
Quia.com
IXL.com
McDougall/Littell Algebra and Pre-Algebra Texts

Differentiation

IEP accommodations and modifications
Read aloud
Teacher notes
Clear break down of steps
Visual and pneumonic devices
Manipulatives

Enrichment

Peer tutoring
Challenge questions

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

- **Identify, understand and apply numeric properties**
- **Add, subtract, multiply and divide rational numbers (integers, fractions and decimals)**

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Lesson 1

General Topics: SWBAT apply and identify the following properties:

- Inverse (addition and multiplication)
- Identity (addition and multiplication)
- Zero (multiplication)
- Distributive
- Associative
- Commutative

INM: Using a guided notes power point presentation, students will fill out boxes that include what each property states, details on that property, an algebraic and a numeric example.

IP: 1) In small groups, students will be given chart paper and a set of markers. Their task to is make a poster "advertising" a specific property (must include: Property Name, Graphic, Definition, and a Numeric Example). Scholars will get a chance to post and view each other's posters.

2) Independent class work to include identifying properties and applying the distributive property.

Key Vocabulary: Inverse, Identity, Distribute, Associative and Commutative

Check for Understanding: During notes, various CFU slides contain "Prove It" sample problems (cold call students for answers to these)

Lesson 2

General Topic: SWBAT

- add and subtract decimals
-review properties
-round and estimate with decimals
-determine the reasonability of an answer

Brain pop video and quiz as a class
INM: Using a guided notes power point presentation, students will work through examples that emphasize lining up decimal points and using zeroes as place holders. We will work through 6 examples that address different types of problems.

IP: 1) In shoulder partners, students will work through "shopping" activity that requires them to find the total of items and how much change they should receive. Hamburger Hut and WP activity: use fake menu, requires students to work through ordering scenarios. (14 problems total)
2) Independently, students will work on a class work assignment

Key Vocabulary: Round, Estimate, Reasonable(ity)

Check for Understanding: During notes, guided release within the context of the examples.

Lesson 3

General Topics: SWBAT
- multiply and divide decimals
-round and estimate with decimals
-determine the reasonability of an answer

INM: Using a guided notes power point presentation, students will work through examples that address multiplying decimals (don't line up, count digits) and Dec/W#, W#/Dec and Dec/Dec.

IP: First in shoulder partners, then independently, scholars will work through puzzle sheets that require them to multiply and divide decimals in order to crack codes and solve riddles

Key Vocabulary: None

Check for Understanding: During notes, guided release within the context of the examples.

Lesson 4

General Topics: SWBAT
- multiply and divide fractions with like and unlike denominators
-round and estimate with fractions
-determine the reasonability of an answer

INM: Using a guided notes power point presentation, students will work through examples that address rounding, multiplying (cancellation, across, and simplify) and dividing fractions (flip into reciprocal and multiply) .

IP: 1) After splitting the class in half, we will have a relay. In teams, scholars will "vs" each other at the board to solve problems involving the multiplication and division of fractions
2) Independently, scholars will complete a class work exercise that practices and multiplying and dividing fractions
Key Vocabulary: Denominator, Numerator, Simplest Form, Reciprocal

Check for Understanding GP: During notes, guided release within the context of the examples.

Lesson 5

General Topics

- add and subtract fractions with like and unlike denominators
-round and estimate with fractions
-determine the reasonability of an answer

INM: Using a guided notes power point presentation, students will work through examples that address adding like fractions, adding unlike fractions, subtracting like fractions and unlike fractions (with and without borrowing) .

IP: 1) In small groups (2-4 scholars), they will rotate in stations to practice the different types of adding and subtracting fractions.
2) Independently, scholars will complete a class work exercise that practices adding and subtracting like and unlike fractions

Key Vocabulary:

Check for Understanding GP: During notes, guided release within the context of the examples.

Lesson 6

General Topics

- define absolute value
- compare expressions using absolute value
- simplify expressions involving absolute value
- define integer
- compare and order integers
- place integers on a number line

INM: Using a guided notes power point presentation, students will work through examples that address absolute value, simplifying with absolute value, integers, comparing and ordering. Stress treating absolute value brackets like parentheses.

IP: 1) Independently, scholars will complete a class work exercise that practices simplifying with absolute value, comparing and ordering integers

Key Vocabulary: Absolute Value, Integer, Positive, Negative

Check for Understanding GP: During notes, guided release within the context of the examples.

Lesson 7

General Topics

- add, subtract, multiply, and divide integers

INM: Using a guided notes power point presentation, students will work through examples that address the rules of adding and subtracting integers (keep, change, change; same sign add and keep, different sign subtract) and multiplication and division (same sign +, different signs -) .

IP: 1) As a class, we will create foldable graphic organizers to be kept in our binders that outline the rules of integer operations.
2) Independently, scholars will complete a class work exercise that practices adding, subtracting, multiplying and dividing integers.

Check for Understanding GP: During notes, guided release within the context of the examples.

Name: ______________________ **Date:** ______________________

MATH **Homeroom:** ______________________

DAY #9
Independent Practice

IA 1 Countdown: 16 DAYS

1.) Which property allows you to write $4 + (3 + 9) = (4 + 3) + 9$? ______________________

2.) Explain how the commutative property of multiplication can help you evaluate the product of $5 \cdot 17 \cdot 2$ mentally. Write your answer using complete sentences!

____

____

Identify the property that the statement illustrates.

3.) $mn + 0 = mn$ _______

4.) $19 \cdot 5^3 = 5^3 \cdot 19$ _______

5.) $(2x + 3y) + z = 2x + (3y + z)$ _______

6.) $\frac{1}{5} + \frac{3}{5} = \frac{3}{5} + \frac{1}{5}$ _______

7.) $(-7u)(1) = -7u$ ______

8.) $\frac{2}{9} + \left(\frac{1}{9} + \frac{6}{4}\right) = \left(\frac{2}{9} + \frac{1}{9}\right) + \frac{6}{4}$ ______

9.) The calories in a McDonald's Egg McMuffin come from three sources: 144 calories are from carbohydrates, 108 calories are from fat, and 56 calories are from protein. **Use properties of addition to find the total number of calories in the sandwich.**

Answer: __________ calories

10.) During the summer, you work 4 hours each day as a cashier at Wal-Mart and earn $7 each hour. **Use properties of multiplication to find how much money you earn during a 5 day work week.**

Answer: ___________ dollars

11.) Are putting on your socks and putting on your shoes commutative activities (hint, think back to the definition of the commutative property!)? Explain your answer.

____

____

Identify the property being illustrated (example: Commutative Property of Addition). Write your answer in the space provided.

12.) $-5.25(1) = -5.25$ ____________________ Property of______________

13.) $(7 \cdot 6) \cdot 43 = 7 \cdot (6 \cdot 43)$ ____________________ Property of______________

14.) $(8 + 4) + 19 = (4 + 8) + 19$ ____________________ Property of______________

15.) $4 + (23 + 12) = (4 + 23) + 12$ ____________________ Property of______________

16.) $12 \cdot (-14) \cdot 56 = -14 \cdot 56 \cdot 12$ ____________________ Property of______________

17.) $0 + (-0.354) = (-0.354)$ ____________________ Property of______________

Name the property and find the value of the missing integer.

18.) $-7 \cdot$ _____ $= -7$ _________________________________

19.) $6\,(8 - 2) = (6 \cdot$ ___$) - (6 \cdot 2)$ _________________________________

20.) ______ $= -2 + 0$ _________________________________

21.) $6\,[\,4 + (-5)\,] = 6 \cdot 4 + 6 \cdot$ _____ _________________________________

22.) $4(-6) + 4($ _____ $) = 4\,(-6 + 9)$ _________________________________

Use the distributive property to evaluate the expression.

23.) $2(3 + 5)$

24.) $5(9 - 3)$

25.) $(10 - 4)7$

26.) 10(18 + 8) 27.) (6+ 21)3 28.) 3(y + 9)

Name: ______________________ **Date:** ______________________

MATH **Homeroom:** ______________________

Exit Slip: Properties

_________/10 = _________%

For #1 - #5, identify the property being illustrated. (Identity of Addition or Multiplication, Inverse of Addition or Multiplication, Associative, or Commutative)

1.) 2 + 5 = 5 + 2 ______________________

2.) 7 • 1 = 7 ______________________

3.) (a + b) + c = a + (b + c) ______________________

4.) -4 + 4 = 0 ______________________

5.) $n \bullet \frac{1}{n} = 1$ ______________________

For #6 – #10, use the Distributive Property to evaluate each expression.

6.) 2(7 + 3)

7.) 5(11 – 6)

8.) (12 + 3)6

9.) 7(20 + 8)

10.) Ms. Versaci and Mr. Troiano are purchasing calculators for the class. Ms. Versaci bought calculators from Staples that cost $12 each. Mr. Troiano bought calculators from Office Max for $8 each. Use the distributive property in the expression to find the total cost, in dollars.

5(12 + 8)

Prestige Academy Charter School

Name:________________________________ Date:_________________

MATH Homeroom:____________

Homework #9: Properties

Parent Signature

Part 1: Fill in the Blank

Directions: Use the word bank to fill in the blanks for the following properties.

Associative	Inverse	Addition
Distributive	Commutative	Zero

1. The ______________________ property states that when adding or multiplying numbers, the grouping does not affect the answer. For example, (2 + 4) + 5 is the same as 2 + (4 + 5).

2. Zero is the identity of ______________________ because when applying it to a number, you end up with the same answer.

3. We use the ______________________ property to multiply numbers to the contents of parentheses.

4. Because of the ______________________ property, you can add or multiply numbers in any order and get the same answer. However, you cannot do this when subtracting or dividing.

5. When you multiply a number (n) and its reciprocal ($\frac{1}{n}$), your answer is always one due to the ______________________ property of multiplication.

6. Any number multiplied by ______________________ is zero.

Part 2: Name that Property

Directions: For each example, identify which property it is illustrating. You may abbreviate.

7. 4 + 0 = 4 _____________
8. 7 • 51 = 51 • 7 _____________
9. 3(2 + 1) = 3 • 2 + 3 • 1 _____________
10. 4 • (2 • 5) = (4 • 2) • 2 _____________

Part 3: Create Your Own

Directions: Using numbers, create and write an example for each of the following properties.

11. Commutative Property of Addition _______________________

12. Identity Property of Addition ____________________

13. Commutative Property of Multiplication ____________________

14. Identity Property of Multiplication ____________________

15. Inverse Property of Multiplication ____________________

<u>Part 4: Distributive Practice</u>

Directions: Choose the solution that correctly applies the Distributive Property.

16.) $4(7 + 11)$

(a) $4 \cdot 7 + 11$ (b) $4 \cdot 7 + 4 \cdot 11$ (c) $4 + 7 \cdot 11$

17.) $2(a + 13)$

(a) $2a + 13$ (b) $2 + 13a$ (c) $2a + 2 \cdot 13$

18.) $15 \cdot 9 - 15 \cdot 4$

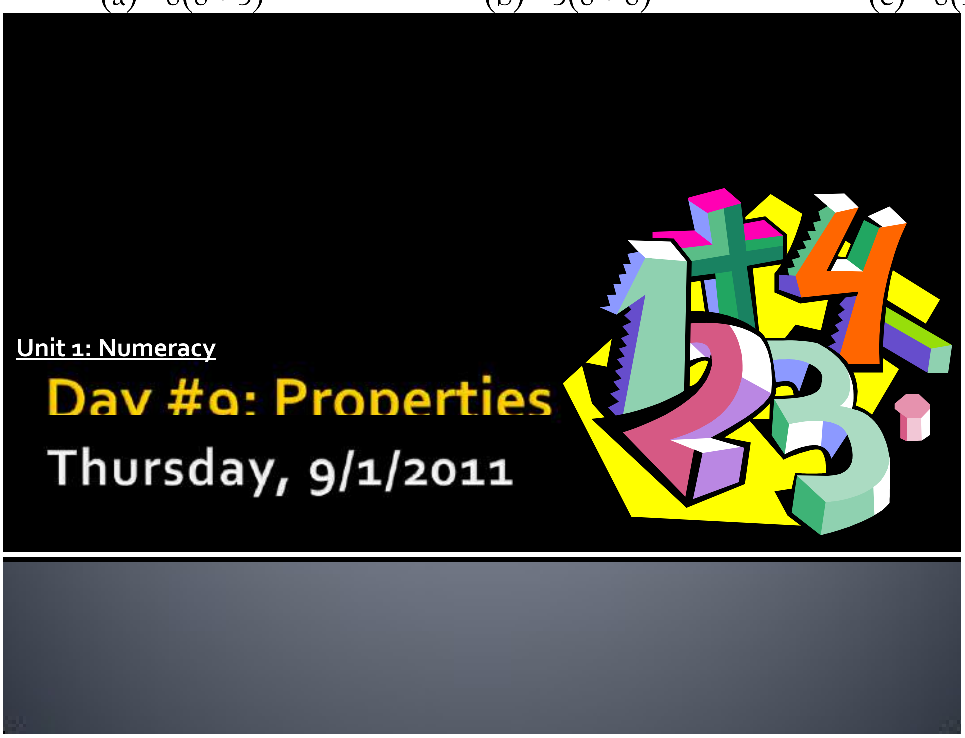
(a) $15 + 9 - 4$ (b) $15(9 - 4)$ (c) $15(9)(4)$

19.) $9(8 - 3)$

(a) $9 \cdot 8 - 9 \cdot 3$ (b) $9 - 9 \cdot 3$ (c) $9 \cdot 8 - 3$

20.) $8 \cdot 3 + 8 \cdot 6$

(a) $8(8 + 3)$ (b) $3(8 + 6)$ (c) $8(3 + 6)$



Objective Mastery Opportunity: Numeracy

Directions: Read each problem. Go slowly. ***Show all of your work in the space provided.*** *Mark your final answer on the scantron sheet.*

1.) Which of the following properties is illustrated by the algebraic expression a + b = b + a?
   a) Associative b) Identity c) Commutative d) Inverse

2.) Which expression correctly illustrates the Inverse of Multiplication Property?
   a) -2 • 2 b) -2 • 1 c) -2 • 0 d) $-2 \bullet \left(-\frac{1}{2}\right)$

3.) Simplify the expression 4(x + 2) using the Distributive Property.
   a) 4x + 8 b) 8x c) 6x d) 4x • 2

4.) What is 0.823 rounded to the nearest tenths place?
   a) 0.9 b) 0.8 c) 0.82 d) 0.83

5.) Sarah and Jen participated in the Frisbee toss on field day. Sarah threw the Frisbee 30.95 meters. Jen threw the Frisbee 39.31 meters. How much farther did Jen throw the Frisbee than Sarah?

a) 9.64 m b) 8.36 m c) 8.64 m d) 9.36 m

6.) Sergio paid for the items listed below with a $20 bill.

- One jar a of peanut butter for $2.39
- One loaf of bread for $2.75

What was the total amount of money Sergio got back after he paid for the items?

a) $14.14 b) $14.86 c) $15.14 d) $15.86

7.) Roberto paid $43.08 for 3 CDs. All 3 CDs were the same price. How much did each CD cost?

a) $11.36 b) $14.36 c) $40.08 d) $46.08

8.) Which of these is the best estimate for 4.382 • 2.641 • 6.438?

a) 48 b) 72 c) 90 d) 105

9.) One month Tony's puppy grew $\frac{7}{8}$ of an inch. The next month his puppy grew $\frac{5}{8}$ of an inch. How many inches did Tony's puppy grow in two months?

a) $\frac{2}{8}$ b) $\frac{35}{64}$ c) $1\frac{1}{2}$ d) $1\frac{1}{4}$

10.) Solve: $\frac{9}{10} - \frac{3}{4}$

a) $\frac{6}{6}$ b) $\frac{6}{20}$ c) $\frac{3}{20}$ d) $\frac{6}{14}$

11.) Solve: $\frac{5}{7} \bullet \frac{4}{15}$

a) $\frac{4}{21}$ b) $\frac{75}{28}$ c) $\frac{3}{28}$ d) $\frac{20}{22}$

12.) Solve : $\frac{3}{4} \div 8$

a) 6 b) $\frac{24}{4}$ c) $\frac{3}{32}$ d) $\frac{24}{32}$

13.) Evaluate $|x+3| - |-4|$ if x = -5

a) 12 b) -2 c) 4 d) -6

14.) Which symbol correctly completes -4 _____ 3?

a) > b) < c) = d) ♥

15.) Which set shows the integers ordered from least to greatest?

a) 3, -5, -11 b) -11, 3, -5 c) -5, -11, 3 d) -11, -5, 3

Unit Title: Foundations of Algebra **Grade Level(s):** 8

Subject/Topic Areas: Exponents, radicals, order of operations, irrational numbers.

Key Vocabulary: Exponent, power, root, radical, square, irrational number

Designed By: Kacie Versaci **Time Frame:** 5 Days
Date: 9/17/2011 – 9/20/11

SUMMARY OF PURPOSE:
Unit 2: Foundations of Algebra was designed to equip scholars with the intermediate skills needed to solve linear and quadratic equations, as well as build a stable foundation needed to use the Pythagorean Theorem. It will also allow scholars to hone their algebraic vocabulary.

Stage 1: Desired Results

Common Core/ Delaware Standards

Primary: Number Systems (Standard 1) and Expressions (Standard 2)

8.NS.1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

8.NS.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

Secondary:

8.EE.3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.*

8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Key Concepts/Big Ideas

Exponents and roots are the building blocks of algebraic functions.

Enduring Understandings

Students will understand that…

- Exponents are repeated multiplications
- Squares and roots are inverses
- Irrational numbers are any real number that cannot be expressed as a fraction
- The order of operations must be followed to correctly evaluate numeric expressions

Essential Questions

- How are exponents simplified?
- What is the difference between an irrational and irrational number?
- How can we estimate roots?
- In what order do we evaluate numeric expressions?

Real World Context

- Real world situations including measurement, economics, and data all to be explored in word problems.

Learning Targets/Goals

Students will know…

- The difference between rational and irrational numbers
- Exponents represent repeated multiplication
- The order of operations (PEMDAS)

Students will be able to… (21st century skills)

- Classify real numbers
- Compare, order, and estimate real numbers
- Simplify algebraic expressions, including exponents

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task
Individually, scholars will create layered foldable graphic organizer to define, illustrate, and clarify the laws for multiplying and raising exponents.

(SEE APPENDIX A FOR STUDENT EXAMPLE)

Rubrics for Transfer Tasks

Performance Task

	4	3	2	1	0
Content	All three laws are accurately and completed defined with a correctly applied example	Contains 1 – 2 errors	Contains 3 – 4 errors OR 1 law is incomplete	Contains More than 4 errors OR 2 laws are incomplete	All 3 laws are incomplete
Following directions	All releveant information pertaining to the law is included. Example is clearly labeled.	Contains 1 error	Contains 2 - 3 errors	Contains 4 errors	Contains more than 4 errors
Neatness and organization	Foldable is neat in appearance, legible, and colorful	Foldable is organized and legible, but may be slightly wrinkled or contain 1 – 2 handwriting errors	Foldable is legible but unorganized. OR Appearance of foldable is unprofessional	Foldable is both unorganized and unprofessional	Foldable is unreadable

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.

Summative Assessments:
Weekly quizzes
Unit Assessment
Daily Exit slips

Student Self-Assessment and Reflection

Pairs Communication Activity
Directions:
Upon completing summative assessments, scholars work in pairs to process and evaluate their assessment data.
Reflection:

1. What standards did you master?
2. What standards do you need more work on?

Scholars will complete an action plan to address how standards not mastered will be relearned and reassessed.

Instructional Resources

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Quia.com
IXL.com
McDougall/Littell Algebra and Pre-Algebra Texts

Differentiation

IEP accommodations and modifications
Read aloud
Teacher notes
Clear break down of steps
Visual and pneumonic devices
Manipulatives

Enrichment

Peer tutoring
Challenge questions

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

- **Define, differentiate between, identify, classify, compare and order rational and irrational numbers**
- **Evaluate exponents**
- **Find the power of a product**
- **Find the power of a power**
- **Evaluate expressions using PEMDAS**
- **Find the root of a perfect square**
- **Estimate the square root of a number that is not a perfect square**

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Lesson 1

General Topic

- define exponent and base
- apply the rule for adding exponents when multiplying exponential expressions with like bases (properties of exponents)
- apply the rule for multiplying exponents when raising a power to a power.
- compute the value of exponential expressions

Discuss "laws of math" and how numbers, much like us, have to follow certain rules. Break the rules, the result will not be what you intended

INM: Using a guided notes power point presentation, students will work through examples that address simplifying powers and the laws of exponents.

IP: 1) Independently, scholars will complete a class work exercise that practices applying the laws of exponents.

Key Vocabulary: Exponent, power, base

Check for Understanding:
GP: During notes, guided release within the context of the examples.

Lesson 2

General Topic: - simplify expressions involving exponents (order of operations)

Order of operations was created so mathematicians could reach the same answers. Spin as story about compromise.

INM: Using a guided notes power point presentation, students will work through examples that address evaluating expressions with and without grouping symbols, including fraction bars.

IP: 1) In 2 teams, we will have a Dual Board challenge where scholars will face off to evaluate different expressions with PEMDAS.
2) Independently, scholars will complete a class work exercise that practices evaluating expressions using PEMDAS.

Check for Understanding: During notes, guided release within the context of the examples.

Lesson 3

General Topics: SWBAT

- - define irrational numbers
- differentiate between rational and irrational numbers
- plot an irrational number on a number line
- compare an irrational number to a rational number or another irrational number
- order groups of numbers that include both rational and irrational numbers

Discuss the word irrational. Possible synonyms (angry, disobedient, misbehaving)
Irrational numbers "don't behave".

INM: Using a guided notes power point presentation, students will work define rational and irrational numbers. We will look at examples, classify numbers, and walk through the steps of "restraining" irrational numbers by estimating so they can be compared and ordered with rational numbers

IP: 1) As a class, we will play a quick game where scholars will use hand signals to show if a number is rational or irrational. We will pause and I will CFU by asking certain scholars to justify their choice.
2) Independently, scholars will complete a class work exercise that practices classifying, comparing, and ordering rational and irrational numbers.

Key Vocabulary: Rational numbers, irrational numbers

Check for Understanding: During notes, guided release within the context of the examples.

Lesson 4

General Topics:

- define square root and perfect square
- find the square root of a perfect square
- approximate the square root of a number that is not a perfect square between two integers
- locate an irrational square root between two integers

Revisit discussion about irrational numbers, explain that we will be digging a little deeper today

INM: Using a guided notes pp model, students will define square root and related vocabulary, work through examples of evaluating expressions with square roots, approximating square roots, and ordering rational and irrational numbers by creating a number line.

IP: 1) Whole class activity scholars will each receive a card with a number on it. First they must organize themselves as irrational or irrational numbers. Then they will have to order themselves from least to greatest.
2) Independently, a class work exercise requires them to evaluate roots, approximate roots, order roots, and solve word problems using square roots.

Key Vocabulary: Root, Perfect Square, Radicand, Radical

Check for Understanding During notes, various CFU slides contain Try These problems

Lesson 5

General Topics

- - read and understand numbers written in scientific notation
- convert between standard and scientific notation
- convert between the verbal description of a number and scientific notation
- understand the proper format for writing numbers in scientific notation
- solve problems involving numbers written in scientific notation
- understand addition and subtraction rules for exponents when multiplying and dividing, respectively
- multiply and divide two numbers expressed in scientific notation

INM: Using a guided notes pp model, students will define scientific notation and work through writing numbers in both scientific notation and standard form. We will then practice multiplying and dividing numbers in scientific notation.

IP: 1)Independently, a class work exercise will require scholars convert between scientific notation and standard form, multiply, and divide numbers in scientific notation.

Key Vocabulary: Scientific Notation

Check for Understanding GP: During notes, guided release within the context of the examples.

.

Name:

Date:

MATH

Homeroom:

Class Work #16

IA 1 Countdown: 9 DAYS

Directions: Read each statement regarding the laws of exponents and circle the word in the parentheses that best completes the statement.

1.) When you multiply like bases, you can (add/multiply) the exponents.

2.) Raising a power to a power requires you to (add/multiply) the exponents.

3.) Exponents (do/do not) distribute when there is a sum inside the parentheses.

4.) Any base raised to the power of zero equals (one/zero).

5.) When a negative number is the base and the exponent is (odd/even), the product will be negative.

Directions: Complete the product chart by applying the laws of exponents. Write all products as powers. You do not have to simplify.

6.)

•	3^2	3^x	3^4
3^4			
3^a			
-3^2			

•		$2a$	3^4
b^{-4}	b^4		
a^8			
		$(2ab)^4$	

Directions: For #7 - #9, solve each multiple choice questions. Show all of your work.

7.) $2^9 \bullet 2^3$

a) 4^{27} b) 2^{12} c) 4^{12} d) 2^{27}

8.) $8^9 \bullet 8^7 \bullet 8^8$

a) 512^{24} b) 8^{24} c) 8^{504} d) 24^{24}

9.) $(-7)^5(-7)^9$

a) 49^{14} b) 49^{45} c) $(-7)^{14}$ d) $(-7)^{45}$

For #10 - #13, simplify each expression. Show all of your work.

10.) $(5xy)^2$

11.) $(10^3)^4$

12.) $[(x + 4)^5]^2$

13.) $(11 \bullet 17)^9$

For #14 - #15, look at each solved problem. Describe in a full sentence what the scholar did incorrectly, then correct the error by showing the right answer.

14.) **Simplify: $c \bullet c^4 \bullet c^5$**

$$c \bullet c^4 \bullet c^5 = c \bullet c^4 \bullet c^5$$
$$= c^{1 \bullet 4 \bullet 5}$$
$$\boxed{= c^{20}}$$

What did the scholar do wrong? ____

____

____

____

Fix it: Simplify: $c \bullet c^4 \bullet c^5$

15.) **Simplify: $(2 + 3)^2$**

$$(2 + 3)^2 = (2 + 3)^2$$
$$= 2^2 + 3^2$$
$$= 4 + 9$$
$$\boxed{= 13}$$

What did the scholar do wrong? ____

____

____

____

Fix it: Simplify: $(2 + 3)^2$

Name: ______________________________ **Date:** ______________________________

MATH

Homeroom:

Exit Slip: Laws of Exponents

__________/10 = __________%

For #1 - #4, evaluate each power. Show all of your work. Draw a box around your final answer.

1.) 6^2

2.) 5^3

3.) 9^4

4.) 10^8

For #5 - #10, simplify each expression. Show all of your work. Draw a box around your final answer.

5.) $2^3 \bullet 2^5$

6.) $4 \bullet 4^3$

7.) $x^6 \bullet x^{11}$

8.) $(\frac{2}{5}d)^2$

9.) $(a^3x^2)^4$

10.) $(2^3)^2$

Name:________________________________ Date:_________________

MATH Homeroom:____________

Homework #16: Laws of Exponents

Parent Signature

Directions: Read each statement regarding the laws of exponents. Use the word bank to fill in the blanks.

Sum	Square	Add	Negative
Positive	Repeated	Multiply	Cube

16.) When a power is raised to a power, you can ________________ the exponents.

17.) When we ________________ a number, it is raised to the second power.

18.) If there is a ________________ inside parentheses, you cannot distribute the power.

19.) A negative integer raised to an even power will result in a ________________ integer.

20.) When we ________________ a number, it is raised to the third power.

21.) A negative integer raised to an odd power will result in a ________________ integer.

22.) Multiplying like bases allows to you to ________________ their exponents.

23.) An exponent represents ________________ multiplication.

Directions: Complete the product chart by applying the laws of exponents. Write all products as powers. You do not have to simplify.

24.)

•	2^4	2^x	2^7
2^2			
2^a			
-2^5			

•		$4a$	3^4
b^{-2}	b^3		
a^8			
		$(4ab)^4$	

Name:________________________________ Date:_________________

MATH Homeroom:___________

Homework #19: Square Roots

Parent Signature

For #1 - #3, evaluate each expression.

1.) $\pm\sqrt{256}$

2.) $\sqrt{484}$

3.) $-\sqrt{49}$

4.) Suppose an unusual chessboard is a square with an area of 729 square meters. What is the length (in meters) of each side of the board?

5.) The top of a folding table is a square whose area is 1243 square inches. Approximate the side length of the tabletop to the nearest inch.

6.) Approximate the square root of 491 to the nearest integer

7.) Approximate the negative square root of 15 to the nearest integer

8.) Approximate the negative square root of 386 to the nearest integer

9.) Order the number from least to greatest: $\frac{5}{4}, -3.5, \sqrt{3}, -\sqrt{6}$

10.) True or false: $\sqrt{97}$ is irrational.

Name: ______________________ **Date:** ______________________

MATH **Homeroom:** ______________________

Exit Slip: Square Roots

__________/8 = __________%

1.) Which of the following numbers is a perfect square?
a) 14 b) 12 c) 16 d) 20

For #2 - #4, evaluate each expression.

2.) $\pm\sqrt{100}$

3.) $\sqrt{121}$

4.) $-\sqrt{400}$

For #5 - #7, approximate the square root to the nearest integer.

5.) $\sqrt{32}$

6.) $\sqrt{103}$

7.) $-\sqrt{48}$

For #8, order the numbers from least to greatest.

8.) $\frac{4}{3}$, $-\sqrt{5}$, $\sqrt{13}$, -2.5, $\sqrt{9}$

__________ __________ __________ __________ __________

Name: ______________________ **Date:** ______________________

MATH **Homeroom:** ______________________

Class Work #19

IA 1 Countdown: 6 DAYS

Directions: For #1 - #5, match each term to its definition by writing the letter on the blank.

1.) Radical ___________
2.) Perfect Square ___________
3.) Irrational Number ___________
4.) Radicand ___________
5.) Square Root ___________

a) The square root of a whole number that is not a perfect square
b) The symbol for square root (√)
c) The number of expression inside the radical
d) The square of an integer
e) All positive numbers have 2 of these—a positive and a negative one

For #6 - #15, evaluate each expression.

6.) $\sqrt{4}$
7.) -$\sqrt{49}$
8.) -$\sqrt{9}$
9.) $\pm\sqrt{1}$
10.) $\sqrt{196}$
11.) $\pm\sqrt{121}$
12.) $-\sqrt{256}$
13.) $-\sqrt{225}$
14.) $\pm\sqrt{169}$
15.) $\pm\sqrt{1600}$

For #16 - #21, approximate each square root to the nearest integer.

16.) $\sqrt{10}$
17.) $-\sqrt{18}$
18.) $-\sqrt{3}$
19.) $\sqrt{150}$
20.) $-\sqrt{86}$
21.) $\sqrt{40}$

For #22 – 23, order the numbers from least to greatest.

22.) $\sqrt{49}, 8, -\sqrt{4}, -3$

23.) $\sqrt{8}, -\frac{2}{5}, -1, 0.6, \sqrt{6}$

For #24 - #25, read each word problem carefully and solve. Show all work.

24.) The area of a square painting is 3600 square inches. Find the side length of the painting in inches.

25.) Some soccer drills are practiced in the square section of a field. If the section of the field for a soccer drill is 1,620 square yards, find the side length of the section. Round your answer to the nearest yard.

Objective Mastery Opportunity: Foundations of Algebra

Directions: Read each problem. Go slowly. ***Show all of your work in the space provided****. Mark your final answer on the scantron sheet.*

1.) Simplify: $(x^5)(x^7)$

a) 12x b) 35x c) x^{12} d) x^{35}

2.) Simplify: $(y^4)^7$

a) y^{28} b) y^{11} c) $11y$ d) $28y$

3.) Simplify: $(a^4b^6)^2$
a) (a^6b^{12}) b) (a^8b^8) c) (a^6b^8) d) (a^8b^{12})

4.) Simplify: $k^4 \bullet (k^3)^5$
a) k^{19} b) k^{12} c) k^{60} d) k^{32}

5.) Simplify: $5x^9 \bullet 3x^2$
a) $8x^{11}$ b) $15x^{11}$ c) $8x^{18}$ d) $15x^{18}$

For #6- #10, mark A for a rational number and mark B for an irrational number.

6.) $-\frac{1}{2}$ a) rational b) irrational

7.) Π a) rational b) irrational

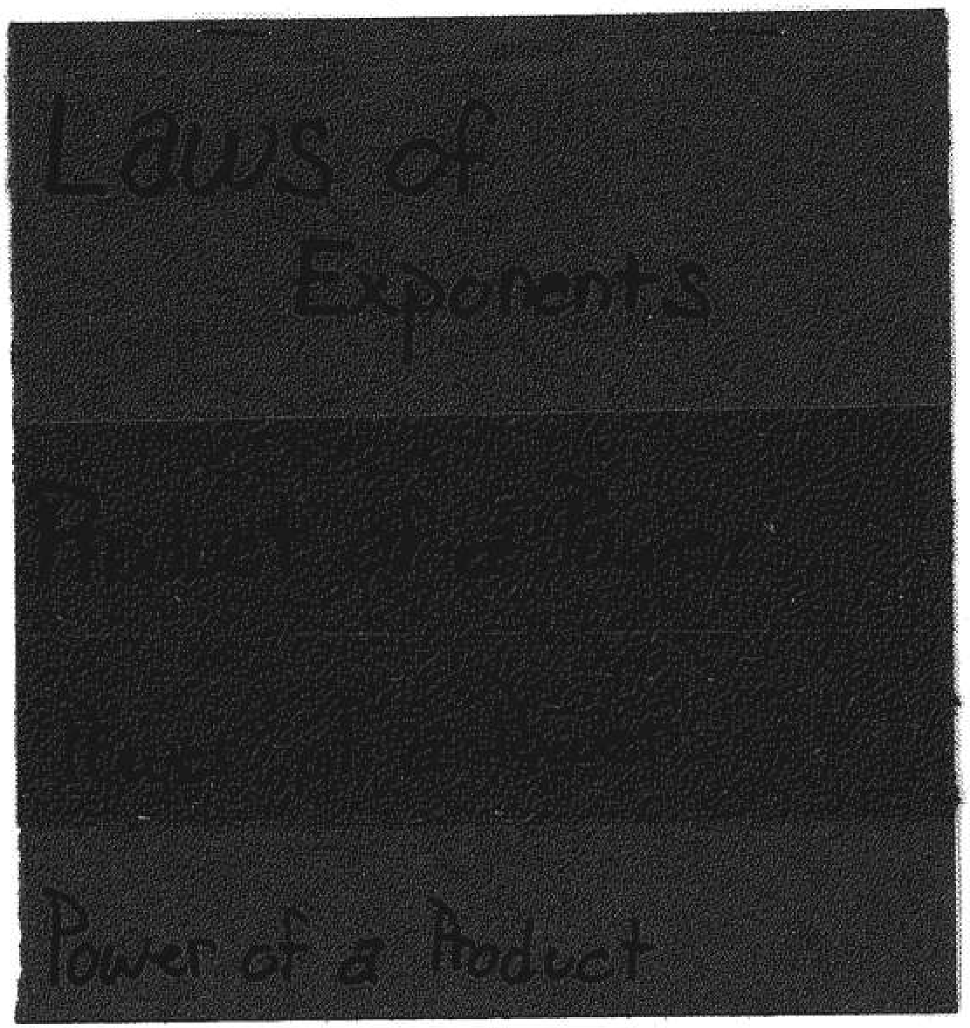
8.) $\sqrt{12}$ a) rational b) irrational

9.) $\sqrt{16}$ a) rational b) irrational

10.) $0.\overline{3}$ a) rational b) irrational

11.) Estimate: $-\sqrt{20}$
a) ~ -4 b) ~ -5 c) ~ 4 d) ~ 5

12.) Which two integers $\sqrt{55}$ in between?
a) 5 and 6 b) 6 and 7 c) 7 and 8 d) 8 and 9


Laws of
Exponents
Power of a Product

- Raising a power to another power

Ex: $(a^2 b^3)^5$ - Multiply Exponents

$a^{10} b^{15}$

* Does NOT work with add

$(x+y)^2 \neq x^2 + y^2$

Power of a Power

Power of a Product

Unit Title: Solving Linear Equations **Grade Level(s):** 8

Subject/Topic Areas: Equations

Key Vocabulary: Expression, equation, inequality, variable, inverse operation

Designed By: Kacie Versaci **Time Frame:** 10 Days
Date: 9/26/2011 – 10/07/11

SUMMARY OF PURPO SE:
Unit 3: Solving Linear Equations lays the foundation of linear algebra, preparing scholars to graph linear equations, solve systems of equations, and represent linear relationships with functions.

Stage 1: Desired Results

Common Core/ Delaware Standards

Primary: Expressions and Equations (Standard 2)

Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property

Key Concepts/Big Ideas

Linear equations are solved by isolating the variable with inverse operations

Enduring Understandings

Students will understand that…

- Variables represent an unknown number
- Inverse operations "undo" each other and allow us to isolate the variable
- Equations can have no solution, one solution, or infinite solutions

Essential Questions

- How do we isolate a variable?

Real World Context

- Real world situations including measurement, economics, and data all to be explored in word problems.
- Using equations to represent real life situations and solve for the unknown

Learning Targets/Goals

Students will know…

- The difference between expressions, equations, and inequalities
- Solving an equation requires isolating a variable

Students will be able to… (21st century skills)

- Solve equations with one variable
- Solve equations with one, two, and multiple steps
- Write equations from real life scenarios
- State if an equation has no, one or many solutions

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task

Scholars will solve a multi-step equation and show all work using the “funnel” or inverted triangle method.

(SEE APPENDIX A FOR STUDENT EXAMPLE)

Rubrics for Transfer Tasks

Performance Task

	4	3	2	1	0
Funnel or Inverted Triangle	Show step-by-step correct work. Funneled work and circle answer	Step-by-step work is shown, but there may be one calculation error. An answer is circled	Step-by-step work has been attempted but there are some conceptual errors. An answer is circled	No work is shown. An answer may or may not be circled	

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.

Summative Assessments:

Weekly quizzes
Unit Assessment
Daily Exit slips

Student Self-Assessment and Reflection

Pairs Communication Activity

Directions:

Upon completing summative assessments, scholars work in pairs to process and evaluate their assessment data.

Reflection:

1. What standards did you master?
2. What standards do you need more work on?

Scholars will complete an action plan to address how standards not mastered will be relearned and reassessed.

Instructional Resources

Achievement Network
Triand.com
Quia.com
IXL.com
McDougall/Littell Algebra and Pre-Algebra Texts

Differentiation

IEP accommodations and modifications
Read aloud
Teacher notes
Clear break down of steps
Visual and pneumonic devices
Manipulatives

Enrichment

Peer tutoring
Challenge questions

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

- **Solve one variable equations**
- **Solve one, two, and multi-step equations**

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Lesson 1

General Topic

- define numeric and algebraic expressions, equations, and inequalities
- distinguish between numeric and algebraic expressions, equations, and inequalities
- verbal phrases into algebraic expressions

translate verbal sentences into equations and inequalities

Tie into grammar: How do you know the difference between a sentence and a fragment (complete vs incomplete thought)

INM: Using a guided notes power point presentation, students will learn the vocabulary, look at examples and non examples, and practice translating verbal phrases and sentences into expressions, equations, and inequalities

IP: 1) As a class, we will play an online game using the smart board. Scholars will be chosen to come up to the smart board to choose a challenge question and type in their answer. Challenge Game

2) Independently, scholars will complete a class work exercise that practices translating verbal phrases and sentences into expressions, equations, and inequalities

Key Vocabulary: Expression, equation, inequality, variable

Check for Understanding:

GP: During notes, guided release within the context of the examples.

Lesson 2

- *General Topic:* write linear equations to model and analyze proportional relationships (writing equations from word problems)

Using a guided notes power point presentation, students will work through examples that address reading a word problem and constructing an expression, equation, or inequality to represent the relationship

Check for Understanding: During notes, guided release within the context of the examples.

Lesson 3

General Topics: SWBAT

- solve one-step equations
- solve two-step equations

INM: Using a guided notes power point presentation, students will solve one step equations, two step equations, with and without rational coefficients

Key Vocabulary:

Check for Understanding: During notes, guided release within the context of the examples.

Lesson 4

General Topics:

- use the distributive property to solve equations
- combine like terms

Key Vocabulary: Like terms

Check for Understanding During notes, various CFU slides contain Try These problems

Lesson 5

General Topics

Solve equations with one, no, or infinite solutions

Key Vocabulary:

Check for Understanding GP: During notes, guided release within the context of the examples.

.

Name: ______________________ **Date:** ______________________

MATH **Homeroom:** ______________________

Class Work #24

IA 1 Countdown: 2 DAYS

WRITING EXPRESSIONS, EQUATIONS AND INEQUALITIES

Directions: For #1 - #6, decide if the example is an expression (EX), equation (EQ) or inequality (IQ).

1.) $5x + 8 = 10$ ___________

2.) $\frac{4}{y+2}$ ___________

3.) $m - 14 \geq 12$ ___________

4.) $15 + \frac{1}{2}z$ ___________

5.) $4 < k < 10$ ___________

6.) $3.8(d - 7) = 22.7$ ___________

For #7 - #11, translate each verbal phrase into an algebraic expression.

7.) $\frac{1}{2}$ of a number *m* ____________________________

8.) The difference of 7 and a number *n* ____________________________

9.) 50 divided by a number *h* ____________________________

10.) 3 less than the square of a number *p* ____________________________

11.) The product of 6 and number *y* ____________________________

For #12 - #16, translate each verbal sentence into an equation.

12.) The sum of a number *b* and 3 is 16. ____________________

13.) 12 divided by the quantity 3 plus a number *q* is 100. ____________________

14.) The difference of 42 and a number *n* equals 51. ____________________

15.) 5 times a number *w* is $\frac{3}{5}$. ____________________

16.) The cube a number *g* increased by 4 equals 28. ____________________

For #17 – 21, translate each verbal sentence into an inequality.

17.) The product of 9 and the quantity 8 times a number *k* is less than 6.

____

18.) 29 divided by a number *u* is at least 3.

____

19.) Twice a number *b* is at most 12.

____

20.) The difference of a number *t* and 7 is greater than 10 and less than 20.

____

21.) 4 more than twice a number k is no greater than the sum of k and 11.

____

For #22 – 25, read each multiple choice question and select the best answer choice.

22.) Which expression represents the phrase "the product of 15 and the quantity 12 more than a number x"?

a) 15 + 12 • x b) (15 + 12)x c) 15(x + 12) d) 15 • 12 + x

23.) Which expression represents the phrase "twice the quotient of 50 and the sum of a number y and 8"?

a) $\frac{2 \cdot 50}{y} + 8$ b) $2(\frac{50+y}{8})$ c) $2(\frac{50}{y+8})$ d) $\frac{2}{50} + (y + 8)$

24.) Which inequality corresponds to the sentence "The product of a number b and 3 is no less than 12"?

a) 3b < 12 b) 3b ≤ 12 c) 3b > 12 d) 3b ≥ 12

25.) Which equation corresponds to the sentence "Half of a number z increased by 9 equals 23"?

a) $\frac{1}{2}z + 9 = 23$ b) $\frac{1}{2} + 9z = 23$ c) $\frac{1}{2}(z + 9) = 23$ d) $\frac{1}{2}z \cdot 9 = 23$

Name: ______________________________ **Date:** ______________________

MATH **Homeroom:** ______________________

Exit Slip: Express Linear Relationships

__________/10 = __________%

For #1 - #3, decide if the example is an expression, equation, or inequality

1.) $4x + 3 > 11$ ______________________

2.) $\frac{3y}{7a}$ ______________________________

3.) $y = 2x + 4$ ______________________________

For #4 - #6, translate each verbal phrase into an algebraic expression.

4.) The product of 12 and a number *y* ______________________________

5.) The quotient of the square of a number *w* and 5 ______________________________

6.) The product of 15 and the quantity 12 more than *x* ______________________________

For #7 - #10, translate each verbal sentence into an equation or inequality.

7.) The sum of 42 and a number *n* is equal to 51. ______________________

8.) 9 times the quantity of 5 plus a number *t* is less than 6 ______________________

9.) The sum of a number *b* and 3 is greater than 8 ______________________

10.) The sum of twice a number *r* and 3 is 11 ______________________

Name:_________________________________ Date:_________________

MATH Homeroom:___________

Homework #24: Writing Expressions, Equations and Inequalities

Parent Signature

What did the cucumber say to the vinegar?

To find out, choose the correct algebraic expression for each word phrase. Then find the letter associated with each expression you wrote to complete the answer below.

1. 8 more than twice n

$8 - 2n$	**T**	$8n + 2$	**U**
$2n - 8$	**V**	$8 + 2n$	**P**

2. 3 less than the product of 4 and n

$3 - 4n$	**F**	$3n - 4$	**G**
$4n - 3$	**K**	$4n + 3$	**L**

3. 9 more than the product of 6 and n

$9 - 6n$	**F**	$6n + 9$	**E**
$9n + 6$	**D**	$6n - 9$	**G**

4. 3 more than the quotient of 4 and n

$\frac{4}{n} + 3$	**C**	$\frac{n}{4} + 3$	**D**
$\frac{(n + 3)}{4}$	**E**	$\frac{n}{3} + 4$	**F**

5. 1 divided by the sum of 2 and n

$\frac{1}{2} + n$	**J**	$\frac{(n + 1)}{2}$	**K**
$\frac{1}{n} + 2$	**L**	$\frac{1}{(2 + n)}$	**I**

6. 5 less than n divided by 6

$\frac{n}{6} - 5$	**L**	$\frac{n}{5} - 6$	**Q**
$5 - \frac{n}{6}$	**M**	$6 - \frac{n}{5}$	**U**

7. $\frac{1}{3}$ of the sum of 9 and n

$9 + \frac{n}{3}$	**M**	$\frac{1}{3}(9) + n$	**O**
$\frac{1}{3}(n + 9)$	**N**	$\frac{1}{3} + 9n$	**I**

8. 12 times the sum of 8 and n

$12(8) + n$	**S**	$12(n - 8)$	**T**
$12(n + 8)$	**R**	$12n + 8$	**U**

9. half the sum of n and 20

$\frac{1}{2}(20n)$	**B**	$\frac{1}{2} + 20n$	**L**
$\frac{(n + 20)}{2}$	**A**	$\frac{n}{2} + 20$	**R**

10. twice the quotient of n and 10

$2(\frac{n}{10})$	**W**	$2n + 10$	**M**
$2n - 10$	**N**	$2 + \frac{n}{10}$	**O**

____ ____   ____ ____ ____   ____ ____

10 3   9 8 3   5 7

____   ____ ____ ____ ____ ____ ____.

9   1 5 4 2 6 3

Directions: Translate each sentence into an algebraic equation or inequality.

11. The sum of a number and eleven times the same number *y* is 84.

    ____

12. A number *d* increased by 2 is 26.

    ____

13. 5 less than the product of 9 and a number *t* is at least 22.

    ____

14. The sum of 43 and a number *x* is greater than 61 but less than 100.

____

15. One-tenth of a number *h* is 20.

____

16. 8 times a number *b* equals 8.

____

17. 12 times a number *u* added to 10 is no greater than 22.

____

18. The sum of 10 and the quantity of 4 plus a number *k* is 27.

____

19. One-sixth of a number *w* is less than 66.

____

20. The product of 10 and the quantity of 5 plus a number *j* is 55.

____

Name: ____________________ **Date:** ________________

MATH **Homeroom:** ________________

Class Work #26

IA 1 Countdown: 0 DAYS

ONE AND TWO STEP EQUATIONS

1.) $-3 = 5 + a$

2.) $5g = 20$

3.) $8 = \frac{x}{6}$

4.) $-187 = -17r$

5.) $\frac{1}{3}c = 32$

6.) $5h + 4 = 19$

7.) $\frac{b}{2} - 9 = 11$

8.) $2g - 13 = 3$

9.) $17 = \frac{w}{5} = 13$

10.) $10 = \frac{2}{7}n + 4$

Name: ______________________ **Date:** ______________________

MATH **Homeroom:** ______________________

Exit Slip: Solve One Variable Equations

__________/10 = __________%

Directions: Solve for the variable. Show all of your work. Draw a box around your final answer.

1. $6x = 42$

2. $y + 9 = 26$

3. $-13 - w = -3$

4. $\frac{b}{13} = 9$

5. $a - 11 = -4$

6. $3k + 7 = -5$

7. $\frac{c}{5} - 11 = -6$

8. $(d + 9) \div 3 = 19$

9. $7d + 8 = 43$

10. $\frac{z+10}{2} = -8$

Name:________________________________ Date:_________________

MATH Homeroom:___________

Homework #26: One and Two Step Equations

Parent Signauture

Solve the equation. Remember to work backwards! Make sure you are showing every step when solving. Please circle your answer and check your work!

1.) $20 = 8t + 4$

2.) $8 + 2g = 30$

3.) $10 = 7w - 18$

4.) $\frac{x}{2} - \; = 5\frac{x}{2} - 3 = 15$

5.) Put the steps for solving the equation $7x - 10 = -3$ in order (by writing the letters in the correct order on the lines below).

A. Add 10 to each side. B. Check your answer. C. Divide each side by 7.

__________ first __________ second __________ third

6.) Which equation has a solution of -12?

(a) $\frac{y}{-2} - 2 = 4$

(b) $2y - 2 = -8$

(c) $-2y + 4 = -20$

(d) $\frac{y}{-2} + 4 = -2$

Tell whether each statement is **<u>true</u>** or **<u>false</u>**.

7.) To solve the equation $11x + 9 = -4$, you first subtract 9 from each side, then divide each side by 11.

8.) To solve the equation $\frac{x}{5} - 7 = 3$, you first multiply each side by 5, then add 7 to each side.

Match the equation with its solution.

__________ 9.) $2y - 3 = 1$

__________ 10.) $2y + 3 = 1$

__________ 11.) $3y - 2 = 1$

A. $y = -\frac{1}{3}$

B. $y = -1$

C. $y = 1$

_________ 12.) $3y + 2 = 1$ D. y=$2y = 2$

13.) Is $x = 2$ a solution of the equation $7x - 3 = 11$? *Show all of your work.*

Circle your answer: Yes No

14.) Is $c = 20$ a solution of the equation $\frac{c}{5} -$ $=$ $2\frac{c}{5} - 8 = 12$? *Show all of your work.*

Circle your answer: Yes No

Prestige Academy Charter School

Name: [handwritten signature]

Date: 6-29-11

MATH

Homeroom: Gray Jane 8

Exit Slip: Solve One Variable Equations

8/8 = 100%

______/10 = ______%

Directions: Solve for the variable. Show all of your work. Draw a box around your final answer.

1. $6x = 42$

$6x = 42$

$\boxed{x = 7}$ C

2. $y + 9 = 26$

$-9 \quad -9$

$\boxed{y = 17}$ C

3. $-13 - w = -3$

$+13 \quad +13$

$w = 16$

4. $\frac{b}{13} = 9$

$13\left(\frac{b}{13}\right) = (9)13$

$\boxed{b = 117}$ C

5. $a - 11 = -4$

$+11 \quad +11$

$\boxed{a = 7}$ C

6. $3k + 7 = -5$

$-7 \quad -7$

$3k = -12$

$\boxed{k = -4}$ C

7. $\frac{c}{5} - 11 = -6$

$+11 \quad +11$

$5\left(\frac{c}{5}\right) = (5)5$

$\boxed{c = 25}$ C

8. $(d + 9) \div 3 = 19$

$\times 3 \quad \times 3$

$d + 9 = 57$

$-9 \quad -9$

$\boxed{d = 48}$ C

$19 \times 3 = 57$

9. $7d + 8 = 43$

$-8 \quad -8$

$7d = 35$

$\boxed{d = 5}$ C

10. $\frac{z+10}{2} = -8$

Interim Cycle 1
Teacher: Patel
Subject: SCIENCE
Grade: 8

Focus for Week 1: Set Class expectations **Sub-Skills: Daily transitions, expectations**				
Monday, August 29, Day #6 ELA Standards Goal:	Tuesday, August 30, Day #7	Wednesday, August 31, Day #8	Thursday, September 1, Day #9	Friday, September 2 ELA Standards Goal:
RE-ORIENTATION: NO ACADEMIC CLASSES	**RE-ORIENTATION: NO ACADEMIC CLASSES**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**LABOR DAY: NO SCHOOL**
Focus for Week 2: • **Standard 1 Nature & Application of Science & Technology** **Sub-Skills:** • **Scientific Method**				
Monday, September 5	Tuesday, September 6, Day #10	Wednesday, September 7, Day #11	Thursday, September 8, Day #12	Friday, September 9, Day #13
LABOR DAY: NO SCHOOL	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis
Focus for Week 3: • **Standard 1 Nature & Application of Science & Technology** **Sub-Skills:** • **Scientific Method**				
Monday, September 12, Day #14	Tuesday, September 13, Day #15	Wednesday, September 14, Day #16	Thursday, September 15, Day #17	Friday, September 16, Day #18
State Standard Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis **Sub-Skill 3:** Make/Record Observations	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis **Sub-Skill 3:** Make/Record Observations **Sub-Skill 4:** **Record Data**
Focus for Week 4: • **Standard 1 Nature & Application of Science & Technology** **Sub-Skills:** • **Scientific Method**				

Monday, September 19, Day #19	Tuesday, September 20, Day #20	Wednesday, September 21, Day #21	Thursday, September 22, Day #22	Friday, September 23, Day #23
State Standard Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis **Sub-Skill 3:** Make/Record Observation **Sub-Skill 4:** **Record Data** **Sub-Skill 5:** **Draw conclusions**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis **Sub-Skill 3:** Make/Record Observation **Sub-Skill 4:** **Record Data** **Sub-Skill 5:** **Draw conclusions**

Focus for Week 5:

- **Standard 1 Nature & Application of Science & Technology**

Sub-Skills:

- **Scientific Method**

Monday, September 26, Day #24	Tuesday, September 27, Day #25	Wednesday, September 28, Day #26	Thursday, September 29, Day #27	Friday, September 30, Day #28
State Standard Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis **Sub-Skill 3:** Make/Record Observation **Sub-Skill 4:** **Record Data** **Sub-Skill 5:** **Draw conclusions**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**INTERIM #1 MATH**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and History Society & Context of Science **Sub-Skill 1:** Identify Purpose/Objective **Sub-Skill 2:** State Hypothesis **Sub-Skill 3:** Make/Record Observation **Sub-Skill 4:** **Record Data** **Sub-Skill 5:** **Draw conclusions**

Interim Cycle 2

Teacher: PATEL

Subject:SCI

Grade: 8

Focus for Week 1:

- **Standard 1 The Nature & Application of Science & Technology**
- **Standard 3 Energy and its Effects**

Sub-Skills:

- Energy comes in different forms, and can change from one form to another.
- Energy can be transferred from one object to another.
- Energy cannot be created or destroyed.

Monday, October 3, Day #29	Tuesday, October 4, Day	Wednesday, October 5,	Thursday, October 6, Day	Friday, October 7, Day #33

<table>
<tr><td></td><td>#30</td><td>Day #31</td><td>#32</td><td>½ Day – one hour block</td></tr>
<tr>
<td><u>State Standard</u>
The Nature and Application of Science and Technology

Understandings and Abilities of Scientific Inquiry

Science, Technology, and Society

Energy and its Effects

The Forms and Sources of Energy

Forces and the Transfer of Energy

Energy Interacting With Materials; the Transformation and Conservation of Energy

The Production, Consumption and Application of Energy

<u>Sub-Skill 1:</u>
• Determine the speed of a released object as the release height is changed.

<u>Sub-Skill 2:</u>
• Review the calculation of average speed as distance divided by time.</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
The Nature and Application of Science and Technology

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Energy Interacting With Materials; the Transformation and Conservation of Energy

The Production, Consumption and Application of Energy

<u>Sub-Skill 1:</u>
• Establish a connection between the kinetic energy of an object and its speed and mass.

<u>Sub-Skill 2:</u>
• Establish a connection between the amount of “change” that occurs and the energy of the object.

<u>Sub-Skill 3:</u>
• Establish a relationship between release height, speed at the bottom of a ramp, and the kinetic energy of the object.</td>
</tr>
<tr><td colspan="5">Focus for Week 2:

• Standard 1 The Nature & Application of Science & Technology
• Standard 3 Energy and its Effects

Sub-Skills:

• Energy comes in different forms, and can change from one form to another.
• Energy can be transferred from one object to another.
• Energy cannot be created or destroyed.</td></tr>
<tr><td>Monday, October 10, Day #34</td><td>Tuesday, October 11, Day #35</td><td>Wednesday, October 12, Day #36</td><td>Thursday, October 13, Day #37</td><td>Friday, October 14, Day #38</td></tr>
<tr>
<td><u>State Standard</u>
The Nature and Application of Science and Technology

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Energy Interacting With Materials; the Transformation and Conservation</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
The Nature and Application of Science and Technology

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Energy Interacting With</td>
</tr>
</table>

<table>
<tr>
<td>of Energy

The Production, Consumption and Application of Energy

<u>Sub-Skill 1:</u>
• Recognize that mass and speed have a direct relationship on the amount of kinetic energy

<u>Sub-Skill 2:</u>
• Describe gravitational potential energy and kinetic energy as the components of mechanical energy.

<u>Sub-Skill 3:</u>
• Describe how energy can be transferred between objects and how it can be transformed into other forms of energy.</td>
<td></td>
<td></td>
<td></td>
<td>Materials; the Transformation and Conservation of Energy

The Production, Consumption and Application of Energy

<u>Sub-Skill 1:</u>
• Describe the energy transfer and transformations that take place as a pendulum swings back and forth.

<u>Sub-Skill 2:</u>
• Use the particle model to help explain the energy transfers and transformations.</td>
</tr>
<tr>
<td colspan="5">Focus for Week 3:

• Standard 1 The Nature & Application of Science & Technology
• Standard 3 Energy and its Effects

Sub-Skills:

• Energy comes in different forms, and can change from one form to another.
• Energy can be transferred from one object to another.
• Energy cannot be created or destroyed.</td>
</tr>
<tr>
<td>Monday, October 17, Day #39</td>
<td>Tuesday, October 18, Day #40</td>
<td>Wednesday, October 19, Day #41</td>
<td>Thursday, October 20, Day #42</td>
<td>Friday, October 21, Day #43
½ Day – one hour block</td>
</tr>
<tr>
<td><u>State Standard</u>
The Nature and Application of Science and Technology

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Energy Interacting With Materials; the Transformation and Conservation of Energy

The Production, Consumption and Application of Energy

<u>Sub-Skill 1:</u>
• Recognize that different materials transfer energy at different rates.
<u>Sub-Skill 2:</u>
• Explain how the physical characteristics of an object can influence that object's ability to transfer and transform energy.</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
The Nature and Application of Science and Technology

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Energy Interacting With Materials; the Transformation and Conservation of Energy

The Production, Consumption and Application of Energy

<u>Sub-Skill 1:</u>
• Construct an energy chain that describes the energy flow, transfer and transformation, of an everyday phenomena</td>
</tr>
</table>

Focus for Week 4:

- **Standard 1 The Nature & Application of Science & Technology**
- **Standard 3 Energy and its Effects**

Sub-Skills:

- Energy comes in different forms, and can change from one form to another.
- Energy can be transferred from one object to another.
- Energy cannot be created or destroyed.

Monday, October 24, Day #44	Tuesday, October 25, Day #45	Wednesday, October 26, Day #46	Thursday, October 27, Day #47	Friday, October 28, Day #48
State Standard The Nature and Application of Science and Technology Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Energy Interacting With Materials; the Transformation and Conservation of Energy The Production, Consumption and Application of Energy **Sub-Skill 1:** • Observe the role that forces play in the transfer of kinetic energy, and its transformation into heat energy	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** The Nature and Application of Science and Technology Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Energy Interacting With Materials; the Transformation and Conservation of Energy The Production, Consumption and Application of Energy **Sub-Skill 1:** • The temperature of an object is NOT determined by how the object feels to our touch; the human sensation of "hot" and "cold" are often misleading due to the direction of the transfer of heat energy. **Sub-Skill 2:** • The temperature of an object is linked to the motion of the individual particles that make up the object. The temperature is a measure of the average kinetic energy of these particles.

Focus for Week 5:

- **Standard 1 The Nature & Application of Science & Technology**
- **Standard 3 Energy and its Effects**

Sub-Skills:

- Energy comes in different forms, and can change from one form to another.
- Energy can be transferred from one object to another.
- Energy cannot be created or destroyed.

Monday, October 31, Day #49	Tuesday, November 1, Day #50	Wednesday, November 2, Day #51	Thursday, November 3, Day #52	Friday, November 4, Day #53 End of Quarter 1

State Standard The Nature and Application of Science and Technology Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Energy Interacting With Materials; the Transformation and Conservation of Energy The Production, Consumption and Application of Energy **Sub-Skill 1:** • Heat energy is the combined random kinetic energy of the particles that make up an object **Sub-Skill 2:** • The temperature of an object is an indicator of the motion of particles and is determined by how much energy it receives or transfers away, and it's mass.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**INTERIM #2 MATH**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** The Nature and Application of Science and Technology Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Energy Interacting With Materials; the Transformation and Conservation of Energy The Production, Consumption and Application of Energy **Sub-Skill 1:** • When two substances are mixed together, heat energy will be transferred from the substance at a higher temperature to a substance with a lower temperature until the combination reaches a single temperature (the equilibrium temperature). **Sub-Skill 2:** • Heat energy is involved in the change of state process (i.e. solid to liquid, liquid to gas, etc.). When heat energy is transferred into a substance, it may be used to increase the temperature of the substance or it may be used to change the state of the substance.

Interim Cycle 3
Teacher: PATEL
Subject: SCI
Grade: 8

Focus for Week 1:

- **Standard 1 The Nature & Application of Science & Technology**
- **Standard 3 Energy and its Effects**

Sub-Skills:

- Energy comes in different forms, and can change from one form to another.
- Energy can be transferred from one object to another.
- Energy cannot be created or destroyed.

Monday, November 7, Day #54	Tuesday, November 8, Day	Wednesday, November 9,	Thursday, November 10, Day	Friday, November 11, Day #58

<table>
<tr><td></td><td>#55</td><td>Day #56</td><td>#57
½ Day – one hour block</td><td></td></tr>
<tr><td><u>State Standard</u>
The Nature and Application of Science and Technology

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Energy Interacting With Materials; the Transformation and Conservation of Energy

The Production, Consumption and Application of Energy

<u>Sub-Skill 1:</u>
When heat energy passes through a solid, it is called conduction and when it passes through a liquid or gas, it is called convection.

<u>Sub-Skill 2:</u>
The particle model can be used to explain the how density varies with differences in the motion of particles of varying temperatures resulting in a flow of matter.

<u>Sub-Skill 3:</u>
Besides conduction and convection, objects can also transfer heat energy (“cool”) by emitting electromagnetic radiation, usually in the infrared (IR) region.</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td>VETERANS DAY: NO SCHOOL</td></tr>
<tr><td colspan="5">Focus for Week 2:
Standard 1 The Nature & Application of Science & Technology
Standard 3 Energy and its Effects
Sub-Skills:
Energy comes in different forms, and can change from one form to another.
Energy can be transferred from one object to another.
Energy cannot be created or destroyed.</td></tr>
<tr><td>Monday, November 14, Day #58</td><td>Tuesday, November 15, Day #59</td><td>Wednesday, November 16, Day #60</td><td>Thursday, November 17, Day #61</td><td>Friday, November 18, Day #62</td></tr>
<tr><td><u>State Standard</u>
The Nature and Application of Science and Technology

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Energy Interacting With Materials; the Transformation and Conservation of Energy

The Production, Consumption and Application of Energy</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>
The Nature and Application of Science and Technology

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Energy Interacting With Materials; the Transformation</td></tr>
</table>

Sub-Skill 1: Explain that waves transfer energy without transporting mass. **Sub-Skill 2:** Describe waves as organized vibrations that transfer energy				and Conservation of Energy The Production, Consumption and Application of Energy **Sub-Skill 1:** • Waves are grouped based on the kind of energy they carry and how they carry this energy. The two main types of waves are mechanical and electromagnetic. **Sub-Skill 2:** • Sound waves and seismic waves are primarily used to illustrate mechanical energy being transferred by mechanical waves. **Sub-Skill 3:** • The characteristics of the wave (wavelength and frequency) and the properties of the material determine how much of the energy carried by the wave reflects from, transmit through, or are absorbed by the material

Focus for Week 3:

- **Standard 1 The Nature & Application of Science & Technology**
- **Standard 3 Energy and its Effects**

Sub-Skills:

- Energy comes in different forms, and can change from one form to another.
- Energy can be transferred from one object to another.
- Energy cannot be created or destroyed.

Monday, November 21, Day #63	Tuesday, November 22, Day #64	Wednesday, November 23	Thursday, November 24	Friday, November 25
State Standard Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Components of the Earth Interactions Throughout Earth's Systems Technology and Applications **Sub-Skill 1:** • Electromagnetic waves have a broad range of characteristics, depending on their wavelength or frequency. **Sub-Skill 2:** • The characteristics of the wave (wavelength	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**THANKSGIVING BREAK: NO SCHOOL (PD DAY FOR TEACHERS)**	**THANKSGIVING BREAK: NO SCHOOL**	**THANKSGIVING BREAK: NO SCHOOL**

and frequency) and the properties of the material determine how much of the energy carried by the wave reflects from, transmit through, or are absorbed by the material. **<u>Sub-Skill 3:</u>** • Visible, Infrared (IR), and Ultraviolet (UV) light are used to illustrate how energy is transferred by electromagnetic waves since they constitute the primary categories of radiation from the Sun.				

Focus for Week 4:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 5 Earth's Dynamic Systems**
- **Standard 5 Interactions throughout Earth's Systems**

Sub-Skills:

- Observation and Evidence: Students make observations of weather systems using satellite imagery and use weather data as evidence to support a particular weather pattern.
- Reasoning and Explanations: Students use weather data to support and explain their weather predictions.
- Properties of Materials: Students use the particle model to explain density, air pressure and movement of air.
- Systems: The hydrosphere, geosphere and atmosphere are all involved in creating weather patterns.
- Interaction of Science and Technology: Weather instruments and internet data may be used to collect data to support weather predictions and explanations of weather phenomena.
- Cycles: The water cycle actively transfers water from one form to another and influences cloud formation and precipitation.
- Models: Models are used to demonstrate the unequal heating and cooling of the Earth's surface and how this influences weather.
- Patterns: Patterns in weather data observed enable us to form explanations of weather observed.

Monday, November 28, Day #65	Tuesday, November 29, Day #66	Wednesday, November 30, Day #67	Thursday, December 1, Day #68	Friday, December 2, Day #69
<u>State Standard</u> Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Components of the Earth Interactions Throughout Earth's Systems Technology and Applications **<u>Sub-Skill 1:</u>** Students collect data on a hurricane **<u>Sub-Skill 2:</u>** Make a recommendation to evacuate or not evacuate the town **<u>Sub-Skill 3:</u>** Work in groups using a jigsaw technique and take the information gained on the hurricane and potential danger to generate and share their recommendations to evacuate or stay using the available data given on the storm.	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Components of the Earth Interactions Throughout Earth's Systems Technology and Applications **<u>Sub-Skill 1:</u>** Collect weather data and record it in their journal. **<u>Sub-Skill 2:</u>** This data is plotted on a graph and analyzed weekly for a grade using a rubric.

Focus for Week 5:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 5 Earth's Dynamic Systems**
- **Standard 5 Interactions throughout Earth's Systems**

Sub-Skills:

- Observation and Evidence: Students make observations of weather systems using satellite imagery and use weather data as evidence to support a particular weather pattern.
- Reasoning and Explanations: Students use weather data to support and explain their weather predictions.
- Properties of Materials: Students use the particle model to explain density, air pressure and movement of air.
- Systems: The hydrosphere, geosphere and atmosphere are all involved in creating weather patterns.
- Interaction of Science and Technology: Weather instruments and internet data may be used to collect data to support weather predictions and explanations of weather phenomena.
- Cycles: The water cycle actively transfers water from one form to another and influences cloud formation and precipitation.
- Models: Models are used to demonstrate the unequal heating and cooling of the Earth's surface and how this influences weather.
- Patterns: Patterns in weather data observed enable us to form explanations of weather observed.

Monday, December 5, Day #70	Tuesday, December 6, Day #71	Wednesday, December 7, Day #72	Thursday, December 8, Day #73	Friday, December 9, Day #74 ½ Day – one hour block
State Standard Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Components of the Earth Interactions Throughout Earth's Systems Technology and Applications **Sub-Skill 1:** construct and read weather station models. **Sub-Skill 2:** A quiz is given on this topic as well as giving credit for their daily station models recorded in their weather journals.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Components of the Earth Interactions Throughout Earth's Systems Technology and Applications **Sub-Skill 1:** How Does the Sun Heat the Earth's Surface Students conduct the lab investigation and turn in a written report explaining their results. **Sub-Skill 2:** This lab simulates the influence of the Sun's energy on land and water and prepares the students to understand the cause of wind and differences in temperatures over land and water. Students use this information to explain land and sea breezes as a formative assessment.

Focus for Week 6: Standard

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 5 Earth's Dynamic Systems**
- **Standard 5 Interactions throughout Earth's Systems**

Sub-Skills:

- Observation and Evidence: Students make observations of weather systems using satellite imagery and use weather data as evidence to support a particular weather pattern.
- Reasoning and Explanations: Students use weather data to support and explain their weather predictions.
- Properties of Materials: Students use the particle model to explain density, air pressure and movement of air.
- Systems: The hydrosphere, geosphere and atmosphere are all involved in creating weather patterns.
- Interaction of Science and Technology: Weather instruments and internet data may be used to collect data to support weather predictions and explanations of weather phenomena.
- Cycles: The water cycle actively transfers water from one form to another and influences cloud formation and precipitation.
- Models: Models are used to demonstrate the unequal heating and cooling of the Earth's surface and how this influences weather.
- Patterns: Patterns in weather data observed enable us to form explanations of weather observed.

Monday, December 12, Day #75	Tuesday, December 13, Day #76	Wednesday, December 14, Day #77	Thursday, December 15, Day #78	Friday, December 16, Day #79
State Standard Understandings and Abilities of Scientific Inquiry Science Technology and Society	**State Standard**	**State Standard**	**State Standard**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society

<table>
<tr>
<td>History and Context of Science
Components of the Earth
Interactions Throughout Earth's Systems
Technology and Applications

<u>Sub-Skill 1:</u>
How do temperature and pressure differences affect air Movement on the Earth's Surface?

<u>Sub-Skill 2:</u>
Students make predictions and proposed explanations for various demonstrations and lab activities relating to air pressure.</td>
<td><u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td>History and Context of Science
Components of the Earth
Interactions Throughout Earth's Systems
Technology and Applications

<u>Sub-Skill 1:</u>
Students conduct experiments to find the dew point and relative humidity in the classroom and outside

<u>Sub-Skill 2:</u>
This data is reported in data tables and students explain the relationship between dew point and relative humidity in a short writing activity.</td>
</tr>
<tr>
<td colspan="5">Focus for Week 7:

Standard 1 Nature & Application of Science & Technology
Standard 5 Earth's Dynamic Systems
Standard 5 Interactions throughout Earth's Systems

Sub-Skills:

Observation and Evidence: Students make observations of weather systems using satellite imagery and use weather data as evidence to support a particular weather pattern.
Reasoning and Explanations: Students use weather data to support and explain their weather predictions.
Properties of Materials: Students use the particle model to explain density, air pressure and movement of air.
Systems: The hydrosphere, geosphere and atmosphere are all involved in creating weather patterns.
Interaction of Science and Technology: Weather instruments and internet data may be used to collect data to support weather predictions and explanations of weather phenomena.
Cycles: The water cycle actively transfers water from one form to another and influences cloud formation and precipitation.
Models: Models are used to demonstrate the unequal heating and cooling of the Earth's surface and how this influences weather.
Patterns: Patterns in weather data observed enable us to form explanations of weather observed.
</td>
</tr>
<tr>
<td>Monday, December 19, Day #80</td>
<td>Tuesday, December 20, Day #81</td>
<td>Wednesday, December 21, Day #82</td>
<td>Thursday, December 22, Day #83</td>
<td>Friday, December 23</td>
</tr>
<tr>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology and Society
History and Context of Science
Components of the Earth
Interactions Throughout Earth's Systems
Technology and Applications

<u>Sub-Skill 1:</u>
Students conduct experiments to find the dew point and relative humidity in the classroom and outside

<u>Sub-Skill 2:</u>
This data is reported in data tables and students explain the relationship between dew point and relative humidity in a short writing activity.</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td>WINTER BREAK: NO SCHOOL (PD DAY FOR TEACHERS)</td>
</tr>
<tr>
<td colspan="5">Focus for Week 8:

Standard 1 Nature & Application of Science & Technology
Standard 5 Earth's Dynamic Systems
Standard 5 Interactions throughout Earth's Systems

Sub-Skills:

Observation and Evidence: Students make observations of weather systems using satellite imagery and use weather data as evidence to support a particular weather pattern.
Reasoning and Explanations: Students use weather data to support and explain their weather predictions.
</td>
</tr>
</table>

- Properties of Materials: Students use the particle model to explain density, air pressure and movement of air.
- Systems: The hydrosphere, geosphere and atmosphere are all involved in creating weather patterns.
- Interaction of Science and Technology: Weather instruments and internet data may be used to collect data to support weather predictions and explanations of weather phenomena.
- Cycles: The water cycle actively transfers water from one form to another and influences cloud formation and precipitation.
- Models: Models are used to demonstrate the unequal heating and cooling of the Earth's surface and how this influences weather.
- Patterns: Patterns in weather data observed enable us to form explanations of weather observed.

Monday, January 2	Tuesday, January 3	Wednesday, January 4, Day #85	Thursday, January 5, Day #86	Friday, January 6, Day #87
WINTER BREAK: NO SCHOOL)	**WINTER BREAK: NO SCHOOL (PD DAY FOR TEACHERS)**	**CULTURE RESET (NO ACADEMIC CLASSES)**	**CULTURE RESET**	**CULTURE RESET**

Focus for Week 9:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 5 Earth's Dynamic Systems**
- **Standard 5 Interactions throughout Earth's Systems**

Sub-Skills:

- Observation and Evidence: Students make observations of weather systems using satellite imagery and use weather data as evidence to support a particular weather pattern.
- Reasoning and Explanations: Students use weather data to support and explain their weather predictions.
- Properties of Materials: Students use the particle model to explain density, air pressure and movement of air.
- Systems: The hydrosphere, geosphere and atmosphere are all involved in creating weather patterns.
- Interaction of Science and Technology: Weather instruments and internet data may be used to collect data to support weather predictions and explanations of weather phenomena.
- Cycles: The water cycle actively transfers water from one form to another and influences cloud formation and precipitation.
- Models: Models are used to demonstrate the unequal heating and cooling of the Earth's surface and how this influences weather.
- Patterns: Patterns in weather data observed enable us to form explanations of weather observed.

Monday, January 9, Day #87	Tuesday, January 10, Day #88	Wednesday, January 11, Day #89	Thursday, January 12, Day #90	Friday, January 13, Day #91
State Standard Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Components of the Earth Interactions Throughout Earth's Systems Technology and Applications **Sub-Skill 1:** Students will make a short term weather forecast supporting their forecast with weather data. A short presentation will be made using this data. **Sub-Skill 2:** This may be done in small groups and a rubric will be used to grade the results on supporting data and explanations and not accuracy of actual weather that takes place.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science Components of the Earth Interactions Throughout Earth's Systems Technology and Applications **Sub-Skill 1:** Students use satellite photos to aid in identifying weather systems and students make weather advisories for local fisherman to leave the waters or stay with a possible advancing storm system. **Sub-Skill 2:** This may be assessed as a group activity. Students also construct a Venn Diagram using information about Tornadoes, Hurricanes, and Thunderstorms.

Focus for Week 10:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 4 Earth in Space**

Sub-Skills:

- The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
- Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.

- Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
- The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
- Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
- Great advances in information about Solar System objects have been obtained through the use of science and technology.

Monday, January 16	Tuesday, January 17, Day #92	Wednesday, January 18, Day #93	Thursday, January 19, Day #94	Friday, January 20, Day #95
MLK DAY: NO SCHOOL	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **Sub-Skill 1:** Students will have an opportunity to recall their understanding of the Solar System from them previous learning.

Focus for Week 11:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 4 Earth in Space**

Sub-Skills:

- The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
- Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
- Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
- The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
- Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
- Great advances in information about Solar System objects have been obtained through the use of science and technology.

Monday, January 23, Day #96	Tuesday, January 24, Day #97	Wednesday, January 25, Day #98	Thursday, January 26, Day #99	Friday, January 27, Day #100 End of Quarter 2
State Standard Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **Sub-Skill 1:** The tide data will be supplied by the teacher. Data collected for the Sky Log and Tide Log will be used in activities throughout the unit to identify patterns created by the movement of the Earth, Sun and Moon.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**Interim #3 Math**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **Sub-Skill 1:** Students will be reinforced the idea that we live on a round Earth **Sub-Skill 2:** Round Earth/Flat Earth is designed to solidify this conception for those who already have it and to inculcate it for those students who don't. **Sub-Skill 3:** Enable students to understand why shadow length varies around the world at any particular time due to the angle of the Sun in the sky at a particular time of day. For example, on the first day of Summer, the Sun would be directly overhead at the Tropic

				of Cancer and much lower in the sky in the Southern hemisphere around noon.

Interim Cycle 4
Teacher: PATEL
Subject: SCI
Grade: 8

Focus for Week 1:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 4 Earth in Space**

Sub-Skills:

- The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
- Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
- Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
- The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
- Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
- Great advances in information about Solar System objects have been obtained through the use of science and technology.

Monday, January 30, Day #101	Tuesday, January 31, Day #102	Wednesday, February 1, Day #103	Thursday, February 2, Day #104 ½ Day – one hour block	Friday, February 3, Day #105 ½ Day – one hour block
State Standard Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **Sub-Skill 1:** With all the recent changes in classifying Pluto as a planet, students will be able to understand that our scientific picture of the Universe is both stable and changing. **Sub-Skill 2:** Students should understand that the basis for making these changes are rational, reasoned discussions among different scientists. **Sub-Skill 2:** Students look at the arguments posed by different scientists and recognize that some of arguments are better than others. **Sub-Skill 3:** The debate over keeping Pluto as one of our nine planets (Activity 4) reinforces how scientists have acquired knowledge about our Solar System and how this knowledge can be used to reclassify Solar System objects.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **Sub-Skill 1:** Students will be provided a model to demonstrate the distance and size relationships between our Solar System planets, Earth's Moon, and the Sun. **Sub-Skill 2:** Students recognize how large the Solar System is and how small the Earth is in this system. The enormous distances between the inner and outer planets are effectively shown with this scale model. It is important to find an appropriate place to set up the scale model.

<table>
<tr><td><u>Sub-Skill 4:</u>
Students get a chance to defend their opinions after researching the available information on this topic.</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Focus for Week 2:
Standard 1 Nature & Application of Science & Technology
Standard 4 Earth in Space
Sub-Skills:
The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
Great advances in information about Solar System objects have been obtained through the use of science and technology.</td></tr>
<tr><td>Monday, February 6, Day #106</td><td>Tuesday, February 7, Day #107</td><td>Wednesday, February 8, Day #108</td><td>Thursday, February 9, Day #109</td><td>Friday, February 10, Day #110</td></tr>
<tr><td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology and Society
History and Context of Science
The Earth/Sun/Moon System
The Solar System
Technology and Applications

<u>Sub-Skill 1:</u>
Students write a galactic address, observe their school from a bird's eye view at various elevations and investigate how our solar system relates to the entire universe</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology and Society
History and Context of Science
The Earth/Sun/Moon System
The Solar System
Technology and Applications

<u>Sub-Skill 1:</u>
Students will obtain a clear understanding of the acceleration due to gravity</td></tr>
<tr><td colspan="5">Focus for Week 3:
Standard 1 Nature & Application of Science & Technology
Standard 4 Earth in Space
Sub-Skills:
The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
Great advances in information about Solar System objects have been obtained through the use of science and technology.</td></tr>
<tr><td>Monday, February 13, Day #111</td><td>Tuesday, February 14, Day #112</td><td>Wednesday, February 15, Day #113</td><td>Thursday, February 16, Day #114</td><td>Friday, February 17</td></tr>
<tr><td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology and Society
History and Context of Science
The Earth/Sun/Moon System
The Solar System
Technology and Applications

<u>Sub-Skill 1:</u>
Students will be able to find relationships between tide height and Moon phases.

<u>Sub-Skill 2:</u>
By observing Sunrise/set data</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td>NO SCHOOL (PD DAY FOR TEACHERS)</td></tr>
</table>

<table>
<tr><td>and Moonrise/set data, the strong influence of the Moon's gravity on the water level here on Earth, is explained using this data.

<u>Sub-Skill 3:</u>
The tides, which are related to the changing phases of the Moon, have an important connection to the treatment of horseshoe crabs in the eighth grade ecosystems unit.</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Focus for Week 4:
• Standard 1 Nature & Application of Science & Technology
• Standard 4 Earth in Space

Sub-Skills:
• The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
• Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
• Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
• The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
• Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
• Great advances in information about Solar System objects have been obtained through the use of science and technology.</td></tr>
<tr><td>Monday, February 20</td><td>Tuesday, February 21, Day #115</td><td>Wednesday, February 22, Day #116</td><td>Thursday, February 23, Day #117</td><td>Friday, February 24, Day #118</td></tr>
<tr><td>PRESIDENT'S DAY: NO SCHOOL</td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td><td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology and Society
History and Context of Science
The Earth/Sun/Moon System
The Solar System
Technology and Applications

<u>Sub-Skill 1:</u>
The use of models in this unit allow students to model the positions of the Earth, Sun and Moon to demonstrate why we have day and night on the Earth and Moon.

<u>Sub-Skill 2:</u>
We can also use the models to demonstrate the length of day and night. This concept will be further explored in the Seasons activities that follow.</td></tr>
<tr><td colspan="5">Focus for Week 5:
• Standard 1 Nature & Application of Science & Technology
• Standard 4 Earth in Space

Sub-Skills:
• The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
• Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
• Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
• The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
• Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
• Great advances in information about Solar System objects have been obtained through the use of science and technology.</td></tr>
<tr><td>Monday, February 27, Day #119</td><td>Tuesday, February 28, Day #120</td><td>Wednesday, February 29, Day #121</td><td>Thursday, March 1, Day #122</td><td>Friday, March 2, Day #123</td></tr>
<tr><td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry</td><td><u>State Standard</u></td><td><u>State Standard</u></td><td><u>State Standard</u></td><td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry</td></tr>
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<tr>
<td>Science Technology and Society
History and Context of Science
The Earth/Sun/Moon System
The Solar System
Technology and Applications
<u>Sub-Skill 1:</u>
Students will understand how the rising and setting of the Sun, and its changing path across the sky, make a great deal of difference in the seasons.

<u>Sub-Skill 2:</u>
The models used in these two lessons are class tested models that show how the tilt of the Earth's axis produces warmth in the summertime and cold weather in the wintertime.</td>
<td><u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td>Science Technology and Society
History and Context of Science
The Earth/Sun/Moon System
The Solar System
Technology and Applications
<u>Sub-Skill 1:</u>
The connection between the phases of the Moon, the seasons, and the general makeup of the Solar System is really not that hard to understand, using the right kinds of models of the Solar System.</td>
</tr>
<tr>
<td colspan="5">Focus for Week 6:

Standard 1 Nature & Application of Science & Technology
Standard 4 Earth in Space

Sub-Skills:

The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.Great advances in information about Solar System objects have been obtained through the use of science and technology.
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</tr>
<tr>
<td>Monday, March 5, Day #124</td>
<td>Tuesday, March 6, Day #125</td>
<td>Wednesday, March 7, Day #126</td>
<td>Thursday, March 8, Day #127</td>
<td>Friday, March 9, Day #128</td>
</tr>
<tr>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology and Society
History and Context of Science
The Earth/Sun/Moon System
The Solar System
Technology and Applications

<u>Sub-Skill 1:</u>
Students will develop a clear understand of the solar system based on models and diagrams</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry
Science Technology and Society
History and Context of Science
The Earth/Sun/Moon System
The Solar System
Technology and Applications

<u>Sub-Skill 1:</u>
Students will explore and research scientists and technologies used in the space program. These scientists and space technologies will be posted on a timeline in the classroom to show the progression of knowledge in the field of planetary sciences.</td>
</tr>
<tr>
<td colspan="5">Focus for Week 7:

Standard 1 Nature & Application of Science & Technology
Standard 4 Earth in Space

Sub-Skills:

The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
Great advances in information about Solar System objects have been obtained through the use of science and technology.
</td>
</tr>
<tr>
<td>Monday, March 12, Day #129</td>
<td>Tuesday, March 13, Day #130</td>
<td>Wednesday, March 14, Day #131</td>
<td>Thursday, March 15, Day #132</td>
<td>Friday, March 16</td>
</tr>
<tr>
<td><u>State Standard</u></td>
<td></td>
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<td>NO SCHOOL (PD DAY FOR</td>
</tr>
</table>

Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **<u>Sub-Skill 1:</u>** Students will explore the existence of planets beyond our own solar system. These extra-solar planets were unknown in 1995.	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**TEACHERS)**

Focus for Week 8:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 4 Earth in Space**

Sub-Skills:

- The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
- Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
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- The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
- Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
- Great advances in information about Solar System objects have been obtained through the use of science and technology.

Monday, March 19, Day #133	Tuesday, March 20, Day #134	Wednesday, March 21, Day #135	Thursday, March 22, Day #136	Friday, March 23, Day #137
<u>State Standard</u> Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **<u>Sub-Skill 1:</u>** Students will develop an understanding of the process a spacecraft must speed up to reach, and to escape the gravitational pull of different planets.	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **<u>Sub-Skill 1:</u>** Students will examine the Rectified Globe Developed by Hank Bouchelle to better understand the position of the Sun in at various times of the day or year **<u>Sub-Skill 2:</u>**

Focus for Week 9:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 4 Earth in Space**

Sub-Skills:

- The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
- Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
- Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
- The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
- Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
- Great advances in information about Solar System objects have been obtained through the use of science and technology.

Monday, March 26, Day #138	Tuesday, March 27, Day #139	Wednesday, March 28, Day #140	Thursday, March 29, Day #141	Friday, March 30, Day #142
<u>State Standard</u> Understandings and Abilities of Scientific Inquiry Science Technology and Society	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>**	**<u>State Standard</u>** Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science

History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **<u>Sub-Skill 1:</u>** Students collectively make measurements of variously-sized cylinders and record their data. **<u>Sub-Skill 2:</u>** Students use their data to derive a crude value of pi, and determine the distances and velocities at which planets orbit the Sun.	**<u>Sub-Skill 2:</u>**	**<u>Sub-Skill 2:</u>**	**<u>Sub-Skill 2:</u>**	The Earth/Sun/Moon System The Solar System Technology and Applications **<u>Sub-Skill 1:</u>** Students will develop an understanding of the position of the Sun, Moon and Earth influence what we see in the night sky.

Focus for Week 10:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 4 Earth in Space**

Sub-Skills:

- The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
- Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
- Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
- The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
- Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
- Great advances in information about Solar System objects have been obtained through the use of science and technology.

Monday, April 2, Day #143	Tuesday, April 3, Day #144	Wednesday, April 4, Day #145	Thursday, April 5, Day #146	Friday, April 6
<u>State Standard</u> Understandings and Abilities of Scientific Inquiry Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **<u>Sub-Skill 1:</u>** Focusing on the speed a spacecraft much reach to escape the gravitational pull of different planets. **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**SPRING BREAK: NO SCHOOL**

Focus for Week 11:

- **Standard 1 Nature & Application of Science & Technology**
- **Standard 4 Earth in Space**

Sub-Skills:

- The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
- Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
- Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
- The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
- Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
- Great advances in information about Solar System objects have been obtained through the use of science and technology.

Monday, April 16, Day #147	Tuesday, April 17, Day #148	Wednesday, April 18, Day #149	Thursday, April 19, Day #150	Friday, April 20, Day #151 End of Quarter 3
<u>State Standard</u> Understandings and Abilities of Scientific Inquiry	**<u>State Standard</u>**	**INTERIM #4 MATH**	**<u>State Standard</u>**	**<u>State Standard</u>** Understandings and Abilities of Scientific Inquiry

Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **Sub-Skill 1:** Reinforce how the position of the Sun, Moon and Earth influence what we see in the night sky.	**Sub-Skill 1:** **Sub-Skill 2:**		**Sub-Skill 1:** **Sub-Skill 2:**	Science Technology and Society History and Context of Science The Earth/Sun/Moon System The Solar System Technology and Applications **Sub-Skill 1:** Reinforce how the position of the Sun, Moon and Earth influence what we see in the night sky.

(Post-Interims) Review; DCAS Testing Period
Teacher:
Subject: MATH
Grade: 8

Focus for Week 1:

- Standard 1: The Nature and Application of Science and Technology
- Standard 3: Energy and Its Effects
- Standard 6: Life Processes
- Standard 7: Diversity and Continuity of Living Things
- Standard 8: Ecology

Sub-Skills:

- Observation and evidence
- Reasoning and Explanations
- Investigations
- Control and Conditions
- Change
- Constancy
- Interactions
- Processes
- Systems
- Structure and Function
- Cycles
- Models
- Behavior/regulation
- Habitat
- Adaptation

Monday, April 23, Day #152	Tuesday, April 24, Day #153	Wednesday, April 25, Day #154	Thursday, April 26, Day #155	Friday, April 27, Day #156 ½ Day – one hour block
State Standard Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution Interactions within the	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution Interactions within the

Environment Energy Flow and Material Cycles in the Environment Human Impact **Sub-Skill 1:** Students are asked what Science is. They look at research articles in a group and compile a list of characteristics that make the article scientific.				Environment Energy Flow and Material Cycles in the Environment Human Impact **Sub-Skill 1:** Students look at questions and determine if they can be answered scientifically. **Sub-Skill 2:** Students will develop an understanding of point of reference from various profession by role playing

Focus for Week 2:

- Standard 1: The Nature and Application of Science and Technology
- Standard 3: Energy and Its Effects
- Standard 6: Life Processes
- Standard 7: Diversity and Continuity of Living Things
- Standard 8: Ecology

Sub-Skills:

- Observation and evidence
- Reasoning and Explanations
- Investigations
- Control and Conditions
- Change
- Constancy
- Interactions
- Processes
- Systems
- Structure and Function
- Cycles
- Models
- Behavior/regulation
- Habitat
- Adaptation

Monday, April 30, Day #157	Tuesday, May 1, Day #158	Wednesday, May 2, Day #159	Thursday, May 3, Day #160	Friday, May 4, Day #161
State Standard Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution Interactions within the Environment Energy Flow and Material Cycles in the Environment	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution Interactions within the Environment Energy Flow and Material Cycles in the Environment

Human Impact **Sub-Skill 1:** Students discuss the situation in Delaware with the horseshoe crabs and shorebirds				Human Impact **Sub-Skill 1:** Students will be able to define a population and propose a reasonable technique for estimating the number of organisms in a given population. **Sub-Skill 2:** Students first brainstorm ways to sample the population of the school and then do an activity called Bird beans which provides a way of sampling populations of birds. (beans represent birds)

Focus for Week 3:

- Standard 1: The Nature and Application of Science and Technology
- Standard 3: Energy and Its Effects
- Standard 6: Life Processes
- Standard 7: Diversity and Continuity of Living Things
- Standard 8: Ecology

Sub-Skills:

- Observation and evidence
- Reasoning and Explanations
- Investigations
- Control and Conditions
- Change
- Constancy
- Interactions
- Processes
- Systems
- Structure and Function
- Cycles
- Models
- Behavior/regulation
- Habitat
- Adaptation

Monday, May 7, Day #162	Tuesday, May 8, Day #163	Wednesday, May 9, Day #164	Thursday, May 10, Day #165	Friday, May 11, Day #166
State Standard Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution Interactions within the	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution Interactions within the

Environment Energy Flow and Material Cycles in the Environment Human Impact **Sub-Skill 1:** Students will be introduced to population sampling techniques used by biologists in the field and also to the biodiversity present in the schoolyard. **Sub-Skill 2:** Students take a 10 cm x 10 cm sample in the schoolyard and count and identify the all living organisms (plants and animals) found in this sample. Data is then recorded as a group. Students do plot studies in the schoolyard.				Environment Energy Flow and Material Cycles in the Environment Human Impact **Sub-Skill 1:** Students study the abiotic factors in the environment using a reading and soil samples while collecting data on soil pH, soil texture, soil temperature, air temperature, amount of moisture and amount of sunlight for that particular area studied.

Focus for Week 4:

- Standard 1: The Nature and Application of Science and Technology
- Standard 3: Energy and Its Effects
- Standard 6: Life Processes
- Standard 7: Diversity and Continuity of Living Things
- Standard 8: Ecology

Sub-Skills:

- Observation and evidence
- Reasoning and Explanations
- Investigations
- Control and Conditions
- Change
- Constancy
- Interactions
- Processes
- Systems
- Structure and Function
- Cycles
- Models
- Behavior/regulation
- Habitat
- Adaptation

Monday, May 14, Day #167	Tuesday, May 15, Day #168	Wednesday, May 16, Day #169	Thursday, May 17, Day #170	Friday, May 18, Day #171
State Standard Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution

<table>
<tr>
<td>Interactions within the Environment

Energy Flow and Material Cycles in the Environment

Human Impact

<u>Sub-Skill 1:</u>
Students will recognize the components of suitable habitat and the effect of limiting factors on a species.</td>
<td></td>
<td></td>
<td></td>
<td>Interactions within the Environment

Energy Flow and Material Cycles in the Environment

Human Impact

<u>Sub-Skill 1:</u>
Students learn how factors (space, food, water, disease) limit the number of organisms an ecosystem can support.</td>
</tr>
<tr>
<td colspan="5">Focus for Week 5:
• Standard 1: The Nature and Application of Science and Technology
• Standard 3: Energy and Its Effects
• Standard 6: Life Processes
• Standard 7: Diversity and Continuity of Living Things
• Standard 8: Ecology

Sub-Skills:
• Observation and evidence
• Reasoning and Explanations
• Investigations
• Control and Conditions
• Change
• Constancy
• Interactions
• Processes
• Systems
• Structure and Function
• Cycles
• Models
• Behavior/regulation
• Habitat
• Adaptation</td>
</tr>
<tr>
<td>Monday, May 21, Day #172</td>
<td>Tuesday, May 22, Day #173</td>
<td>Wednesday, May 23, Day #174</td>
<td>Thursday, May 24, Day #175</td>
<td>Friday, May 25, Day #176
½ Day – one hour block</td>
</tr>
<tr>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Matter and Energy Transformations

Reproduction, Heredity, and Development

Diversity and Evolution

Interactions within the Environment

Energy Flow and Material Cycles in the Environment

Human Impact</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Matter and Energy Transformations

Reproduction, Heredity, and Development

Diversity and Evolution

Interactions within the Environment

Energy Flow and Material Cycles in the Environment

Human Impact</td>
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<tr>
<td><u>Sub-Skill 1:</u>
Students will use their understanding of the interaction of abiotic and biotic factors to show how an accumulation of adaptations to a changing environment can allow a species to survive.</td>
<td></td>
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<td><u>Sub-Skill 1:</u>
Students will learn how the structure of a bird’s beak is directly related to function. Each type of bird has a special beak adapted to eating specific food items.

<u>Sub-Skill 2:</u>
Students will demonstrate the advantages and disadvantages of obtaining food using varying beak structures.</td>
</tr>
<tr>
<td colspan="5">Focus for Week 6:
• Standard 1: The Nature and Application of Science and Technology
• Standard 3: Energy and Its Effects
• Standard 6: Life Processes
• Standard 7: Diversity and Continuity of Living Things
• Standard 8: Ecology

Sub-Skills:
• Observation and evidence
• Reasoning and Explanations
• Investigations
• Control and Conditions
• Change
• Constancy
• Interactions
• Processes
• Systems
• Structure and Function
• Cycles
• Models
• Behavior/regulation
• Habitat
• Adaptation</td>
</tr>
<tr>
<td>Monday, May 28</td>
<td>Tuesday, May 29, Day #177</td>
<td>Wednesday, May 30, Day #178</td>
<td>Thursday, May 31, Day #179</td>
<td>Friday, June 1, Day #180</td>
</tr>
<tr>
<td>MEMORIAL DAY: NO SCHOOL</td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>

<u>Sub-Skill 1:</u>

<u>Sub-Skill 2:</u></td>
<td><u>State Standard</u>
Understandings and Abilities of Scientific Inquiry

Science, Technology, and Society

The Forms and Sources of Energy

Forces and the Transfer of Energy

Matter and Energy Transformations

Reproduction, Heredity, and Development

Diversity and Evolution

Interactions within the Environment

Energy Flow and Material Cycles in the Environment

Human Impact</td>
</tr>
</table>

				Sub-Skill 1: Examine conservation issues confronting the Galapagos islands.

Focus for Week 7:

- Standard 1: The Nature and Application of Science and Technology
- Standard 3: Energy and Its Effects
- Standard 6: Life Processes
- Standard 7: Diversity and Continuity of Living Things
- Standard 8: Ecology

Sub-Skills:

- Observation and evidence
- Reasoning and Explanations
- Investigations
- Control and Conditions
- Change
- Constancy
- Interactions
- Processes
- Systems
- Structure and Function
- Cycles
- Models
- Behavior/regulation
- Habitat
- Adaptation

Monday, June 4, Day #181	Tuesday, June 5, Day #182	Wednesday, June 6, Day #183	Thursday, June 7, Day #184	Friday, June 8, Day #185
State Standard Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution Interactions within the Environment Energy Flow and Material Cycles in the Environment Human Impact **Sub-Skill 1:** Students will use observation and creative skills to learn about animal's adaptability as they study the animal's anatomical structures.	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** **Sub-Skill 1:** **Sub-Skill 2:**	**State Standard** Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution Interactions within the Environment Energy Flow and Material Cycles in the Environment Human Impact **Sub-Skill 1:** on symbiotic relationships between organisms including parasitism, commensalism and mutualism.

Focus for Week 8:

- Standard 1: The Nature and Application of Science and Technology
- Standard 3: Energy and Its Effects
- Standard 6: Life Processes
- Standard 7: Diversity and Continuity of Living Things
- Standard 8: Ecology

Sub-Skills:

- Observation and evidence
- Reasoning and Explanations
- Investigations
- Control and Conditions
- Change
- Constancy
- Interactions
- Processes
- Systems
- Structure and Function
- Cycles
- Models
- Behavior/regulation
- Habitat
- Adaptation

Monday, June 11, Day #186	Tuesday, June 12, Day #187	Wednesday, June 13, Day #188 ½ Day - Finals	Thursday, June 14, Day #189 ½ Day – Finals	Friday, June 15, Day #190 ½ Day - Finals
<u>State Standard</u> Understandings and Abilities of Scientific Inquiry Science, Technology, and Society The Forms and Sources of Energy Forces and the Transfer of Energy Matter and Energy Transformations Reproduction, Heredity, and Development Diversity and Evolution Interactions within the Environment Energy Flow and Material Cycles in the Environment Human Impact **<u>Sub-Skill 1:</u>** Reinforce classification and organism identification skills. Students will use a dichotomous key to identify migratory shorebirds that use the Delaware Bay.	**<u>State Standard</u>** **<u>Sub-Skill 1:</u>** **<u>Sub-Skill 2:</u>**	**MATH FINALS**	**ELA FINALS**	**SCIENCE/SS FINALS**

Unit Title: Planetary Science **Grade Level(s): 8th**

Subject/Topic Areas: Planetary Science

Key Vocabulary: Planets, Satellites, Direct Rays, Indirect Rays, Eclipse, Gravity, Waxing, Waning, Gibbous, Crescent, Elliptical

Designed By: V. Patel **Time Frame: 23 Class Meetings**

Date: 09/30/2011

SUMMARY OF PURPOSE:
The Planetary Systems unit focuses on observable, predictable patterns of movement in the Sun, Earth, Moon system including Moon phases, Sunrise and Sunset, rotation and revolution, seasons and day/night. The influence of gravity and energy from the Sun on the planets and other solar system objects is also addressed throughout the unit. Technology is used in this unit to research information about the Solar System and technology, such as satellites, used to study the planets, moons, asteroids and Sun. The Planetary Systems unit is typically taught after the Transformation of Energy unit and before the Ecosystems unit in eighth grade. Students collect data on Moon phases, Sunrise and Sunset and tides and use this data to observe visible patterns caused by the motion of the Sun, Moon and Earth. Modeling, analyzing data and researching data from the internet are some methods used to effectively teach this unit.

Stage 1: Desired Results

Common Core/ Delaware Standards

This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1 and 4 found on the following web site:
http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard 1: The Nature and Application of Science and Technology
Understandings and Abilities of Scientific Inquiry
Students should know and be able to:

1. Understand that: Scientific investigations involve asking testable questions. Different kinds of questions suggest different scientific investigations. The current body of scientific knowledge guides the investigation.
   - Be able to: Frame and refine questions that can be investigated scientifically, and generate testable hypotheses.
2. Understand that: A valid investigation controls variables. Different experimental designs and strategies can be developed to answer the same question.
   - Be able to: Design and conduct investigations with controlled variables to test hypotheses.

3. Understand that: In a scientific investigation, data collection involves making precise measurements and keeping accurate records so that others can replicate the experiment.
    - Be able to: Accurately collect data through the selection and use of tools and techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students.

4. Understand that: There is much experimental and observational evidence that supports a large body of knowledge. The scientific community supports known information until new experimental evidence arises that does not match existing explanations. This leads to the evolution of the scientific body of knowledge.
    - Be able to: Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.

5. Understand that: Evaluating the explanations proposed by others involves examining and comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Conflicting data or conflicting interpretations of the same data suggest the need for further investigation. Continued investigation can lead to greater understanding and resolution of the conflict.
    - Be able to: Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.

6. Understand that: Scientific habits of mind and other sources of knowledge and skills are essential to scientific inquiry. Habits of mind include tolerance of ambiguity, skepticism, openness to new ideas, and objectivity. Other knowledge and skills include mathematics, reading, writing, and technology.
    - Be able to: Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Science, Technology, and Society
Students should know that:

1. Advances in technology can expand the body of scientific knowledge. Technological tools allow people to observe objects and phenomena that otherwise would not be possible. Technology enhances the quality, accuracy, speed and analysis of data gathered.
3. Science and technology in society are driven by the following factors: economical, political, cultural, social, and environmental. Increased scientific knowledge and technology create changes that can be beneficial or detrimental to individuals or society through impact on human health and the environment.

Students should be able to:

- Analyze data on sunrise and sunset times (in terms of length of daylight) and describe patterns. Explain the reason for the patterns by using models or computer simulations of the Earth and Sun.
    - Using internet, newspaper, and actual observations of the night sky for at least two months, collect data on the Moon's appearance, and moonrise and moonset times. Analyze the data to describe the observable patterns (phases). Explain why the Moon's appearance changes in a repeating cyclical pattern.
    - Use a variety of resources (e.g., NASA photographs, computer simulations) to compare and contrast the physical properties (i.e., temperature, size, composition, surface features) of planets.
    - Recognize that spin offs are products which have undergone a technology transfer process from research to public use. Research spin-offs from the space program that have affected our everyday lives (i.e., Velcro, smoke detectors, cordless tools).

History and Context of Science
Students should know that:

1. Over the course of human history, contributions to science have been made by different people from different cultures. Studying some of these contributions and how they came about provides insight into the expansion of scientific knowledge.

Students should be able to:

- Describe how scientists have historically confirmed that the Earth is round, not flat.
- Describe how scientists have acquired knowledge about components of our Solar System. Recognize the importance of people and technologies that have led to our current understanding of space.

Standard 4 : Earth in Space
The Earth/Sun/Moon System
Students should know that:

1. The Sun is a star that gives off radiant energy that drives Earth systems and is essential for life. The amount of radiant energy Earth receives from the Sun throughout the year is nearly constant.

Students should be able to:

- Analyze data on sunrise and sunset times (in terms of length of daylight) and describe patterns. Explain the reason for the patterns by using models or computer simulations of the Earth and Sun.

Students should know that:

2. The tilt of Earth's axis of rotation as it orbits the Sun points in the same direction with respect to the stars. The tilt and the orbital motion of Earth around the Sun cause variation in the amount of solar radiation striking a location on the Earth's surface which results in variation in the length of day/night and seasons.

Students should be able to:

- Analyze data on sunrise and sunset times (in terms of length of daylight) and describe patterns. Explain the reason for the patterns by using models or computer simulations of the Earth and Sun.

Students should know that:

3. Moon phases occur because the relative positions of Earth, Moon, and Sun change, thereby enabling us to see different amounts of the Moon's surface.

Students should be able to:

- Using internet, newspaper, and actual observations of the night sky for at least two months, collect data on the Moon's appearance, and moonrise and moonset times. Analyze the data to describe the observable patterns (phases). Explain why the Moon's appearance changes in a repeating cyclical pattern.

Students should know that:

4. The Moon is a natural satellite of Earth and is different than the Earth in size, atmosphere, gravity, and surface features.

Students should be able to:

- Using internet, newspaper, and actual observations of the night sky for at least two months, collect data on the Moon's appearance, and moonrise and moonset times. Analyze the data to describe the observable patterns (phases). Explain why the Moon's appearance changes in a repeating cyclical pattern.

Students should know that:

5. Tides are caused by the gravitational interactions of the Sun, Moon and Earth

Students should be able to:

- Use models to describe how the relative positions of the Sun, Moon, and Earth account for Moon phases, eclipses, and tides.

Students should know that:

6. The Moon has a greater impact on tides because of its proximity to Earth

Students should be able to:

- Describe how the relative positions of the Earth, Moon and Sun can cause high and low tides, and unusually high or low tides.

The Solar System

Students should know that:

1. The Sun is by far the most massive object in the Solar System, therefore gravitationally dominating all other members of the Solar System.

Students should be able to:

- Demonstrate an understanding of the motion of the bodies in our Solar System. Use models, charts, illustrations, and other suitable representations to predict and describe regular patterns of motion for most objects in the Solar System.
- Explain how the Sun is the central and largest body in our Solar System and the source of the light energy that hits our planet. Use models to explain how variations in the amount of Sun's energy hitting the Earth's surface results in seasons.
- Recognize that the force of gravity keeps planets in orbit around the sun and

influences objects on Earth and other planets (i.e., tides, ability of humans to move and function). Differentiate between an object's mass and weight.

Students should know that:

2. The Solar System consists of comets, asteroids, planets, and their respective satellites, most of which orbit the Sun on a plane called the ecliptic. The planets in our Solar System revolve in the same direction around the Sun in elliptical orbits that are very close to being in the same plane. Most planets rotate in the same direction with respect to the Sun.

Students should be able to:

- Demonstrate an understanding of the components of our Solar System and their characteristics, including the Moon, the Sun, the planets and their moons, extra-solar planets, and smaller objects such as asteroids and comets. Construct scale models of the Solar System in order to describe the relative sizes of planets and their distances from the Sun.

Students should know that:

3. Planets can be categorized as inner or outer planets according to density, diameter and surface features.

Students should be able to:

- Use a variety of resources (e.g., NASA photographs, computer simulations) to compare and contrast the physical properties (i.e., temperature, size, composition, surface features) of planets.

Students should know that:

4. Planets and their moons have been shaped over time by common processes such as cratering, volcanism, erosion, and tectonics. The presence of life on a planet can contribute to its unique development.

Students should be able to:

- Use a variety of resources (e.g., NASA photographs, computer simulations) to compare and contrast the physical properties (i.e., temperature, size, composition, surface features) of planets.

Technology and Application

Students should know that:

1. Technology, including humans landing on the Moon, robot Landers and other space probes, satellites, and radio telescopes, allow scientists to investigate conditions on Earth and on other objects in the Solar System.

Students should be able to:

- Describe how scientists have historically confirmed that the Earth is round, not flat.
- Describe how scientists have acquired knowledge about components of our Solar System. Recognize the importance of people and technologies that have led to our current understanding of space.

Students should know that:

2. The technology used in space exploration expands our knowledge of the Universe and has many spin-offs related to everyday applications.

Students should be able to:

- Recognize that spin-offs are products which have undergone a technology transfer process from research to public use. Research and report on spin-offs from the space program that have affected our everyday lives (i.e., Velcro, smoke detectors, cordless tools).

Key Concepts/Big Ideas

- The use of modeling to demonstrate Earth, Sun and Moon movements creating Moon phases, Day/night, seasons and the amount of concentrated energy in particular locations around the Earth.
- Students observe patterns in Moon phases, Sunrise and Sunset and tides with the use of daily data collection of this information from the internet.
- Students observe the cycle of Moon phases and Sunrise and Sunset throughout the unit and record this information in journals.
- The use of scientific investigations allows students to explain the causes of seasons on Earth and influence of gravity on weight and jump height on different planets.
- Interactions between the Sun, Moon and Earth are observed through phenomena such as tides, seasons, Moon phases, day/night and eclipses.
- Great advances in information about Solar System objects have been obtained through the use of science and technology.

Enduring Understandings

Students will understand that…

Enduring Understanding: Observable, predictable patterns of movement in the Sun, Earth, and Moon system occur because of gravitational interaction and energy from the Sun.

Enduring Understanding: Most objects in the Solar System orbit the Sun and have distinctive physical characteristics and orderly motion

Enduring Understanding: Technology expands our knowledge of the Solar System

Essential Questions

- What predictable, observable patterns occur as a result of the interaction between the Earth, Moon, and Sun? What causes these patterns?

- How does Earth's physical characteristics and motion compare to other bodies in the Solar System?

- How has technology expanded our knowledge of the Solar System?

Real World Context

-

Learning Targets/Goals

Students will know…

- Regular patterns are observed in Sunrise and Sunset

- The length of day increases daily from winter to summer and decreases daily from summer to winter
- There is evidence that supports the Earth is round
- The Solar system consists of comets, asteroids, planets, and their respective satellites, most of which orbit the Sun on a plane called the Ecliptic
- Planets can be categorized as inner or outer planets according to density, diameter, and surface features.
- Technology used in space exploration expands our knowledge of the Solar System and Universe.
- Understand there is much experimental and observational evidence that supports a large body of knowledge that is used to form explanations based on accurate and logical analysis of evidence.
- Understand that evaluating the explanations proposed by other involves examining and comparing evidence.
- Modeling is an effective tool to represent real objects in space.
- A person's specific location can be described in many ways, depending on the frame of reference.
- The attractive force of gravity is always present, but only noticeable when large objects such as planets are involved, and acts without contact between the objects.
- The force of gravity between two objects depends upon their masses and the distance between them
- Since each planet in our solar system has a different mass, each has its own unique gravitational force on other objects.
- The Sun is the gravitationally dominant object in our solar system.
- Gravity has an influence on observable phenomena such as tides, planetary orbits and our own ability to move and function on Earth.
- Tides are caused by gravitational interactions of the Sun, Moon and Earth.
- There is a correlation between the phase of the Moon and height of the tide.

- The daily rotation and yearly revolution of the Sun, Earth and Moon cause regular patterns (day/night, seasons, phases, eclipses etc.)

- Day and night is the product of the spinning Earth.

- The Earth rotates from west to east.

- The varying tilted positions of Earth create areas which receive more concentrated and prolonged Sunlight in their summer months.

- The angle of insolation determines the amount of concentrated radiant energy an area receives from the Sun. By decreasing the angle of insolation, there is a corresponding decrease in the amount of energy in a given area.

- The Moon is a satellite of the Earth and experiences phases which are caused by the changing relative positions of the Moon, Earth, and Sun.

- The Moon is different from the Earth in size, atmosphere, gravity and surface features.

- There are many people and technologies that have led to our current understandings of space.

- Spin-offs from space have provided many benefits to us on Earth.

Students will be able to… (21st century skills)

- Describe how scientists have historically confirmed that the Earth is round, not flat.

- Analyze data on sunrise and sunset times (in terms of length of daylight) and describe patterns. Explain the reason for the patterns by using models or computer simulations of the Earth and Sun.

- Using internet, newspaper, and actual observations of the night sky for at least two months, collect data on the Moon's appearance, and moonrise and moonset times. Analyze the data to describe the observable patterns (phases). Explain why the Moon's appearance changes in a repeating cyclical pattern.

- Use models to describe how the relative positions of the Sun, Moon, and Earth account for Moon phases, eclipses, and tides.

- Describe how the relative positions of the Earth, Moon and Sun can cause high and low tides, and unusually high or low tides

- Demonstrate an understanding of the components of our Solar System and their characteristics, including the Moon, the Sun, the planets and their moons, extra-solar planets, and smaller objects such as asteroids and comets.

- Construct scale models of the Solar System in order to describe the relative sizes of planets and their distances from the Sun.

- Use a variety of resources (e.g., NASA photographs, computer simulations) to compare and contrast the physical properties (i.e., temperature, size, composition, surface features) of planets.

- Demonstrate an understanding of the motion of the bodies in our Solar System. Use models, charts, illustrations, and other suitable representations to predict and describe regular patterns of motion for most objects in the Solar System.

- Explain how the Sun is the central and largest body in our Solar System and the source of the light energy that hits our planet. Use models to explain how variations in the amount of Sun's energy hitting the Earth's surface results in seasons.

- Recognize that the force of gravity keeps planets in orbit around the sun and influences objects on Earth and other planets (i.e., tides, ability of humans to move and function). Differentiate between an object's mass and weight

- Describe how scientists have acquired knowledge about components of our Solar System. Recognize the importance of people and technologies that have led to our current understanding of space.

- Recognize that spin-offs are products which have undergone a technology transfer process from research to public use.

- Research and report on spin-offs from the space program that have affected our everyday lives (i.e., Velcro, smoke detectors, cordless tools).

Stage 2: Evidence of Student Achievement
Transfer Task
Performance Task **Suggested Performance Task(s)** **The Planetary Systems unit has a summative assessment consisting of 9 questions covering the following items….** • **The motion of the Earth, Moon, and sun in Space (day/night, seasons, phases)** • **The effects of gravitational influences on phenomena such as tides and planet orbits.** • **Relative positions, movement and the use of Models to demonstrate the relationships of planetary systems.** • **New technologies and how they have added to our knowledge of space such as space probes, satellites** **http://www.doe.k12.de.us/programs/sci_assess/default.shtml for summative assessment**
Rubrics for Transfer Tasks
http://www.doe.k12.de.us/programs/sci_assess/default.shtml for rubrics for summative assessment
Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations) All copies can be found in Appendix A.

Summative Assessments:
Comprehnsive exams
Aligned to standards

The Sky Log and sky log questions will be collected at the end of each 4 weeks and a grade will be given for completion of the data and analysis of the data.

Students may be given the *Applying what you Learned* as a graded activity for the activities in the unit. Some may require more time and effort than others to complete.

Data tables, graphs and analysis of data will be graded for Activity 7: Gravity.

Activity 10: Students will conduct an investigation, collect and analyze data on Seasons as an assessment.

Activity 11: Students complete the Light Concentration and Seasons activity and use both graphing and modeling using clay to demonstrate the energy concentration in different locations on Earth.

Quizzes and or formative assessments will be given after major topics such as Seasons, Moon phases and eclipses, tides and day/night.
A project will be completed for Activity 14 including researching a scientist, technology used in the space program and spin off from space. Students will complete both and written and oral presentation of this material for a grade. A page with information and a picture will be placed on a time line generated around the room showing what time period the scientist and technology occurred. The spin offs will be briefly described by the students and presented orally.

Short formative assessments will be given throughout the unit testing important concepts and information critical to the understanding of the unit. These short assessments may be in the form of start ups, warm ups, journal questions or another form that suits the classroom teacher's needs.

Student Self-Assessment and Reflection

Pairs Communication Activity

Students keep a daily journal recording Moonrise and Moonset, Moon phase, Sunrise and Sunset, and tide data. The journal will also be used to record data from lab activities, take notes and draw and label positions of the Sun, Moon and Earth during various seasons, Moon phases and eclipses.

A pre test will be given prior to beginning the unit. This will be a test with four questions including the following:

1. What causes Moon phases? Use a drawing to help explain your response.
1. What causes the Seasons? Use a drawing to help explain your response.
2. What causes day and night?
3. What are the effects of gravity in our Solar system?

Students will be given a post test. This is from
http://www.doe.k12.de.us/programs/sci_assess/default.shtml

Instructional Resources

Resource: Delaware Department of Education Planetary Systems: A Unit for Eighth Grade (2007)
The Regents of the University of California. *FOSS Planetary Science.*

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This activity reinforces the idea that we live on a round Earth. Research shows that by the time that kids reach the 8th grade, in a whole variety of cultures; kids have a reasonably correct view of what the Earth is like. Round Earth/Flat Earth is designed to solidify this conception for those who already have it and to inculcate it for those students who don't.

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The tides, which are related to the changing phases of the Moon, have an important connection to the treatment of horseshoe crabs in the eighth grade ecosystems unit. You may recall that the whole reproductive cycle of horseshoe crabs is driven by the tides. The crabs come up to the beaches in southern Delaware on the strong tides, technically the spring tides, in May and June; thus, there are only a few days during the year when the crabs come on to the beach. An understanding of the life cycle of the crabs really requires an understanding of how the gravitational forces of the Moon and Sun work together in order to produce these spring, or strong tides.

Activity 9: Day and Night
The use of models in this unit allow students to model the positions of the Earth, Sun and Moon to demonstrate why we have day and night on the Earth and Moon. We can also use the models to demonstrate the length of day and night. This concept will be further explored in the Seasons activities that follow.

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The above two activities demonstrate how the rising and setting of the Sun, and its

changing path across the sky, make a great deal of difference in the seasons. This changing solar behavior, in latitudes similar to Delaware's, controls the temperatures in different seasons. The models used in these two lessons are class tested models that show how the tilt of the Earth's axis produces warmth in the summertime and cold weather in the wintertime.

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OPTIONAL ACTIVITIES:
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The importance of the Sun and how the size of the Earth and Sun compare are emphasized in this activity.

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This activity explores the existence of planets beyond our own solar system. These extra-solar planets were unknown in 1995. Now, there are over 150 extra solar planets. It is very likely that during the years this book is in use, the number of known extra solar planets will increase significantly. Astronomers are just beginning to think seriously about what these discoveries all mean in terms of our understanding of our own Solar System.

Activity 18: Escape Velocity
This is a short activity focusing on the speed a spacecraft much reach to escape the gravitational pull of different planets.

Activity 19: Rectified Globe
Developed by Hank Bouchelle, this is a supplemental activity that may be used at various times throughout the year during the Planetary Systems unit or other 8th grade units when discussing the position of the Sun in the sky at various times of the day or year.

Activity 20: From Cylinders to Planet Velocities
Students collectively make measurements of variously-sized cylinders and record their data. This data provides an opportunity for a discussion of the process of gathering information scientifically and the reasons why scientists do science as they do. Once these questions are resolved, the students use their data to derive a crude value of pi, and determine the distances and velocities at which planets orbit the Sun.

Activity 21: The Zodiac
This activity further reinforces how the position of the Sun, Moon and Earth influence what we see in the night sky.

Planetary Science Suggested Sequence and Pacing Guide

Planetary Systems Activity Number	Suggested Class Time
Activity 1: K-5 Standard Review	**1 class period** Introduction (10 minutes) Group discussions (20 minutes) Class Overview of Activity (15 minutes) Investigating Further (5 minutes)
Activity 2: Sky Log Data	The Sky log will be introduced prior to the start of the unit and data will be collected for at least one month. The actual analysis of the Sky Log Data (Activity 2) will take place after one month of data is collected. Activity 2: Introduction (10 minutes) Investigation (20 minutes) Class discussion (15 minutes) Investigating Further (15 minutes)
Activity 3: Round Earth/Flat Earth	**2 class periods** Part 1:Introduction (15 minutes) Investigation (15 minutes) Discussion and CD Rom (15 minutes) Investigating Further (5 minutes) Part 2: Shadows Introduction and set up of lab with

	students (building shadow poles and latitude and longitude review) 15minutes Activity data collection (10 minutes) Review and discussion (10 minutes) Applying what you know (15 minutes)
Activity 4: Is Pluto a Planet?	**2 periods** Introduction (10 minutes) Read script (5 minutes) Group investigation of reports (20 minutes) Discussion and write brief report (15 minutes) Day 2 Continue final writing and share report with class. (35 minutes) Investigating Further and final discussion (15 minutes)
Activity 5: Scale Models of the Solar System	**1 period plus** 15 minutes the next day Introduction (10 minutes) Conduct Activity outdoors (30 minutes) Return to class and discuss (5 minutes) Homework: Applying what you learned Day 2: Review Applying what you learned and Investigating further (15-20 minutes)
Activity 6: Where Am I?	**2 periods** Part 1: Mapping the School (30 minutes) Part 2: Neighborhood and Community Look at Teraserver for your area and Bret Hart neighborhood (20 minutes) Day 2: Part 2: Galactic address: 10 minutes Power of Ten video (10 minutes) Discussion of Activity 6 including Applying What you Learned and Investigating Further: 30 minutes
Activity 7: Gravity The Invisible Force	**4 class periods** **Day 1**: Video: Gravity: The Invisible Force Before Viewing Preview (5 minutes) View Video (25 minutes) After video viewing (5 minutes) Discussion Questions (15 minutes) **Day 2**: Finish review of Discussion questions from video (15 minutes) How much you Weigh at Different Locations

	Introduction (5 minutes) How much you Weigh activity (20 minutes) includes discussion Summarize Results (10 minutes) **Day 3**: How Does the Mass of a Planet Affect Jump Height? Introduction (10 minutes) Conduct activity and collect data (10 minutes) Complete data table 2 and follow up activities (30 minutes) **Day 4:** Introduce Part D and complete demonstration (15 minutes) Part E: Analyze data and complete Discussion questions (15 minutes) Investigating Further and Applying what You Learned (20 minutes)
Activity 8: Tides	Prior to completing this activity, tide data needs to be collected for at least two weeks. This can be done the same time as the sky log. **2 class periods** **Day 1**: Introduction to tides (15 minutes) Analyzing Sky Log and Tide data (30 minutes) Investigating Further (5 minutes) **Day 2**: Applying What You Learned (50 minutes)
Activity 9: Day and Night	**2 periods** Day 1: Introduce Day and Night with modeling (20 minutes) Answer Day/Night Think Questions (30 minutes) Day 2: Day and Night with Globes Review Day/Night modeling (25 minutes) Investigating Further (20 minutes) This is optional on Time Zones
Activity 10: Shadows and Seasons	**1 period** Introduce Activity: (10 minutes) Activity and Questions (40 minutes)
Activity 11: Light Concentration and the Seasons	**2 periods** **Day 1**: Review angle of insolation (10 minutes) Complete flashlight part of activity and draw areas illuminated at 3 angles (20 minutes) Count squares and calculate percentage of concentration (20 minutes) **Day 2**: Clay portion of lab (20 minutes) Investigation Reflection and Applying What You Learned (30 minutes)

Activity 12: The Moon and Moon Phases	**5 class periods** **Part A**: Background on Moon and review questions (50 minutes) **Part B**: Modeling the Moon and Earth Introduction (10 minutes) Activity (30 minutes) Summary of Activity (10 minutes) **Part C**:A Month of Phases Introduction (10 minutes) Activity (30 minutes) Review (10 minutes) **Part D**: Moon Clock Introduction (5 minutes) Construction of Moon Clock (10 minutes) Use of Moon Clock and questions (25 minutes) Summary of Activity (10 minutes) **Day 5**: Investigating Further and Applying What you Learned (40 minutes) Final review (10 minutes)
Activity 13: Our Solar System	**Day 1:Part 1**: Brainstorming (15 minutes) **Part 2**: Begin Powerpoint on planets (35 minutes) **Day 2**: Finish powerpoint on planets (50 minutes) **Day 3**: Investigating Further (15 minutes) Applying What You Learned (35 minutes)
Activity 14: Timeline	**5 class periods** **Day 1:Part A**: Introduction (10 minutes) Hand out one technology and one person and have students review information needed to cover activity (15 minutes) Begin Research (25 minutes) **Day 2:Part B**: Research in Library or classroom if you have available computers (50 minutes) **Day 3:Part C**: 1 period: Presentations by students and timeline (50 minutes) **Day 4:** (Part C) Finish presentations and place events on timeline in classroom (50 minutes) **Day 5**: Investigating Further Spinoffs (35 minutes) Applying What you Learned (15 minutes)
Optional Activities:	
Activity 15/16: Why Do We Need the Sun	**1 class period** Brainstorm Why We Need the Sun (15 minutes) How Far to the Sun (35 minutes)
Activity 17: Classifying	**1 class period**

Planets Beyond the Sun	Introduction: (15 minutes) Activity (30 minutes) Summary (5 minutes)
Activity 18: Escape Velocity	**1 class period** Introduction: (15 minutes) Activity (35 minutes)
Activity 19: Rectified Globe	**1 class period** Introduction (15 minutes) Activity (35 minutes)
Activity 20: Cylinder Activity	**2 class periods** Part A: Introduction (15 minutes) Finding the Circumference (25 minutes) Investigation Reflection: (10 minutes) Part B: Circumference of Planets, Sun and Moon Introduction (10 minutes) Activity : (20 minutes) Investigating Further and Applying What You Learned (20 minutes)
Activity 21: The Zodiac	**1 class period** Introduction (15 minutes) Activity (35 minutes)

Note to teachers: The above suggested time allowances for the lessons may vary due to many circumstances in science classrooms. The required activities may be taught in less than 6 weeks, which allows time for the additional enriching activities. (Activities 15-21)

Differentiation

The use of modeling throughout this unit provides reinforcement of difficult concepts for students with learning disabilities.

The FOSS kit CD ROM has many simulations for seasons, Moon phases, Sunrise and Sunset, round and flat Earth, Space missions, planet facts and images that can be used to reinforce concepts in the Planetary Science unit.

In the Making sense of _______________section in the activities, the reading material may be broken into smaller pieces and discussed with students, highlight the most important concepts in class as a group or rewrite in a much lower reading level for students with significant reading disabilities.

The math involved in activities 7, 8, 12, 18 and 20 may be simplified to help students with low math ability.

Extended time to finish activities.

KWL before new concepts taught in the unit

Review previous day's lesson and continuously reinforce concepts from the unit.

Students may use graphic organizers, maps and diagrams to effectively facilitate differing levels of cognitive processing for students of different ability levels.

Permit the apt student to accelerate their rate of progress and work independently on some content.

Enrichment

- **What text/print/media/kit/web resources best support this unit?**
- ***The revised Planetary Systems notebook is provided with the kit training for the Planetary Systems Revised unit.***
- ***Teachers receive the FOSS Planetary Systems notebook during kit training to use in the appropriate lessons during the unit.***
- ***It is also suggested that teachers use free NASA materials available through NASA sites such as Goddard Space Center***

Web sites

Where Am I lesson web sites:

http://earth.google.com This web site combines satellite images, maps and a Google search to find locations around the world. You can type in an address and zoom in to see schools, parks etc. at different elevations.

http://www.terraserver-usa.com/ This web site allows users to type an address in and get aerial views of these locations from different elevations.

General Astronomy web sites and Planet sites:

http://www.nasa.gov Nasa.gov is an outstanding web site that provides updated information for students, educators and more, covering a wide variety of astronomy topics.

http://www.space.com This web site focuses attention on present, future and past space missions. It also provides information on the night skies, planets visible, moon phases, top stories in science and much more!

http://www.earthsky.org **This web site is developed from interviews with scientists and tries to build a bridge between scientists and you. The site also provides a view of the recent night skies, science topics and weather and climate.**

http://www.science.gov **This web site covers a wide variety of science topics including Astronomy and Space, Agriculture, Energy, Health and Medicine, Biology, Earth Sciences and much more.**

http://www.nineplanets.org/ **Information about each planet and moon in our solar system is focused on this web site with outstanding pictures.**

http://edtech.kennesaw.edu/web/solar.html **This web site has information on planets, space exploration, additional web sites, lesson plans and much more for Astronomy.**

http://www.crystalinks.com/einstein.html **This is a wonderful web site to investigate scientists, space missions and technology .**

http://www.windows.ucar.edu/tour/link=/headline **This website can be used to investigate the planets, Sun, space missions, space weather, space geology, history and people and much more.**

Two websites to research tides:

http://tidesandcurrents.noaa.gov/

www.saltwatertides.com

Web site for Sunrise/Sunset, Moonrise/Moonset for one year

http://aa.usno.navy.mil/data/docs/RS_One Year.html

http://www.iau2006.org/mirror/www.iau.org/iau0601/iau0601_resolution.htm l

Web sites for Is Pluto a Planet

http://www.iau.org/fileadmin/content/pdfs/Resolution_GA26-5-6.pdf#search='IAU%20resolution%20planet%20definition'

http://www.gps.caltech.edu/~mbrown/whatsaplanet/

http://www.thespacereview.com/article/692/1

http://air.noao.edu/cgi-bin/article.pl?id=207

Additional web sites

http://science.howstuffworks.com/space-shuttle7.htm

http://science.howstuffworks.com/satellite5.htm

www.qrg.northwestern.edu/projects/vss/docs/**space**-environment/1-is-there-**sound**-in-**space**.html

- **What tips to teachers of the unit can you offer about likely rough spots/student misunderstandings and performance weaknesses, and how to troubleshoot those issues?**

- Students have great difficulty understanding Moon phases. For this reason, a variety of different methods are provided to teach this difficult concept. Please use all the methods to reinforce understanding of Moon phases. This includes modeling Moon phases using a flashlight, Styrofoam ball and globe, paper folding activities, Moon clock and computer simulations. Actual observations of the Moon in the day and night sky are also highly recommended.

- Students have difficulty understanding the seasons. In activities 10 and 11, various techniques are used to simulate how seasons occur and why the energy concentration varies in different regions around the world. The use of models including the balloon with the grid system showing energy concentration, flashlight models and clay simulating the amount of energy concentrated in a particular area, computer simulations and drawings all help to increase understanding of this difficult topic.

- Students have difficulty understanding the difference between mass and weight. Activity 7 addresses this issue using data for different planets including our own planet and compares how a person's weight and jump height varies and masses of these planets. The influence of mass and distance of planets on gravitational pull on each other is also covered in this lesson.

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)

H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

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This is a short activity focusing on the speed a spacecraft much reach to escape the gravitational pull of different planets.

Activity 19: Rectified Globe
Developed by Hank Bouchelle, this is a supplemental activity that may be used at various times throughout the year during the Planetary Systems unit or other 8th grade units when discussing the position of the Sun in the sky at various times of the day or year.
Activity 20: From Cylinders to Planet Velocities
Students collectively make measurements of variously-sized cylinders and record their data. This data provides an opportunity for a discussion of the process of gathering information scientifically and the reasons why scientists do science as they do. Once these questions are resolved, the students use their data to derive a crude value of pi, and determine the distances and velocities at which planets orbit the Sun.

Activity 21: The Zodiac
This activity further reinforces how the position of the Sun, Moon and Earth influence what we see in the night sky.

Planetary Science Suggested Sequence and Pacing Guide

Planetary Systems Activity Number	Suggested Class Time
Activity 1: K-5 Standard Review	**1 class period** Introduction (10 minutes) Group discussions (20 minutes) Class Overview of Activity (15 minutes) Investigating Further (5 minutes)
Activity 2: Sky Log Data	The Sky log will be introduced prior to the start of the unit and data will be collected for at least one month. The actual analysis of the Sky Log Data (Activity 2) will take place after one month of data is collected. Activity 2: Introduction (10 minutes) Investigation (20 minutes) Class discussion (15 minutes) Investigating Further (15 minutes)
Activity 3: Round Earth/Flat Earth	**2 class periods** Part 1:Introduction (15 minutes) Investigation (15 minutes) Discussion and CD Rom (15 minutes) Investigating Further (5 minutes) Part 2: Shadows Introduction and set up of lab with students (building shadow poles and latitude and longitude review) 15minutes Activity data collection (10 minutes) Review and discussion (10 minutes) Applying what you know (15 minutes)
Activity 4: Is Pluto a Planet?	**2 periods** Introduction (10 minutes) Read script (5 minutes) Group investigation of reports (20 minutes) Discussion and write brief report (15 minutes) Day 2 Continue final writing and share report with class. (35 minutes) Investigating Further and final discussion (15 minutes)
Activity 5: Scale Models of the Solar System	**1 period plus** 15 minutes the next day Introduction (10 minutes) Conduct Activity outdoors (30 minutes) Return to class and discuss (5 minutes) Homework: Applying what you learned Day 2:

	Review Applying what you learned and Investigating further (15-20 minutes)
Activity 6: Where Am I?	**2 periods** Part 1: Mapping the School (30 minutes) Part 2: Neighborhood and Community Look at Teraserver for your area and Bret Hart neighborhood (20 minutes) Day 2: Part 2: Galactic address: 10 minutes Power of Ten video (10 minutes) Discussion of Activity 6 including Applying What you Learned and Investigating Further: 30 minutes
Activity 7: Gravity The Invisible Force	**4 class periods** **Day 1**: Video: Gravity: The Invisible Force Before Viewing Preview (5 minutes) View Video (25 minutes) After video viewing (5 minutes) Discussion Questions (15 minutes) **Day 2**: Finish review of Discussion questions from video (15 minutes) How much you Weigh at Different Locations Introduction (5 minutes) How much you Weigh activity (20 minutes) includes discussion Summarize Results (10 minutes) **Day 3**: How Does the Mass of a Planet Affect Jump Height? Introduction (10 minutes) Conduct activity and collect data (10 minutes) Complete data table 2 and follow up activities (30 minutes) **Day 4:** Introduce Part D and complete demonstration (15 minutes) Part E: Analyze data and complete Discussion questions (15 minutes) Investigating Further and Applying what You Learned (20 minutes)
Activity 8: Tides	Prior to completing this activity, tide data needs to be collected for at least two weeks. This can be done the same time as the sky log. **2 class periods** **Day 1**: Introduction to tides (15 minutes) Analyzing Sky Log and Tide data (30 minutes) Investigating Further (5 minutes)

	Day 2: Applying What You Learned (50 minutes)
Activity 9: Day and Night	**2 periods** Day 1: Introduce Day and Night with modeling (20 minutes) Answer Day/Night Think Questions (30 minutes) Day 2: Day and Night with Globes Review Day/Night modeling (25 minutes) Investigating Further (20 minutes) This is optional on Time Zones
Activity 10: Shadows and Seasons	**1 period** Introduce Activity: (10 minutes) Activity and Questions (40 minutes)
Activity 11: Light Concentration and the Seasons	**2 periods** **Day 1**: Review angle of insolation (10 minutes) Complete flashlight part of activity and draw areas illuminated at 3 angles (20 minutes) Count squares and calculate percentage of concentration (20 minutes) **Day 2**: Clay portion of lab (20 minutes) Investigation Reflection and Applying What You Learned (30 minutes)
Activity 12: The Moon and Moon Phases	**5 class periods** **Part A**: Background on Moon and review questions (50 minutes) **Part B**: Modeling the Moon and Earth Introduction (10 minutes) Activity (30 minutes) Summary of Activity (10 minutes) **Part C**:A Month of Phases Introduction (10 minutes) Activity (30 minutes) Review (10 minutes) **Part D**: Moon Clock Introduction (5 minutes) Construction of Moon Clock (10 minutes) Use of Moon Clock and questions (25 minutes) Summary of Activity (10 minutes) **Day 5**: Investigating Further and Applying What you Learned (40 minutes) Final review (10 minutes)
Activity 13: Our Solar	**Day 1:Part 1**: Brainstorming (15 minutes) **Part 2**: Begin Powerpoint on planets (35 minutes) **Day 2**: Finish powerpoint on planets (50 minutes) **Day 3**: Investigating Further (15 minutes)

System	Applying What You Learned (35 minutes)
Activity 14: Timeline	**5 class periods** **Day 1:Part A**: Introduction (10 minutes) Hand out one technology and one person and have students review information needed to cover activity (15 minutes) Begin Research (25 minutes) **Day 2:Part B**: Research in Library or classroom if you have available computers (50 minutes) **Day 3:Part C**: 1 period: Presentations by students and timeline (50 minutes) **Day 4:** (Part C) Finish presentations and place events on timeline in classroom (50 minutes) **Day 5**: Investigating Further Spinoffs (35 minutes) Applying What you Learned (15 minutes)

ACTIVITY #1:Pre-Assessment of K-5 Standards

How much do you remember about Earth in Space from elementary school? In this activity, a review of elementary standards and supporting evidence for them will be conducted by groups in the classroom.

.

GOALS: **In this lab activity, you will …**

- Review planetary concepts taught at the elementary level.
- Determine students' prior knowledge of planetary motions.
- Uncover possible misconceptions regarding the motions and behaviors of Earth, Moon and Sun.

ACTIVITY OVERVIEW: **A synopsis of this lesson is as follows…**

The teacher will separate students into small groups (2-3) and hand out one or two of the statement sheets to each group. Students will identify if the statement is True or False and supply reasoning (evidence or data) that supports their position. After individual groups are finished (5-10 minutes), the teacher hands out a complete standards list to each student and the class reviews each statement. Every group presents their answer and reasoning for each statement. The teacher will guide discussion noting misconceptions, adding supporting evidence, and facilitating the completion of a correct and complete Standards sheet for each student.

CONNECTIONS

Scientific Content -

- The content involves the K-3 and 4-5 sections of the State of Delaware Science Standard 4-Earth in Space

Scientific Process -

- The science process skills being emphasized will include factual recall, inferring, describing observations, and developing descriptions, identifying relationships between evidence and explanations and communicating a position.

Math/Graphing -

- None

Let's Investigate…..

1. This is the beginning of a unit designed to study the Earth, Sun and Solar system. As part of this unit, it is important to find out what you already know, think you know, or may have questions about. This activity is designed to determine this information.
2. Teacher separates students into groups (2 or 3 in a group).
3. Hand each group of students **ONE OR TWO** of the elementary standard statement papers. (Steps 1-3 take about 5 minutes).
4. Determine if the statement your group has is true or false and then provide as many lines of evidence, data or observations to support your position. Any of the group members may be expected to present explanations and support evidence.
5. The class will come back together for whole class discussion. **EACH** student will get a list of the complete elementary science standards. This list will be completed as each group presents their ideas.
6. Lead discussion around each of the statements, identifying T/F and emphasizing the evidence used to support each position.

Investigating Further …

Hand out 3 x 5 index cards and have each student pose a question or describe a phenomenon that they do not completely understand and would like answered during the course of the unit. Questions may include such things as:

- Is there life on Mars?
- Will we ever send man to distant planets?
- Are day and night the same all over the world?
- What are the latest satellites in space that are designed to study distant planets, Moons or asteroids

Summary of Activity …

In your journal or notebook, write a concise summary of this activity.

Be sure to address the following questions and use your data to support your responses.

- ✓ *How comfortable did* ***you*** *feel with the questions from elementary standards?*
- ✓ *Do you feel that you are ready to advance into 6-8th grade standards?*

Statement: The Earth orbits the Sun

True or false (circle one)

Supporting Evidence, Data or Observations:
1.

2.

Statement: The size of an object appears to change as the observer moves closer to or farther away from the object.

True or false (circle one)

Supporting Evidence, Data or Observations:
1.

2.

Statement: The changes in the appearance of the Moon are called eclipses.

True or false (circle one)

Supporting Evidence, Data or Observations:
1.

2.

Statement: The Earth orbits the Moon

True or false (circle one)

Supporting evidence, Data or Observations
1.

2.

Statement: The only objects in the sky include the Sun, Moon and stars

True or false (circle one)

Supporting Evidence, Data or Observations
1.

2.

Statement: The Moon's shape is that of a sphere.

True or false (circle one)

Supporting Evidence, Data or Observations:
1.

2.

Statement: The Shape of the Earth is similar to a sphere
True or false (circle one)

Supporting Evidence, Data or Observations:
1.

2.

Statement: The appearance of bodies in the sky varies with the actual size and distance from the Earth.

True or false (circle one)

Supporting Evidence, Data or Observations:
1.

2.

Statement: The appearance of the Moon changes as it moves through its orbit.

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement: Half the Moon is always illuminated by the Sun.

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement: The Sun can only be seen in the daytime.

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement: The apparent path of the Sun is from west to east.

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement: The appearance of the Moon changes in a cycle that lasts about a week.

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement: The Moon can be seen sometimes at night and sometimes during the day.

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement: The pattern of day and night repeats every 24 hours.

True or false (circle one)

Supporting Evidence, Data or Observations:
1.

2.

Statement: Technology is not necessary to study distant planets.

True or false (circle one)

Supporting Evidence, Data or Observations:
1.

2.

Statement: Half the Earth is always illuminated by the Sun, causing day and night.

True or false (circle one)

Supporting Evidence, Data or Observations:
1.

2.

-

Statement: The Sun and Moon appear to move slowly across the sky everyday.

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement:

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement:

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement:
True or false (circle one)
Supporting Evidence, Data or Observations: **1.** **2.**

Planetary Statements (Individual Student)

NAME: ____________________________

As you listen to your classmate's and teacher's descriptions for each statement, record the answer (T/F) and evidence for each statement. Place a T or F in the box and list the supporting ideas in the data table provided.

Statement	True or False	Support: Evidence, Data or Observations
The Earth orbits the Sun.		
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are called eclipses.		
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- Review planetary concepts taught at the elementary level.
- Determine students' prior knowledge of planetary motions.
- Uncover possible misconceptions regarding the motions and behaviors of Earth, Moon and Sun.

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The teacher will separate students into small groups (2-3) and hand out one or two of the statement sheets to each group. Students will identify if the statement is True or False and supply reasoning (evidence or data) that supports their position. After individual groups are finished (5-10 minutes), the teacher hands out a complete standards list to each student and the class reviews each statement. Every group presents their answer and reasoning for each statement. The teacher will guide discussion noting misconceptions, adding supporting evidence, and facilitating the completion of a correct and complete Standards sheet for each student.

CONNECTIONS

Scientific Content -

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Scientific Process -

- The science process skills being emphasized will include factual recall, inferring, describing observations, and developing descriptions, identifying relationships between evidence and explanations and communicating a position.

Math/Graphing -

- None

Let's Investigate…..

1. This is the beginning of a unit designed to study the Earth, Sun and Solar system. As part of this unit, it is important to find out what you already know, think you know, or may have questions about. This activity is designed to determine this information.
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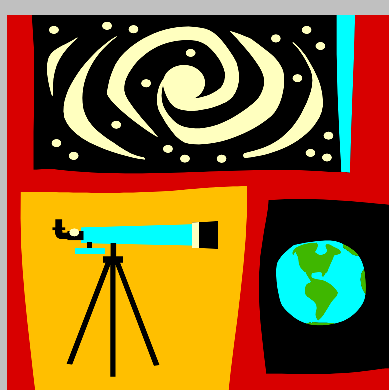
6. Lead discussion around each of the statements, identifying T/F and emphasizing the evidence used to support each position.



Investigating Further …

Hand out 3 x 5 index cards and have each student pose a question or describe a phenomenon that they do not completely understand and would like answered during the course of the unit. Questions may include such things as:

- Is there life on Mars?
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In your journal or notebook, write a concise summary of this activity. Be sure to address the following questions and use your data to support your responses.

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- ✓ *Do you feel that you are ready to advance into 6-8th grade standards?*

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True or false (circle one)

Supporting Evidence, Data or Observations:
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Supporting Evidence, Data or Observations:
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True or false (circle one)

Supporting Evidence, Data or Observations:
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2.

Statement: The pattern of day and night repeats every 24 hours.

True or false (circle one)

Supporting Evidence, Data or Observations:
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2.

Statement: Technology is not necessary to study distant planets.

True or false (circle one)

Supporting Evidence, Data or Observations:
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2.

Statement: Half the Earth is always illuminated by the Sun, causing day and night.

True or false (circle one)

Supporting Evidence, Data or Observations:
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2.

Statement: The Sun and Moon appear to move slowly across the sky everyday.

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement:

True or false (circle one)

Supporting Evidence, Data or Observations:

1.

2.

Statement:

True or false (circle one)

Supporting Evidence, Data or Observations:

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2.

Statement:

True or false (circle one)

Supporting Evidence, Data or Observations:
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2.

Planetary Statements (Individual Student)

NAME: ______________________________

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The apparent path of the Sun is from west to east.		
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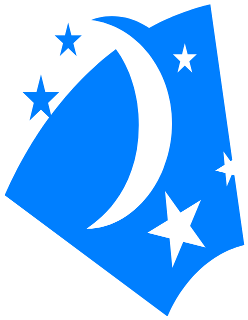
The Moon can sometimes be seen sometimes at night and sometimes be seen during the day.		
The pattern of day and night repeats every 24 hours.		
Technology is not necessary to study distant planets.		
The shape of the Earth is similar to a sphere		

ACTIVITY #2: SKY LOG DATA



Observing the night skies, and Sunrise and Sunset throughout a month, help to establish patterns in the day and night sky that are readily observed. In earlier times in history, the patterns visible in the skies enabled people to develop calendars and explain the motions of objects in our solar system.

- Does the Sun rise and set the same time each day?
- Does the Moon rise and set the same time each day?

GOALS: In this lab activity, you will …

- Keep a sky log for at least one month.
- Interpret patterns in Sunrise, Sunset, Moonrise and Moonset.

MAIN IDEAS: The important concepts and skills covered in this activity are …

- Regular patterns are observable in Sunrise and Sunset.
- The length of day length increases daily from winter to summer and decreases daily from summer to winter.
- The Sunrise varies by a few minutes each day.
- Moonrise varies by about 52 minutes each day and also occurs in a regular pattern called phases.

ACTIVITY OVERVIEW: A synopsis of this lesson is as follows…

The teacher will hand out a sky log to be completed by students daily in class or at home. Teacher will provide data in class because many students do not have home computer access. The sky log data will begin prior to starting the Planetary Systems Unit for a minimum of one month to have data to analyze and interpret. Students will complete the activity, “Interpreting sky log data/Moon phases”. Data will also be discussed periodically throughout the data collection period. Students will look for patterns in times and appearances of sky objects.

CONNECTIONS

Scientific Content –

- Sunrise and Sunset vary by about 1-2 minutes per day. The day length is one to two minutes less each day between summer and winter, and 1-2 minutes per day greater between winter and summer.
- On average, Moonrise and Moonset are one hour later each succeeding day, but these times change a great deal from one location to another. Both latitude and longitude have an effect on this time difference.
- Two times a year, day and night are almost equal. These two times include the **Vernal Equinox (first day of spring) and Autumn Equinox (first day of fall).**
- The cycle of Moon phases last about a month (29.5 days).
- There are about two weeks between New and Full Moon and the same between Full and New Moon.
- The light moves across the Moon from right to left. In waxing phases, the light moves from right to left. In waning phases, the dark area moves from right to left.
- The visible portion of the Moon is 50% illuminated during the quarter Moons.
- If greater than 50% is visible, it is called a gibbous. If less than 50% is visible, it is called a crescent.
- Starting with New Moon, the eight phases of the Moon in order are: New, Waxing Crescent, First Quarter, Waxing Gibbous, Full, Waning Gibbous, Last Quarter, Waning Crescent.

Scientific Process –

- Science process skills that are emphasized during this lesson include observing, recording, predicting, and interpreting.

Math/Graphing –

- Students will predict Sunrise and Sunset times using data previously collected. Students will estimate increases or decreases in day length by observing patterns in the data. Students must understand percentages to interpret Moon data indicating 50 percent illumination or less of the Moon's surface.

MAKING SENSE OF THE SKY LOG …

Using the sky log, students will notice an increase or decrease of a minute or two in Sunrise and Sunset daily. The students will observe Moonrise and Moonset vary by an average of one hour each day. The gradual increase and decrease of the illuminated surface will also be observed and recorded.

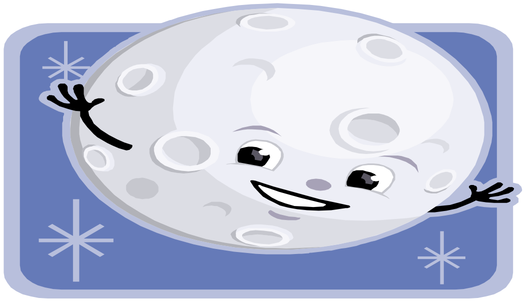
Let's Investigate …

Part A: Sky Log........

1. Using the provided Sky log, collect and record data using various websites including www.wunderground.com for your local area.

DAY	MONDAY	TUESDAY	WED.	THURSDAY	FRIDAY	MONDAY	TUESDAY	WED.	THURSDAY	FRIDAY
DATE										
SUNRISE										
SUNSET										
MOONRISE										
MOONSET										
MOON PHASE										
% illumination										
DIAGRAM										
DATE										
SUNRISE										
SUNSET										
MOONRISE										
MOONSET										
MOON PHASE										
% illumination										
DIAGRAM										

SKY LOG……….SKY LOG……..SKY LOG



Name: ____________________Class period: ____Date:_______

INTERPRETING SKY LOG DATA/MOON PHASES

Directions: Use your Sky Log and class references to answer the following questions.

1. Find and list Sunrise and Sunset for 3 consecutive days.

2. Looking at the pattern of Sunrise and Sunset, what is happening to the amount of daylight hours?

3. What date would daylight and darkness be almost equal?

4. What is the term that means "equal night" for spring?

5. What is the date the "equal night usually occurs for spring?

6. What is the term that means "equal night" in the fall?

7. What is the date the "equal night" usually occurs for fall?

8. Predict data for a Saturday and Sunday following one of your weeks of data on the Sky Log. List the dates for the Saturday and Sunday after the days on the following chart.

	Saturday:	**Sunday:**
Sunrise		
Sunset		
Moonrise		
Moonset		
Moon phase		
Illumination		
Diagram		

9. How many days were between New Moon and Full Moon?

10. How long would you predict it would take to make one full cycle of the phases of the Moon? (New Moon to New Moon) Why?

11. After a New Moon, what is the next phase?

12. After a Full Moon, what is the next phase?

13. What direction does the light go across the Moon? Circle the correct answer: left to right or right to left

14. What dates have 50% of the visible part of the Moon illuminated?

15. What were the phases when 50 % of the visible portion of the Moon was illuminated?

16. Why are the phases not called the same thing, if both phases have 50% of the visible portion of the Moon illuminated?

17 .What percent difference in the Moon's illumination do you notice from one day to the next (Look at several days to get an average)?

18. Starting with New Moon, list additional phases of the Moon that you observed.

Investigating Further ...

It is fascinating to investigate **Sunrise and Sunset** at the poles. If you were exactly at the poles, the Sun would rise one time each year and set one time each year at the equinoxes. This would be around March 21 and September 23. The length of time Sunrise and Sunset take at the poles is much longer than other areas. Around the beginning of spring, at the poles, it takes the Sun about 30 hours to just rise above the horizon until the Sun moves all the way above the horizon. At the beginning of spring and autumn, exactly at the North Pole and South Pole, daytime lasts for 6 months and nighttime for 6 months (Polar day and night). For more information on this topic check out the website….

http://www.phys.uu.nl/~strous/AA/en/antwoorden/zonpositie.html

Summary of Activity …

In your journal or notebook, write a concise summary of this activity. Be sure to address the following questions and use your data to support your responses.

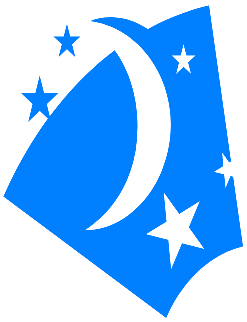
- ✓ *What is the difference in Sunrise and Sunrise from one day to the next? Yearly?*
- ✓ *Is the difference in Sunrise and Sunset the same as Moonrise and Moonset each day?*
- ✓ *Is there a predictable pattern of Moon phases throughout a month? Explain.*

Applying what you have learned …

Your friend Sally noticed the Moon was in the day time sky on Monday. She was amazed to find the Moon in the sky during the day. What phases of the Moon do you think may be visible in day hours? Use your sky log data.

TEACHER'S GUIDE

ACTIVITY #2: SKY LOG DATA



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GOALS: **In this lab activity, you will …**

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- Moonrise varies by about 52 minutes each day and also occurs in a regular pattern called phases.

ACTIVITY OVERVIEW: **A synopsis of this lesson is as follows…**

The teacher will hand out a sky log to be completed by students daily in class or at home. Teacher will provide data in class because many students do not have home computer access. The sky log data will begin prior to starting the Planetary Systems Unit for a minimum of one month to have data to analyze and interpret. Students will complete the activity, "Interpreting sky log data/Moon phases." Data will also be discussed periodically throughout the data collection period. Students will look for patterns in times and appearances of sky objects.

CONTEXT: **The concepts that we have been developing, as well as how this activity serves as the 'next step' can be explained as follows …**

This activity serves as reinforcement to patterns observed in Sunrise and Sunset related to seasons and day length. It also aids in interpreting Moon phase data collected throughout the month. Students have observed and recorded both

Moon and Sun data for at least one month. This data will reinforce explanations of Moon phases, and when and where they are visible to people on Earth

Extension Activities & Suggestions …

Students may research additional months of sky data and analyze their results. Students may also collect historical data for another time of year and compare it to the present sky log data. This may be done to reinforce the loss or gain of daylight hours at different times of the year. This contributes to further understanding of seasons and length of day.

CONNECTIONS

Scientific Content –

- Sunrise and Sunset vary by about 1-2 minutes per day. The day length is one to two minutes less each day between summer and winter and 1-2 minutes per day greater between winter and summer.
- On average, Moonrise and Moonset are one hour later each succeeding day, but these times change a great deal from one location to another. Both latitude and longitude have an effect on this time difference.
- Two times a year, day and night are almost equal. These two times include the **Vernal Equinox (first day of spring) and Autumn Equinox (first day of fall).**
- The cycle of Moon phases last about a month (29.5 days).
- There are about two weeks between New and Full Moon and the same between Full and New Moon.
- The light moves across the Moon from right to left. In waxing phases, the light moves from right to left. In waning phases, the dark area moves from right to left.
- The visible portion of the Moon is 50% illuminated during the quarter Moons.
- If greater than 50% is visible, it is called a gibbous. If less than 50% is visible, it is called a crescent.
- Starting with New Moon, the eight phases of the Moon in order are: New, Waxing Crescent, First Quarter, Waxing Gibbous, Full, Waning Gibbous, Last Quarter, and Waning Crescent

Scientific Process –

- Science process skills that are emphasized during this lesson include observing, recording, predicting, and interpreting.

Math/Graphing –

- Students will predict Sunrise and Sunset times using data previously collected. Students will estimate increases or decreases in day length by observing patterns in the data. Students must understand percentages to interpret Moon data indicating 50 percent illumination or less of the Moon's surface.

MAKING SENSE OF THE SKY LOG …

Using the sky log, students will notice an increase or decrease of a minute or two in Sunrise and Sunset daily. The students will observe Moonrise and Moonset vary by an average of one hour each day. The gradual increase and decrease of the illuminated surface will also be observed and recorded.

Students can use the data collected to observe the gradual increase of day length from winter to summer and decrease of day length from summer and winter. This information can be used to support future activities in this unit on seasons and day length. Observations of the visible surface of the Moon and its sequence of patterns reinforce the Moon phase activities in this unit.

MAKING SENSE OF SKY LOG DATA… FOR TEACHERS

The use of the sky log allows for extensive data collection of Moon and Sun rise and set and patterns in the Moon phase cycle. All of this data will support future activities in this unit including seasons, day length and Moon phases.

Let's Investigate …

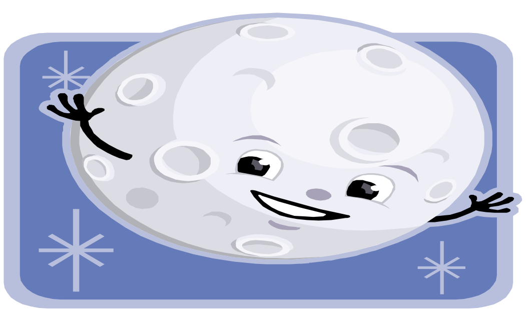
In this investigation section, you will find questions after certain steps in the procedure. These questions are meant to promote understanding of the key concepts in this activity. Write the answers to the questions in your science journal or science notebook.

Part A: Sky Log........

1. Using the provided Sky log, collect and record data using various websites including www.wunderground.com for your local area.

DAY	MONDAY	TUESDAY	WED.	THURSDAY	FRIDAY	MONDAY	TUESDAY	WED.	THURSDAY	FRIDAY
DATE										
SUNRISE										
SUNSET										
MOONRISE										
MOONSET										
MOON PHASE										
% illumination										
DIAGRAM										
DATE										
SUNRISE										
SUNSET										
MOONRISE										
MOONSET										
MOON PHASE										
% illumination										
DIAGRAM										

SKY LOG..........SKY LOG........SKY LOG



Name: ______________________________ **Date:** _________________________

Part B-Questions for Sky Log……….

Name:_____________________ Class period: ____Date:_______

INTERPRETING SKY LOG DATA/MOON PHASES

Directions: Use your Sky Log and class references to answer the following questions.

1. Find and list Sunrise and Sunset for 3 consecutive days.

   Possible answer using Feb. 2006 data:

Feb.1	Feb.2	Feb. 3
7:09 AM	7:08 AM	7:07 AM
5:23 PM	5:24 PM	5:25 PM

2. Looking at the pattern of Sunrise and Sunset, what is happening to the amount of daylight hours? Daylight hours are increasing by a few minutes each day. Remember, this is Feb. and the length of day is slowly increasing until the first day of summer. Following the first day of summer (Summer Solstice), the day length will slowly decrease each day until the first day of winter (Winter Solstice).

3. What date would daylight and darkness be almost equal? This date would be the first day of spring and fall. Check your calendars for these dates.

4. What is the term that means "equal night" for spring? Vernal Equinox

5. What is the date the "equal night usually occurs for spring? Check the calendar for the most recent data. It is usually March 20, 21. For 2006, the first day of spring will be March 20.

6. What is the term that means "equal night" in the fall? Autumn equinox

7. What is the date the "equal night" usually occurs for fall? Sept. 23, 2006 Remember to check your calendar for the date for the present year.

Name: ______________________________ **Date:** _________________________

8. Predict data for a Saturday and Sunday following one of your weeks of data on the Sky Log. List the dates for the Saturday and Sunday after the days on the following chart.

	Saturday: Feb.4,2006	**Sunday: Feb. 5,2006**
Sunrise	7:06 AM	7:05 AM
Sunset	5:26 PM	5:27 PM
Moonrise	10:25 AM	10:51 AM
Moonset	1:00 PM	2:12 PM
Moon phase	Waxing crescent	First Quarter
Illumination	40 %	50 %
Diagram	Draw the Moon with about 40 % illuminated. Light begins on the right side to the left.	Draw the Moon with about 50 % illuminated. The right side of the Moon is illuminated.

Note to teachers: The predictions above may not be accurate because they were just predictions. A teacher may notice from the Feb. 1-3 data that the Sunrise decreased by a minute each day and the Sunset increased by one minute per day. Moonrise appeared to increase by about 26 minutes each day and Moonset seemed to decrease by about 1 hour and 12 minutes looking at the data. Knowing that the amount of the illuminated surface of the Moon was increasing by about an average of 8-9 % each day, the above percentages were estimated. The Drawing reinforces the amount of illumination including the proper side of illumination on the Moon's surface.

9. How many days were between new Moon and full Moon? 14 days

10. How long would you predict it would take to make one full cycle of the phases of the Moon? (new Moon to new Moon) Why? about one month, the Moon takes one month to travel around the Earth

11. After a New Moon, what is the next phase? Waxing Crescent

12. After a Full Moon, what is the next phase? Waning Gibbous

13. What direction does the light go across the Moon? Circle the correct answer: left to right, right to left

14. What dates have 50% of the visible part of the Moon illuminated? (Find dates of the first and last quarter Moon) For Feb. 2006, the dates would be Feb.5 for First Quarter and Feb. 21 for Last Quarter.

Name: ______________________________ **Date:** _________________________

15. What were the phases when 50 % of the visible portion of the Moon was illuminated? First and Last Quarter

16. Why are the phases not called the same thing, if both phases have 50% of the visible portion of the Moon illuminated? First Quarter is in the process of increasing amounts of illumination on the Moon's surface and Last Quarter is in the process of decreasing amounts of illumination. Following First Quarter is the Waxing Gibbous and then Full Moon. Following the Last Quarter is the Waning Crescent and New Moon.

17. What percent difference in the Moon's illumination do you notice from one day to the next (Look at several days to get an average)? about 7 %

18. Starting with New Moon, list additional phases of the Moon that you observed. Students may reply with First and Last Quarter, Full and possibly Crescent and Gibbous. The actual order of phases would be New, Waxing Crescent, First Quarter, Waxing Gibbous, Full, Waning Gibbous, Last Quarter, and Waning Crescent.

Investigating Further …

It is fascinating to investigate **Sunrise and Sunset** at the poles. If you were exactly at the poles, the Sun would rise one time each year and set one time each year at the equinoxes. This would be around March 21 and September 23. The length of time Sunrise and Sunset take at the poles is much longer than other areas. Around the beginning of spring at the poles, it takes the Sun about 30 hours to just rise above the horizon until the Sun moves all the way above the horizon. At the beginning of spring and autumn, exactly at the North Pole and South Pole, daytime lasts for 6 months and nighttime for 6 months. (Polar day and night.) For more information on this topic check out the web site….

http://www.phys.uu.nl/~strous/AA/en/antwoorden/zonpositie.html

Name: ____________________ **Date:** ____________________

Summary of Activity …

In your journal or notebook, write a concise summary of this activity. Be sure to address the following questions and use your data to support your responses.

- ✓ *What is the difference in Sunrise and Sunrise from one day to the next?yearly?*
- ✓ *Is the difference in Sunrise and Sunset the same as Moonrise and Moonset each day?*
- ✓ *Is there a predictable pattern of Moon phases throughout a month? Explain.*

Applying what you have learned …

Your friend Sally noticed the Moon was in the day time sky on Monday. She was amazed to find the Moon in the sky during the day. What phases of the Moon do you think may be visible in day hours? Use your sky log data to support your answer. Many phases are visible at certain times during the day. For example, the waxing crescent Moon rises mid morning and sets before midnight. First quarter rises around noon and sets around midnight. Waning gibbous and last quarter may be seen in the very early morning hours and end before noon. Check your sky log for more exact times and information.

Name: ______________________________ **Date:** _________________________

Planetary Systems Assessment Rubrics

1. Why does using models make it easier to understand planetary systems? Describe one example of how using models has helped in your understanding of planetary relationships.

This item measures the student's ability to recognize the need for models in the classroom when showing the position, movement and size of planetary objects.

Criteria:

1. **Student states that models are the only realistic way to show the visual relationships between Earth, Moon, Sun and planets because planetary diameters are too large and/or astronomical distances are too vast.**
2. **Student describes at least one modeling situation that furthered their personal knowledge of planetary systems (example: rotation, revolution, phases, orbits, diameters, distances, etc.)**

Code	Response
	Correct Response
20	**Meets criteria above.**
21	
29	**Any other completely correct response**
	Partially Complete Response
10	**Explains size and/or distance issues, but doesn't give personal modeling experience**
11	**Gives personal modeling experience, but doesn't explain rationale for using models**
12	
19	**Any other partially correct response.**
	Incorrect Response
70	**Provides incorrect rationale (example: "It is easier")**
71	
76	**Repeats the stem of the question**
79	**Any other incorrect response**
	Non Response
90	**Crosses out, erases, illegible or impossible to interpret.**
99	**Blank**

Name: ______________________________ **Date:** _________________________

2. Shade the side of the Earth model that is experiencing night. If Earth's period of rotation became faster how would it affect the number of hours of daylight? Explain.

This item measures the student's ability to explain the regular and predictable motion of Earth's rotation on its axis that causes day/night.

Criteria:

1. **Student clearly shades one-half of the Earth facing away from the sun. Night occurs when the side of Earth away from the sun is not illuminated. (Side A is shaded)**
2. **Student states that length of day and night is dependent on the rate of the Earth's rotation on its axis. If rotational period is decreased then so is day/night length.**

Code	Response
	Correct Response
20	**Meets criteria above.**
21	
29	**Any other completely correct response**
	Partially Complete Response
10	**Shades partial (not fully half) of side A, but correctly explains rotational period and day length relationship.**
11	**Correctly shades side A, but insufficient explanation for day length decrease (example: hours of daylight will become shorter.).**
12	**Correctly shades side A, but incorrect explanation of rotational period and day length (example: longer day length).**
19	**Any other partially correct response.**
	Incorrect Response
70	**Incorrect shading (of any sort) and incorrect explanation of rotational period and day length.**
71	**Incorrect shading (of any sort) and insufficient explanation for day length decrease (example: hours of daylight will become shorter)**
76	**Repeats stem of question**

Name: ______________________________ **Date:** _________________________

79	**Any other incorrect response**
	Non Response
90	**Crosses out, erases, illegible or impossible to interpret.**
99	**Blank**

3. The diagram above shows the Moon's phase as seen from Earth. In the space provided below, draw and label **the position of the Moon during this phase. Make sure the Moon is drawn to scale with the Earth's diameter.**

This item measures the student's ability to construct and explain an accurate scale model representing Earth/Moon positional relationships which create phases.

Criteria:

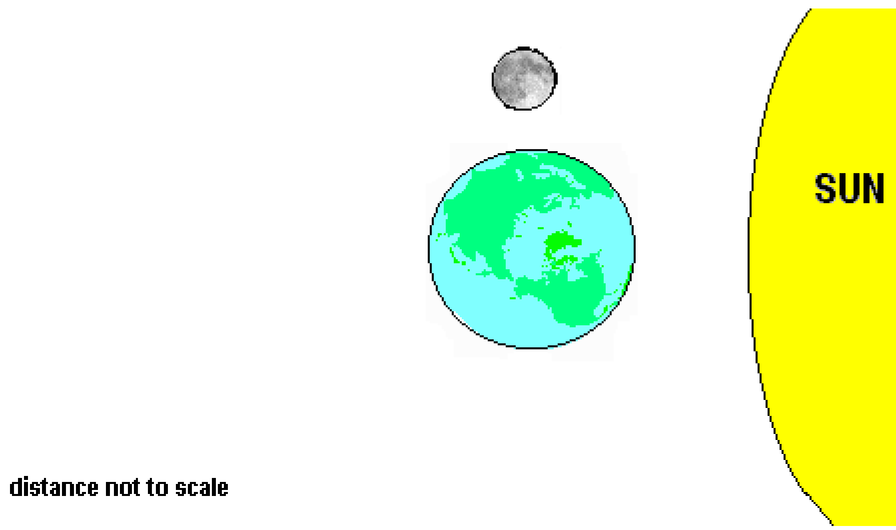
1). Student draws Moon at a vertical right angle to the Earth and Sun.

2). Student draws Moon (1:4 approximately) in relative size to the Earth.

Code	Response
	Correct Response
20	**Meets criteria above.**
29	**Any other completely correct response**
	Partially Complete Response
10	**Draws Earth/Moon approximate sizes correctly but Moon is incorrectly placed.**
11	**Moon is correctly placed, but size relationship is not in approximate scale.**
12	
19	**Any other partially correct response**
	Incorrect Response
70	**Incorrect Earth/Moon size relationship and incorrect placement of Moon**
71	

Name: ______________________________ **Date:** ______________________________

76	**Repeats stem of question**
79	**Any other incorrect response**
	Non Response
90	**Crosses out, erases, illegible or impossible to interpret.**
99	**Blank**



Name: ______________________________ **Date:** _________________________

4. The moon goes through several phases in one month. One-half of the Moon is always illuminated. Explain what causes the phases of the moon?

This item measures the students understanding of the relationship between the relative position of an orbital body and the source of illumination as seen from another point in space.

Criteria:

1. **Student describes the moon's revolution around the Earth.**
2. **As a result of the moon's orbit around the Earth, we see a different amount of the lit portion of the moon.**

Code	Response
	Correct Response
20	**Meets criteria above.**
29	**Any other completely correct response**
	Partially Complete Response
10	**Correctly describes Moon's revolution around Earth, does not cite different angle viewpoint**
11	**Correctly cites different angle viewpoint, but does not identify Moon's orbit as reason**
12	**Includes correct concepts but confuses moon's rotation and revolution**
13	
19	**Any other partially complete response.**
	Incorrect Response
70	**States that the moon changes shape.**
71	**States the Earth's shadow causes the phases.**
72	**States that the Moon's rotation causes the phases**
76	**Repeats stem of question**
79	**Any other incorrect response**
	Non Response
90	**Crosses out, erases, illegible or impossible to interpret.**
99	**Blank**

Name: ______________________________ **Date:** _________________________

5. **If Earth, Moon and Sun were in the following orientation, which lettered location(s) on the Earth would experience high tide. In the space provided below explain why.**

This item measures the student's understanding of the Moon and Sun's gravitational influence on the Earth's tides. Teacher Note: **The Moon's gravitational influence is twice that of the Sun. Therefore, the Sun's gravitational influence on tides may be omitted in student explanation.**

Criteria:
1. Student identifies w and **y as areas of high tide on Earth.**
2. Student describes the Moon's gravitational pull on Earth's waters (the Moon's gravitational pull on Earth itself, the Sun's gravitational pull on Earth's water and there is an effect on the opposite side caused by the rotation of the Earth).

Code	Response
	Correct Response
20	**Meets criteria above.**
21	
29	**Any other completely correct response**
	Partially Complete Response
10	**Identifies either w** or **y, but not both. Correctly describes the gravitational pull.**
11	**Identifies both w** and **y, but no explanation**
12	**Identifies both w** and **y but states that the Moon's gravity causes w and the Sun's gravity causes** y
13	**Identifies both w** and **y but states incorrect reasoning**
19	**Any other partially complete response.**
	Incorrect Response
70	**States x and/or z**
71	**Identifies either w** or **y, or both with an incorrect explanation**
76	**Repeats stem of question**
79	**Any other incorrect response**
	Non Response
90	**Crosses out, erases, illegible or impossible to interpret.**

Name: ______________________________ **Date:** _________________________

99	**Blank**

Name: ______________________________ **Date:** _________________________

6. **Describe** two **conditions on Earth and how they make it suitable for life as we know it?**

This item measures the student's ability to explain the conditions that make Earth suitable for life.

Criteria:

1. **Student states that Earth has any two of the following parameters; a suitable temperature range, atmosphere, liquid water, gravity, etc.**
2. **Student accurately describes how the conditions support life on Earth.**

Code	Response
	Correct Response
20	**Meets criteria above.**
29	**Any other completely correct response with at least two criteria**
	Partially Complete Response
10	**States only one of the criteria with reasonable explanation.**
11	**States 2 of the criteria with no explanation.**
12	**States 2 criteria, but explains only one.**
19	**Any other partially complete response.**
	Incorrect Response
70	**States food as a condition**
71	**States plants as a condition**
76	**Repeats stem of question**
79	**Any other incorrect response**
	Non Response
90	**Crosses out, erases, illegible or impossible to interpret.**
99	**Blank**

Name: ______________________________ **Date:** _________________________

7. Mars has two moons, Phobos and Deimos. Use the diagram below and state which moon (if any) has more of a gravitational affect on Mars. Explain?

This item measures the student's ability to

Criteria for a correct response.

1. **States that Phobos would have greater gravitational influence because it is more massive than Deimos.**
2. **States that Phobos would have greater gravitational influence because it is closer.**

Code	Response
	Correct Response
20	**Meets criteria above.**
29	**Any other completely correct response**
	Partially Complete Response
10	**States 1 but not 2**
11	**States 2 but not 1**
19	**Any other partially complete response.**
	Incorrect Response
70	**States Deimos has greater influence.**
76	**Repeats stem of question**
79	**Any other incorrect response**
	Non Response
90	**Crosses out, erases, illegible or impossible to interpret.**
99	**Blank**

Name: ______________________________ **Date:** _________________________

8. **Use 2 examples to explain how technology has advanced our understanding of the solar system.**

This item measures the student's ability to recognize how technological advances have increased our understanding of the solar system.

Criteria for a correct response.

1. **Identifies and explains 2 examples of technology that has led to changes in our understanding of the solar system.**

Code	Response
	Correct Response
20	**Meets criteria above.**
29	**Any other completely correct response**
	Partially Complete Response
10	**Gives one example and a logical explanation**
11	**Gives 2 examples but only explains one.**
19	**Any other partially complete response.**
	Incorrect Response
70	**Only lists 2 examples with no explanation**
71	**Gives 2 reasonable examples but incorrect explanation**
72	
76	**Repeats stem of question**
79	**Any other incorrect response**
	Non Response
90	**Crosses out, erases, illegible or impossible to interpret.**
99	**Blank**

Name: ______________________________ **Date:** _________________________

9. In the space below, draw a diagram that represents the orientation of the sun and Earth during the summer in the Northern Hemisphere. Label the North and South Poles. Explain why it is warmer in the summer than the winter in the Northern Hemisphere.

This item measures the student's ability to identify the cause of the summer season.

Criteria:

1. **Draws diagram with Northern Hemisphere tilted toward the sun.**
2. **The tilt of Earth on it's axis causes the angle of the sunlight striking the surface to vary the amount of solar energy per unit area received at the Earth's surface.**
3. **Explains that number of hours of daylight are longer during the day, increasing the amount of time that energy is absorbed.**

Code	Response
	Correct Response
20	**Meets criteria above.**
21	
29	**Any other completely correct response**
	Partially Complete Response
10	**Has criteria 1 and 2**
11	**Has criteria 2 and 3 but incorrect diagram.**
19	**Any other partially complete response.**
	Incorrect Response
70	**Attempts to relate distance between Earth and Sun as reason.**
79	**Any other incorrect response**
	Non Response
90	**Crosses out, erases, illegible or impossible to interpret.**
99	**Blank**

Name: ______________________________ **Date:** ___________________________

Planetary Systems Summative Assessment

1. Why does using models make it easier to understand planetary systems? Describe one example of how using models has helped in your understanding of planetary relationships.

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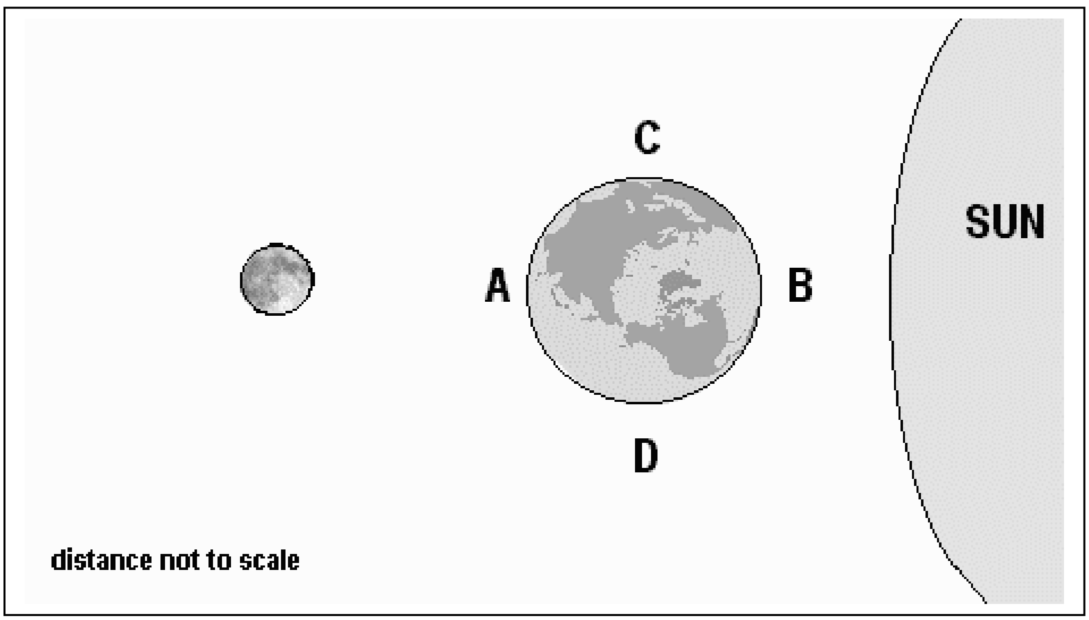
Use the diagram below to answer Question 2:



2. Shade the side of the Earth model that is experiencing night. If the Earth's period of rotation became faster, how would it affect the number of hours of daylight? **Explain.**

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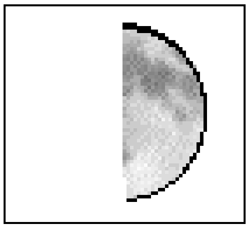
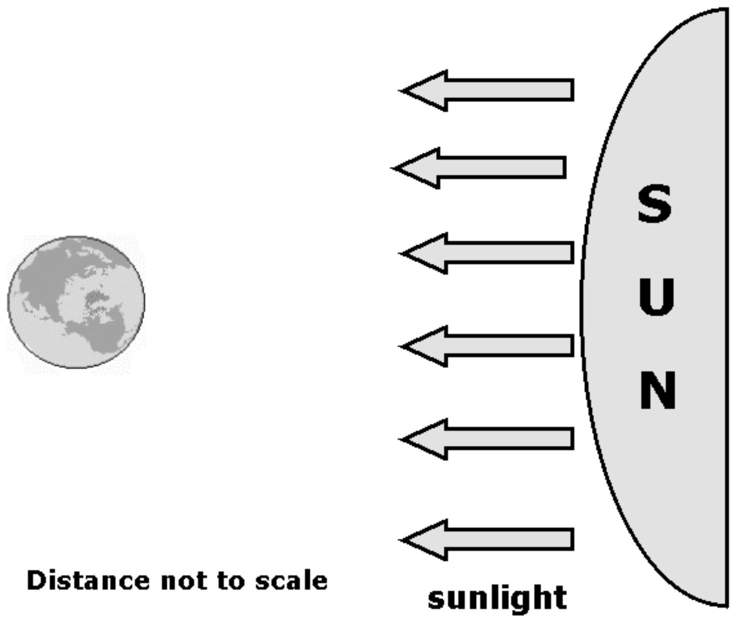


3. The diagram above shows the Moon's phase as seen from Earth. In the space provided below, **draw and label** the position of the Moon during this phase. Make sure the Moon is drawn to scale with the Earth's diameter.



4. The moon goes through several phases in one month. One half of the Moon is always illuminated. Explain what causes the phases of the moon?

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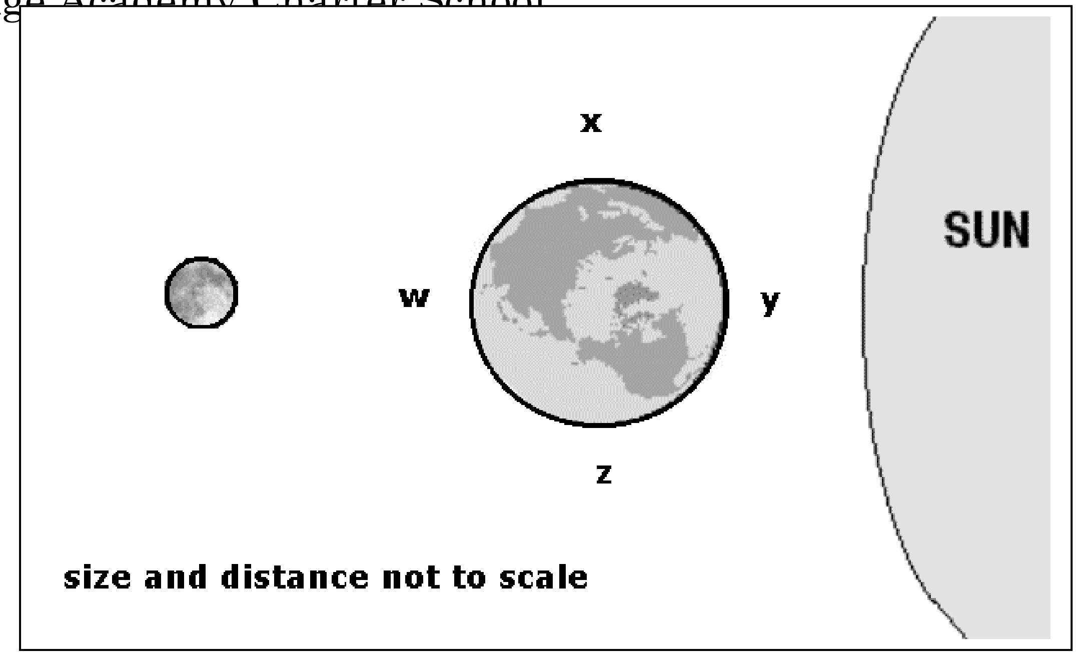

5. If Earth, Moon, and Sun were in the orientation in the diagram above, which lettered location(s) on the Earth would experience high tide? In the space provided below explain why.

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6. Describe **two** conditions on Earth and how they make it suitable for life as we know it?

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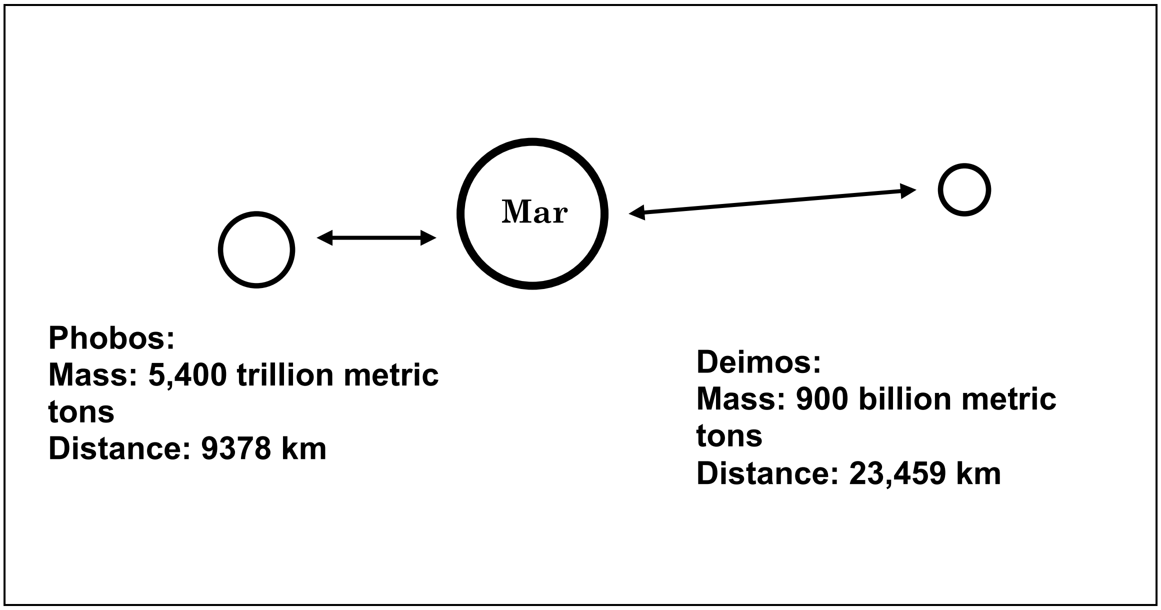

7. Mars has two moons, Phobos and Deimos. Use the diagram above and describe which moon (if any) has more of a gravitational affect on Mars and why?

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8. Use 2 examples to explain how technology has advanced our understanding of the solar system.

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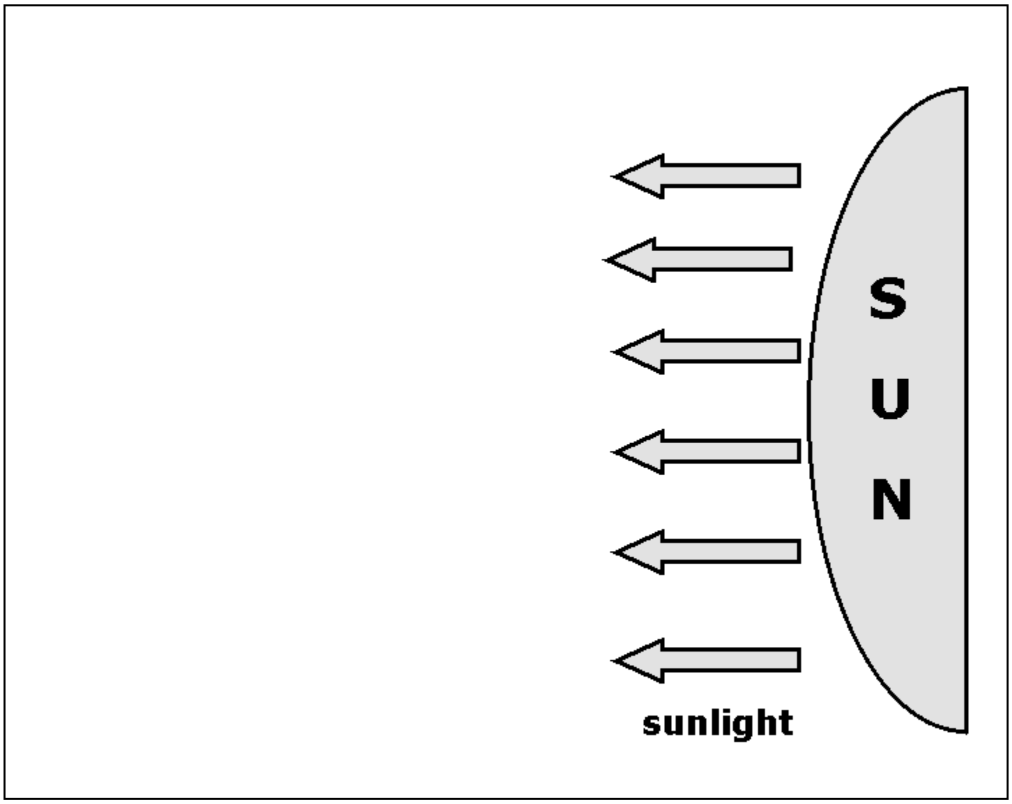
9. In the space below, draw a diagram that represents the orientation of the Sun and Earth during the summer in the Northern Hemisphere. Label the North and South Poles.



Explain why it is warmer in the summer than the winter in the Northern Hemisphere.

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Planetary Systems
Summative Assessment
Teacher Rubrics

1. Why does using models make it easier to understand planetary systems? Describe one example of how using models has helped in your understanding of planetary relationships.

This item measures the student's ability to recognize the need for models in the classroom when showing the position, movement, and size of planetary objects.

Criteria:

1. Student states that models are the only realistic way to show the visual relationships

1. Why does using models make it easier to understand planetary systems? Describe one example of how using models has helped in your understanding of planetary relationships.

This item measures the student's ability to recognize the need for models in the classroom when showing the position, movement, and size of planetary objects.

Criteria:

1. Student states that models are the only realistic way to show the visual relationships between Earth, Moon, Sun, and planets because planetary diameters are too large and/or astronomical distances are too vast.
2. Student describes at least one modeling situation that furthered their personal knowledge of planetary systems (example: rotation, revolution, phases, orbits, diameters, distances, etc.)

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	Explains size and/or distance issues but does not give personal modeling experience.
11	Gives personal modeling experience but does not explain rationale for using models.
19	Any other partially correct response.
	Incorrect Response
70	Provides incorrect rationale—example: "It is easier."
76	Repeats the stem of the question.
79	Any other incorrect response
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

2. Shade the side of the Earth model that is experiencing night. If Earth's period of rotation became faster, how would it affect the number of hours of daylight? Explain.

This item measures the student's ability to explain the regular and predictable motion of Earth's rotation on its axis that causes day/night.

Criteria:

1. Student clearly shades one-half of the Earth facing away from the sun. Night occurs when the side of Earth away from the sun is not illuminated (Side A is shaded).
2. Student states that length of day and night is dependent on the rate of the Earth's rotation on its axis. If rotational period is decreased, then so is day/night length.

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	Shades partial (not fully half) of side A but correctly explains rotational period and day length relationship.
11	Correctly shades side A but insufficient explanation for day length decrease—example: hours of daylight will become shorter.
12	Correctly shades side A but incorrect explanation of rotational period and day length—example: longer day length.
19	Any other partially correct response.
	Incorrect Response
70	Incorrect shading (of any sort) and incorrect explanation of rotational period and day length.
71	Incorrect shading (of any sort) and insufficient explanation for day length decrease—example: hours of daylight will become shorter.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

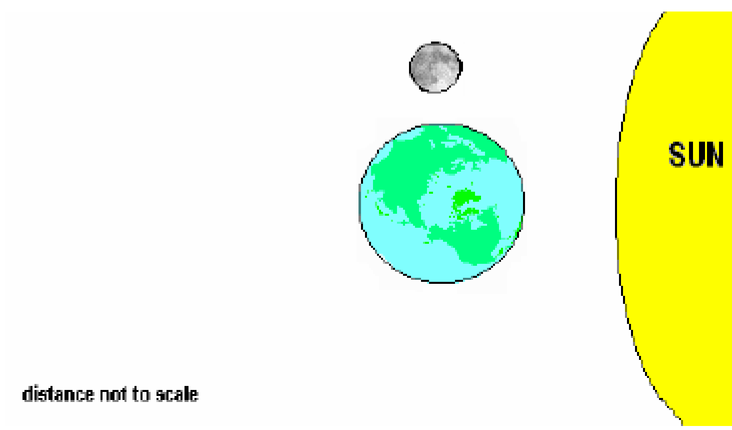
3. The diagram above shows the Moon's phase as seen from Earth. In the space provided below, draw and label the position of the Moon during this phase. Make sure the Moon is drawn to scale with the Earth's diameter.

This item measures the student's ability to construct and explain an accurate scale model representing Earth/Moon positional relationships which create phases.

Criteria:

1. Student draws Moon at a vertical right angle to the Earth and Sun.
2. Student draws Moon (1:4 approximately) in relative size to the Earth.

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	Draws Earth/Moon approximate sizes correctly but Moon is incorrectly placed.
11	Moon is correctly placed but size relationship is not in approximate scale.
19	Any other partially correct response.
	Incorrect Response
70	Incorrect Earth/Moon size relationship and incorrect placement of Moon.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.



4. The moon goes through several phases in one month. One-half of the Moon is always illuminated. Explain what causes the phases of the moon?

This item measures the student's understanding of the relationship between the relative position of an orbital body and the source of illumination as seen from another point in space.

Criteria:

1. Student describes the moon's revolution around the Earth.
2. As a result of the moon's orbit around the Earth, we see a different amount of the lit portion of the moon.

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	Correctly describes Moon's revolution around Earth does not cite different angle viewpoint.
11	Correctly cites different angle viewpoint but does not identify Moon's orbit as reason.
12	Includes correct concepts but confuses moon's rotation and revolution.
19	Any other partially complete response.
	Incorrect Response
70	States that the moon changes shape.
71	States the Earth's shadow causes the phases.
72	States that the Moon's rotation causes the phases.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

5. If Earth, Moon, and Sun were in the following orientation, which lettered location(s) on the Earth would experience high tide? In the space provided below explain why.

This item measures the student's understanding of the Moon and Sun's gravitational influence on the Earth's tides. *Teacher Note:* The Moon's gravitational influence is twice that of the Sun. Therefore, the Sun's gravitational influence on tides may be omitted in student explanation.

Criteria:

1. Student identifies w and y as areas of high tide on Earth.
2. Student describes the Moon's gravitational pull on Earth's waters (the Moon's gravitational pull on Earth itself, the Sun's gravitational pull on Earth's water, and there is an effect on the opposite side caused by the rotation of the Earth).

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	Identifies either w or y but not both. Correctly describes the gravitational pull.
11	Identifies both w and y but no explanation.
12	Identifies both w and y but states that the Moon's gravity causes w and the Sun's gravity causes y.
13	Identifies both w and y but states incorrect reasoning.
19	Any other partially complete response.
	Incorrect Response
70	States x and/or z.
71	Identifies either w or y or both with an incorrect explanation.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

6. Describe two conditions on Earth and how they make it suitable for life as we know it?

This item measures the student's ability to explain the conditions that make Earth suitable for life.

Criteria:

1. Student states that Earth has any two of the following parameters—a suitable temperature range, atmosphere, liquid water, gravity, etc.
2. Student accurately describes how the conditions support life on Earth.

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response with at least two criteria.
	Partially Complete Response
10	States only 1 of the criteria with reasonable explanation.
11	States 2 of the criteria with no explanation.
12	States 2 criteria but explains only 1.
19	Any other partially complete response.
	Incorrect Response
70	States food as a condition.
71	States plants as a condition.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

7. Mars has two moons, Phobos and Deimos. Use the diagram below and state which moon (if any) has more of a gravitational affect on Mars. Explain?

This item measures the student's understanding of gravity as a force that acts between masses over long distances.

Criteria for a correct response:

1. States that Phobos would have greater gravitational influence because it is more massive than Deimos.
2. States that Phobos would have greater gravitational influence because it is closer.

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	States 1 but not 2.
11	States 2 but not 1.
19	Any other partially complete response.
	Incorrect Response
70	States Deimos has greater influence.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

8. Use 2 examples to explain how technology has advanced our understanding of the solar system.

This item measures the student's ability to recognize how technological advances have increased our understanding of the solar system.

Criteria for a correct response:

1. Identifies and explains 2 examples of technology that has led to changes in our understanding of the solar system.

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	Gives 1 example and a logical explanation.
11	Gives 2 examples but only explains one.
19	Any other partially complete response.
	Incorrect Response
70	Only lists 2 examples with no explanation.
71	Gives 2 reasonable examples but incorrect explanation.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

9. In the space below, draw a diagram that represents the orientation of the Sun and Earth during the summer in the Northern Hemisphere. Label the North and South Poles. Explain why it is warmer in the summer than the winter in the Northern Hemisphere.

This item measures the student's ability to identify the cause of the summer season.

Criteria:

1. Draws diagram with Northern Hemisphere tilted toward the sun.
2. The tilt of Earth on its axis causes the angle of the sunlight striking the surface to vary the amount of solar energy per unit area received at the Earth's surface.
3. Explains that the number of hours of daylight are longer during the day, increasing the amount of time that energy is absorbed.

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	Has criteria 1 and 2.
11	Has criteria 2 and 3 but incorrect diagram.
19	Any other partially complete response.
	Incorrect Response
70	Attempts to relate distance between Earth and Sun as reason.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

Prestige Academy Charter School

Unit Title: Weather **Grade Level(s): 8th**

Subject/Topic Areas: Local Weather, Global Weather, Climate

Key Vocabulary: Weather, high and low pressure, humidity, atmosphere, cumulus, cirrus, stratus, Isobars, air masses, fronts, cyclones, tornadoes, nor'easter, thunderstorm, hurricane, Latitude, Ocean currents, Climate

Designed By: V. Patel **Time Frame: 45 Class Meetings**
Date: 12/01/2011

SUMMARY OF PURPOSE:

The Weather Unit is one of four units taught in the 8th grade including Transformation of Energy, Planetary Systems and Ecosystems. The energy connections in Weather, Planetary and Ecosystems will be discussed in each of the kit trainings.

The Weather unit explores how the Earth's heat energy is used to explain many weather occurrences. Not all parts of the Earth absorb energy uniformly, which ultimately influences temperature and pressure differences which affect weather patterns. Geography, water content, elevation and latitude cause variances in temperature. Energy is transferred with evaporation and condensation. The Sun drives the weather. Students collect daily weather data, observe satellite imagery, frontal systems, high and low pressure regions and use this information to make short term and long term weather forecasts. Students study hurricanes, tornadoes, nor'easters and thunderstorms and see how they transfer heat energy from one region to another. Climate is weather patterns observed over a long period of time.

Stage 1: Desired Results

Common Core/ Delaware Standards

The following Science Content Standards are incorporated into this unit. This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1 and 5 found on the following web site: http://doe.k12.de.us/programs/ci/content areas/science.shtml

Standard 1: The Nature and Application of Science and Technology
Understandings and Abilities of Scientific Inquiry
Students should know and be able to:

1. Understand that: Scientific investigations involve asking testable questions. Different kinds of questions suggest different scientific investigations. The current body of scientific knowledge guides the investigation.
   - Be able to: Frame and refine questions that can be investigated scientifically, and generate testable hypotheses.
2. Understand that: A valid investigation controls variables. Different experimental designs and strategies can be developed to answer the same question.
   - Be able to: Design and conduct investigations with controlled variables to test hypotheses.
3. Understand that: In a scientific investigation, data collection involves making precise measurements and keeping accurate records so that others can replicate the experiment.
   - Be able to: Accurately collect data through the selection and use of tools and

techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students.

4. Understand that: There is much experimental and observational evidence that supports a large body of knowledge. The scientific community supports known information until new experimental evidence arises that does not match existing explanations. This leads to the evolution of the scientific body of knowledge.
    - Be able to: Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.
5. Understand that: Evaluating the explanations proposed by others involves examining and comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Conflicting data or conflicting interpretations of the same data suggest the need for further investigation. Continued investigation can lead to greater understanding and resolution of the conflict.
    - Be able to: Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.
6. Understand that: Scientific habits of mind and other sources of knowledge and skills are essential to scientific inquiry. Habits of mind include tolerance of ambiguity, skepticism, openness to new ideas, and objectivity. Other knowledge and skills include mathematics, reading, writing, and technology.
    - Be able to: Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Science, Technology, and Society

Students should know that:

1. Advances in technology can expand the body of scientific knowledge. Technological tools allow people to observe objects and phenomena that otherwise would not be possible. Technology enhances the quality, accuracy, speed and analysis of data gathered.
3. Science and technology in society are driven by the following factors: economical, political, cultural, social, and environmental. Increased scientific knowledge and technology create changes that can be beneficial or detrimental to individuals or society through impact on human health and the environment.

Students should be able to:

- Discuss the origin and identify characteristics (i.e., air circulation pattern, wind speed, temperature and dew point, and air pressure) of storm systems including hurricanes, Nor' easters, tornadoes, thunderstorms, and mid-latitude cyclones. Explain how these weather events can transfer heat. Describe the environmental, economic, and human impact of these storms.
- Examine isobars on weather maps to describe how wind (moving air) travels from a region of high pressure to a region of low pressure. Apply this knowledge to explain the cause of wind.
- Record and interpret daily weather measurements over an extended period of time using a variety of instruments (i.e., barometer, anemometer, sling psychrometer, rain gauge, and thermometer) in order to predict and to identify weather patterns.
- Construct and use surface station models to represent local atmospheric data and interpret

weather patterns on meteorological maps.

- Examine satellite imagery pictures and use these images to identify cloud patterns and storm systems.
- Use weather maps to describe the movement of fronts and storms and to predict their influence on local weather.

History and Context of Science
Students should know that:

1. Over the course of human history, contributions to science have been made by different people from different cultures. Studying some of these contributions and how they came about provides insight into the expansion of scientific knowledge.

Standard 5: Earth's Dynamic Systems
Components of the Earth
Students should know that:

1. The movement of water among the geosphere, hydrosphere and atmosphere affects such things as weather systems, ocean currents, and global climate.

Students should be able to:

- Observe, measure, and predict changes in weather using atmospheric properties (wind speed and direction, cloud cover and type, temperature, dew point, air pressure, and relative humidity). Describe how air pressure and temperature change with increasing altitude and/or latitude.

Students should know that:

2. The atmosphere is a mixture having as its principle components a fixed ratio of nitrogen and oxygen and, depending on the location, variable amounts of carbon dioxide, water vapor, and dust particles.

Interactions Throughout Earth's Systems
Students should know that:

1. Water cycles from one reservoir to another through the processes of evaporation, transpiration, condensation and precipitation. Energy transfers and/or transformations are associated with each of these processes.

Students should be able to:

- Use a variety of models, charts, diagrams, or simple investigations to explain how the Sun's energy drives the cycling of water through the Earth's crust, oceans, and atmosphere.

Students should know that:

2. Some Earth events such as El Nino, volcanism and global warming can affect the entire Earth system and are likely the result of complex interactions among Earth spheres.

Students should be able to:

- Explain how uneven heating of Earth's components – water, land, air – produce local and global atmospheric and oceanic movement. Describe how these local and global patterns of movement influence weather and climate.

Students should know that:

3. The atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.

Students should be able to:

- Investigate the rate at which different Earth materials absorb heat. Explain how these differences in heat absorption causes air pressure differences that result in convection currents (i.e., local land and sea breezes).

Students should know that:

4. The climate at a location on Earth is the result of several interacting variables such as latitude, altitude and/or proximity to water.

Students should be able to:

- Differentiate between weather, which is the condition of the atmosphere at a given time, and climate, which is the weather averaged over a long period of time.

Students should know that:

5. Energy from the Sun heats the Earth unevenly causing pressure differences and air movements (convection currents) resulting in changing weather patterns.

Students should be able to:

- Discuss the origin and identify characteristics (i.e., air circulation pattern, wind speed, temperature and dew point, and air pressure) of storm systems including hurricanes, Nor' easters, tornadoes, thunderstorms, and mid-latitude cyclones. Explain how these weather events can transfer heat. Describe the environmental, economic, and human impact of these storms.

Students should know that:

6. Ocean currents, global winds, and storm systems, redistribute heat energy on Earth's surface and therefore affect weather and long-term climatic patterns of a region.

Students should be able to:

- Examine maps of ocean currents and trace the origin and flow of such currents to explain the transfer of heat energy. Identify which currents have dominant influence on the Delaware coast.

Students should know that:

7. Uneven heating and cooling of the Earth's surface produce air masses that differ in density, humidity and temperature. The interaction of these air masses results in significant weather changes.

Students should be able to:

- Compare and contrast different storm systems in terms of size, formation, and associated weather.
- Describe how origin affects the temperature and moisture content of an air mass. Describe how the interaction of air masses produces different fronts (warm, cold, and stationary) that influence our weather.
- Describe how the formation of clouds is influenced by the dew point, environmental temperature and amount of particles in the air. Explain how various lifting mechanisms affect cloud formation.
- Use cloud characteristics (altitude, composition, and form) to predict the weather. Discuss how different cloud types are indicators of weather and weather systems such as frontal systems and hurricanes.

Students should know that:

8. Heat energy stored in the oceans and transferred by currents influence climate. A disruption of the circulation and temperature of the world's oceans would foster climate change and have environmental and economic consequences.

Technology and Applications
Students should know that:

1. Global weather data from ground measurements, satellites and radar are recorded on maps, analyzed, and used to predict local weather.

Students should be able to:

- Examine isobars on weather maps to describe how wind (moving air) travels from a region of high pressure to a region of low pressure. Apply this knowledge to explain the cause of wind.
- Record and interpret daily weather measurements over an extended period of time using a variety of instruments (i.e., barometer, anemometer, sling psychrometer, rain gauge, and thermometer) in order to predict and to identify weather patterns.
- Construct and use surface station models to represent local atmospheric data and interpret weather patterns on meteorological maps.
- Examine satellite imagery pictures and use these images to identify cloud patterns and storm systems.
- Use weather maps to describe the movement of fronts and storms and to predict their influence on local weather.

Key Concepts/Big Ideas

- Observation and Evidence: Students make observations of weather systems using satellite imagery and use weather data as evidence to support a particular weather pattern.

- Reasoning and Explanations: Students use weather data to support and explain their weather predictions.

- Properties of Materials: Students use the particle model to explain density, air pressure and movement of air.

- Systems: The hydrosphere, geosphere and atmosphere are all involved in creating weather patterns.

- Interaction of Science and Technology: Weather instruments and internet data may be used to collect data to support weather predictions and explanations of weather phenomena.

- Cycles: The water cycle actively transfers water from one form to another and influences cloud formation and precipitation.

- Models: Models are used to demonstrate the unequal heating and cooling of the Earths surface and how this influences weather.

- Patterns: Patterns in weather data observed enable us to form explanations of weather observed.

Enduring Understandings

Students will understand that…

Enduring Understanding: The development of technology and advancement in science influence and drive each other forward.

Enduring Understanding: Understanding past processes and contributions is essential in building scientific knowledge

Enduring Understanding: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.

Enduring Understanding; Earth's systems can be broken down into individual components which have observable measurable properties.

Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.

Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity

Essential Questions

What makes a question scientific? What constitutes evidence? When do you know you have enough evidence?

Why is it necessary to justify and communicate an explanation?

How do science and technology influence each other?

How have past scientific contributions influenced current scientific understanding of the world?

What do we mean in science when we say that we stand on the shoulders of giants?

How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?

How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?

How does technology extend human senses and understanding?

Real World Context

- Students will be required to watch the evening news and record the weekly weather and temperature. The class will construct a report to submit as a final product.

Learning Targets/Goals

Students will know…

- Evaluating the explanations proposed by others involves examining and comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.

- The practice of science and the development of technology are critical pursuits of our society.
- Descriptions, explanations, predictions, and models are developed using evidence, logic and inference.
- Global weather data from ground measurements, satellites and radar are recorded on maps, analyzed, and used to predict local weather

.

- Ocean currents, global winds, and storm systems, redistribute heat energy on Earth's surface and therefore affect weather and long-term climatic patterns of a region
- Science is a human endeavor involving knowledge learned through inquiring about the natural world. Scientific claims are evaluated and knowledge changes as a result of using the abilities and understandings of inquiry. The pursuit of scientific knowledge is a continuous process involving diverse people throughout history. The practice of science and the development of technology are critical pursuits of our society.
- A valid investigation controls variables. Different experimental designs and strategies can be developed to answer the same question.
- Advances in technology can expand the body of scientific knowledge. Technological tools allow people to observe objects and phenomena that otherwise would not be possible. Technology enhances the quality, accuracy, speed and analysis of data gathered.
- Scientists formulate, test, and document explanations of nature using observation, experimentation, and theoretical and mathematical models.

Students will be able to… (21st century skills)

- Observe, measure, and predict changes in weather using atmospheric properties (wind speed and direction, cloud cover and type, temperature, dew point, air pressure, and relative humidity). Describe how air pressure and temperature change with increasing altitude and/or latitude.
- Explain how uneven heating of Earth's components – water, land, air – produce local and global atmospheric and oceanic movement. Describe how these local and global patterns of movement influence weather and climate.
- Investigate the rate at which different Earth materials absorb heat. Explain how these differences in heat absorption causes air pressure differences that result in convection currents (i.e., local land and sea breezes).
- Use a variety of models, charts, diagrams, or simple investigations to explain how the Sun's energy drives the cycling of water through the Earth's crust, oceans, and atmosphere.
- Examine maps of ocean currents and trace the origin and flow of such currents to explain the transfer of heat energy. Identify which currents have dominant influence on the Delaware coast.

- Differentiate between weather, which is the condition of the atmosphere at a given time, and climate, which is the weather averaged over a long period of time.

- Discuss the origin and identify characteristics (i.e., air circulation pattern, wind speed, temperature and dew point, and air pressure) of storm systems including hurricanes, Nor' easters, tornadoes, thunderstorms, and mid-latitude cyclones. Explain how these weather events can transfer heat. Describe the environmental, economic, and human impact of these storms.

- Compare and contrast different storm systems in terms of size, formation, and associated weather

- Describe how origin affects the temperature and moisture content of an air mass.

- Describe how the interaction of air masses produces different fronts (warm, cold, and stationary) that influence our weather.

- Describe how the formation of clouds is influenced by the dew point, environmental temperature and amount of particles in the air. Explain how various lifting mechanisms affect cloud formation.

- Use cloud characteristics (altitude, composition, and form) to predict the weather.

- Discuss how different cloud types are indicators of weather and weather systems such as frontal systems and hurricanes.

- Examine isobars on weather maps to describe how wind (moving air) travels from a region of high pressure to a region of low pressure. Apply this knowledge to explain the cause of wind.

- Record and interpret daily weather measurements over an extended period of time using a variety of instruments (i.e., barometer, anemometer, sling psychrometer, rain gauge and thermometer) in order to predict and to identify weather patterns.

- Construct and use surface station models to represent local atmospheric data and interpret weather patterns on meteorological maps.

- Examine satellite imagery pictures and use these images to identify cloud patterns and storm systems.

- Use weather maps to describe the movement of fronts and storms and to predict their influence on local weather.

    - To form explanations based on accurate and logical analysis

- Revise explanations using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.

- Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.
- Design and conduct investigations with controlled variables to test the hypothesis
- Accurately collect data through the selection and use of tools and techniques
- appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students.

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task

The Weather unit is assessed through the use of an end of the unit summative assessment. This assessment is intended to uncover student misconceptions which will then inform instruction. Both the student guide and teacher rubrics are included. To access the end of the unit assessment, go to the web site listed below. Click on the Delaware Science Comprehensive Assessment Program.

http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Rubrics for Transfer Tasks

Go to: http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Performance Task

	4	3	2	1
Description of work submitted in by student.	Each question of the lab packet is attempted and work is legible.	Work is submitted late. Each question is attempted and work is legible.	Work is submitted in on time/late and work is neat and legible however, much of the lab packet is left blank.	Work is sloppy, packet is in poor condition (unprofessional) and incomplete.

Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations)
All copies can be found in Appendix A.
Formative Assessments:

Summative Assessments:
(Included at the end of this document.)

Student Self-Assessment and Reflection

Teachers are encouraged to have students keep journals. These journals would include weather data collected, notes from the class, lab rough drafts, drawings and short response answers to questions throughout the unit. Reflection throughout the unit will be recorded in the journal.
Students use warm up/quick write/bell ringer questions to help monitor their learning throughout the unit. This information is also recorded in the student journal.

Instructional Resources

Activity 1: What is a Hurricane?
This is a role playing activity designed as a “hook” to get students thinking about the importance of weather forecasting on their lives. Students will explore severe weather in greater depth in Activity 16, so there is not need to focus on the science of hurricanes at this time.

Activity 2: Predicting Weather with Folklore
This activity is designed to address common misconceptions about the accuracy of weather forecasting based on folklore. The point to be made in this activity is that while some folklore has no predictive value, some beliefs can be useful because they are based on the same scientific principles meteorologists use every day. While weather forecasting is not always accurate, our probability of making a correction prediction is intimately bound to our continued exploration and understanding of the science behind atmospheric processes.

Activity 3: How Can The Local State of the Atmosphere Be Described?
This activity asks students to gather and display data that describes the local state of the atmosphere for a given time. This data is analyzed and used to discover patterns that can be used to predict future weather events. Students will be collecting data on variables of which they may have little or no knowledge. There is no need to define terms at this point. Subsequent activities will develop the concepts as needed.

Activity 4: How Can Different Types Of Clouds Be Identified?
This activity is designed to have students identify and classify clouds according to height and form. Students should be able to use the key provided to identify clouds in the sky. It is not necessary for students to memorize cloud types or be able to make identification without a key. Cloud types will be used in a future activity to help predict weather, so students should begin familiarizing themselves with them now.

Activity 5: How Do Meteorologists Organize Their Weather Data Using Station Models?
Students are asked to create station models in this activity. Station Models are graphic representations of local weather information that allow the student to see, in an easy to read format, the atmospheric variables they have been collecting. In later activities, station models will be used to interpret weather patterns on meteorological maps.

Activity 6: How Does the Sun Heats Earth’s Surface?
In previous activities, students collected data on variables that described the state of the atmosphere at their location. This activity explores how different Earth surfaces affect air temperature. The big idea is that the Sun’s energy warms Earth’s surface, which in turn heats the air above it. Different Earth

materials absorb heat at different rates. In later activities students learn that this differential heat absorption sets up pressure differences that cause air movement and cloud formation.

Activity 7: How Do Temperature and Pressure Differences Affect Air Movement on Earth's Surface?
This activity builds upon the idea that different Earth surfaces heats at different rates and in doing so create pressure differences that in turn create winds. Students will see that local land and sea breezes are caused by differentially heated air moving from high to low pressure. The student activity in part 1 demonstrates that air rises when heated. In part 2, the teacher demonstration relates hot rising air to low surface pressure. In part 3 students begin to see that air moves as a response to pressure differences. Students begin to see how air can move horizontally in part 4. Convection cells are introduced and students are asked to relate their findings from activity 6 to help explain land and sea breezes.

Activity 8: What Ingredients Are Needed To Make A Cloud?
This activity is designed to have students discover the necessary ingredients and conditions that must exist for a cloud to form. Part 1 begins by relating clouds to the convection process and then having students determine that cloud formation depends on the presence of water vapor that cools and condenses on the available particles. For demonstration purposes, ice cubes are used to cool the air. However in actual circumstances, air is cooled by a pressure decrease with altitude. This concept is explored in part 2.

Activity 9: What Happens To Air when It Is Cooled?
This activity is related to the previous cloud's activity in that it helps students understand the conditions required for condensation to occur. It develops the idea that the amount of water vapor in the air is related to the dew point and air must be cooled to the dew point for condensation to occur.

Activity 10: What Is Relative Humidity?
Clouds form when the air temperature drops to meet the dew point. When this happens the relative humidity is said to be 100 %. Part 1 is designed to introduce the relationship between relative humidity, dew point, and air temperature. Students typically have difficulty distinguishing between the amount of water vapor air *can* hold and the amount of water vapor air *actually has* at a given temperature. Calculation of relative humidity is easier once these ideas have been mastered.

Activity 11: How Do Clouds Form From Rising Air?
Part 1 of this activity is an application of previous understandings about cloud development. Students are required to determine the height that convective clouds form. They need to know how properties of air change with altitude as well as how condensation forms. In part 2, students apply the principles of cloud formation to fog.

Activity 12: Where Does The Water In The Air Come From?
Water is necessary for cloud formation. Therefore this activity presents an opportunity for students to build a model water cycle to explore where the water comes from for cloud formation. An emphasis should be placed on how energy flows within the cycle. This information is a necessary prerequisite for understanding global energy transfer in future activities. Also, it should be emphasized that heat energy can be transferred by the processes of radiation and convection.

Activity 13: How Can Local Atmospheric Data Be Used To Forecast Weather?

In this activity, students analyze the daily weather data they have been collecting. They will look at the weather graphs they created to find relationships between atmospheric variables and weather patterns. They should see, for example, that low pressure trends are usually associated with precipitation. They will learn to use a set of rules to forecast local weather.

Activity 14: How Can Weather Maps Be Used To Make An Extended Weather Forecast?
Students in previous activities have explored local atmospheric variables and then used patterns in these variables to forecast short-term local weather. However, additional information is needed about large-scale weather patterns to increase accuracy and make an extended forecast. This activity shows the effect mid-latitude cyclones have on local weather and how satellite pictures can aid forecasting by tracking these cyclones over time.

Activity 15: A Closer Look at Weather Stations
This activity is an extension of activity 14 and explores how cyclones and associated fronts are formed from moving air masses. Also, the different types of weather associated with fronts are explored in more detail. Students are given a device called the Weather cycler to help them find the weather at different parts of the system.

Activity 16: How Do Mid-Latitude Cyclones and Hurricanes Distribute Earth's Heat?
This activity explores how mid-latitude cyclones and hurricanes transfer heat energy from lower to higher latitudes. Students study characteristics of thunderstorms, tornadoes and northeasters and see how the heat stored by the process of evaporation is transferred over the Earth's surface and released by condensation in storm systems.

Activity 17: Global Temperature and Latitude
Students learned in activity 16 that heat moves from the equator to the poles. Students in this activity will see that without this heat movement global temperatures would differ significantly from what they are today. Students will explore how average yearly temperatures change with latitude. Then they will describe Earth's heat budget in terms of the difference between heat loss and gain at different locations.

Activity 18: Winds and Ocean Currents as Heat Moves
Students in previous activities learned that storms could move heat energy around the globe. This activity explores the role of winds and ocean currents as primary heat movers. Global wind systems are described as convection cells that are influenced by Earth's rotation. Students should know the direction of the westerly and trade winds since these winds are most likely to affect them personally. Rising air at the equator accounts for rain. Sinking air at approximately 30°north and south latitudes is dry and in many cases associated with deserts. Ocean currents are traced and related to wind systems. The heat capacity of water and the effect of oceans on climate also are explored.

Activity 19: What is Climate?
Part 1 distinguishes climate from weather while part 2 explores the effects of latitude, elevation, and proximity to water on a location's climate.

*This unit is meant to be taught in a 9-10 week format. Here is a suggested timeframe on a regular schedule with 40-55 minute class periods. Students will also graph and analyze weather data on a weekly basis after week 1. This may add a few additional class periods if student understanding is not adequate.

Monday	Tuesday	Wed.	Thurs	Friday
Activity 1	**Activity 1**	**Activity 1**	**Activity 2**	**Activity 3**
Activity 4	**Activity 4**	**Activity 5**	**Activity 5**	**Formative assessment using weather data, graphs and station models**
Activity 6	**Activity 6**	**Activity 7**	**Activity 7**	**Land and Sea breeze assessment and analyze the weeks weather data**
Activity 8	**Activity 9**	**Activity 10**	**Bring together ideas of 9,10 Formative assessment**	**Review weeks weather data Begin Activity 11**
Activity 11	**Activity 12**	**Activity 13**	**Activity 13**	**Activity 14**
Activity 14	**Activity 14**	**Activity 15**	**Activity 15**	**Activity 15**
Activity 16	**Activity 16**	**Activity 16 Student review of storms and formative assessment using Perfect storm data**	**Activity 16 Tie all the information together**	**Activity 17**
Activity 17	**Activity 18**	**Activity 18**	**Activity 18**	**Assessment on influence of wind and ocean currents**
Activity 19	**Activity 19**	**Review of unit**	**Summative Assessment**	**Summative assessment**

Differentiation

The use of group activities throughout this unit enables students with difficulty to gain insight from fellow classmates. Pair them with strong students.

The use of computers and internet are great tools to complete activities and gain additional insight on topics students may be uncomfortable with.

Lab demonstrations and lab activities students participate in.

Extended time to finish activities.

KWL technique

Review previous day’s lesson and continuously reinforce concepts from the unit.

Weekly graphing and analysis of weather data allow for ample time to gain understanding of weather patterns.

Permit the apt student to accelerate their rate of progress and work independently on some content.

Pre test students to determine their prior knowledge and misconceptions

Students may use graphic organizers, maps and diagrams to effectively facilitate differing levels of cognitive processing for students of different ability levels.

Enrichment

- **What text/print/media/kit/web resources best support this unit?**

The coalition unit Weather includes web resources and background information for both the teacher and student to use throughout the unit.

Web sites

www.wunderground.com
http://weathereye.kgan.com/expert/hurricane/index.html
http://www.sun-sentinel.com/news/custom/sfl-inttrackmap,0,1486873.htmlstory

Pensacola geography

http://weathereye.kgan.com/expert/hurricane/olivia_weareat.html

Day 2 (October 1)
http://weathereye.kgan.com/expert/hurricane/olivia_fishing.html

Day 3 (October 2)
http://weathereye.kgan.com/expert/hurricane/olivia_day3.html

Day 4 (October 3)
http://weathereye.kgan.com/expert/hurricane/olivia_day4.html

Day 5 early morning (October 4)
http://weathereye.kgan.com/expert/hurricane/olivia_day5.html

Using the web site below, show the actual effects of hurricane "Opal" on Pensacola Beach. The username is Teacher. The password is Teach.

http://weathereye.kgan.com/expert/hurricane/private/aftermath1.html

The Farmer's almanac is a great web site to get weather predictions and additional folklore. The site is

www.almanac.com

Cloud Pictures Web site:
http://snrs.unl.edu/amet351/noehrenberg/cloudclassification.html
http://vortex.plymouth.edu/clouds.html

Station Model tutorial from website at
http://www.hpc.ncep.noaa.gov/html/stationplot_printer.html
Surface plotting machine website at

http://www.stormchaser.niu.edu/machine/surface.html

Following is a great web site showing animation of land and sea breezes.

http://www.classzone.com/books/earth_science/terc/content/visualizations/es1903/es1903page01.cfm?chapter_no=visualization

Refer to the following websites for visuals on different types of fog:
Web site #3: http://www.usatoday.com/weather/tg/wfallfog/wfallfog.htm
Web Site #4: http://www.usatoday.com/weather/tg/wadvfog/wadvfog.htm

Web sites to look at the water cycle:
http://www.kidzone.ws/water/

http://ga.water.usgs.gov/edu/watercycle.html

http://www.epa.gov/safewater/kids/flash/flash watercycle.html

are:

Quick Reference Weather Forecast Chart
Web Site:
www.wunderground.com/cgi-bin/findweather/getForecast?query=19901

Cloud Pictures Web site:
http://snrs.unl.edu/amet351/noehrenberg/cloudclassification.html
http://vortex.plymouth.edu/clouds.html

Station Model tutorial from website at
http://www.hpc.ncep.noaa.gov/html/stationplot_printer.html
Surface plotting machine website at
http://www.stormchaser.niu.edu/machine/surface.html

http://www.spc.ncep.noaa.gov/faq/tornado/beaufort.html

http://www.zetnet.co.uk/sigs/weather/Met_Codes/beaufort.htm

Following is a great web site showing animation of land and sea breezes.

http://www.classzone.com/books/earth_science/terc/content/visualizations/es1903/es1903page01.cfm?chapter_no=visualization

Web site #1: http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cld/dvlp/upw.rxml
Web site #2:

http://www.classzone.com/books/earth_science/terc/content/visualizations/es1803/es1803page01.cfm?chapter_no=visualization

Web site #3: http://www.usatoday.com/weather/tg/wfallfog/wfallfog.htm
Web Site #4: http://www.usatoday.com/weather/tg/wadvfog/wadvfog.htm

House/Bubble illustration

Have students look at web sites #3 & 4 below to learn how radiation and advection fog form.

http://www.usatoday.com/weather/tg/wfallfog/wfallfog.htm

http://www.usatoday.com/weather/tg/wadvfog/wadvfog.htm

Web sites to look at the water cycle:
http://www.kidzone.ws/water/

http://ga.water.usgs.gov/edu/watercycle.html

http://www.epa.gov/safewater/kids/flash/flash watercycle.html

Quick Reference Weather Forecast Chart
Web Site:
www.wunderground.com/cgi-bin/findweather/getForecast?query=19901

To find out more about these satellite images and see examples of each, go to
http://weather.unisys.cm/satellite/details.html
http://weather.unisys.com/

http://weather.unisys.com/
: http://nmviewogc.cr.usgs.gov/viewer.htm

http://weather.unisys.com/info/wxp_legend.gif

http://weather.unisys.com/satellite/details.html
www.weather.unisys.com/satellite/details.html

http://nmviewogc.cr.usgs.gov/viewer.htm
http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cyc/wnd.rxml

Weathercycler from the kit
Website:
http://www.classzone.com/books/earth_science/terc/content/investigations/es2003/es2003page03.cfm

http://www.classzone.com/books/earth_science/terc/content/investigations/es2003/es2003page03.cfm

http://www.nssl.noaa.gov/edu/safety/tornadoguide.html http://www.nssl.noaa.gov/edu/safety/tornadoguide.html

http://www.usatoday.com/weather/resources/basics/thunderstorms.htm

http://www.fema.gov/kids/thunder.htm

http://www.mcwar.org/articles/noreasters/NorEasters.html

http://www.nhoem.state.nh.us/mitigation/section_iii.htm (site with information on various types of storms)

How a hurricane forms:
http://www.nhoem.state.nh.us/mitigation/Hurricane%20Formation%20Graphic.gif
http://www.nhoem.state.nh.us/mitigation/Hurricane%20Structure%20Graphic.gif
Great background on hurricanes
http://hurricanes.noaa.gov/
http://hurricanes.noaa.gov/pdf/hurricanebook.pdf

http://www.fi.edu/weather/events/video/tornado.mov

Have students observe the animation below
http://observe.arc.nasa.gov/nasa/earth/hurricane/form.html
http://www.ecnnews.com/storm/webstorm.htm

Hurricane names: Using the following websites, find out how hurricanes are named in different places around the world.
http://www.nhc.noaa.gov/aboutnames.shtml

http://www.fema.gov/kids/hunames.htm

http://www.windows.ucar.edu/cgi-bin/tour def/earth/Water/ocean currents.html for more information on ocean currents.

http://www.cloudwall.com/wind/over/overview.htm

http://www.newmediastudio.org/DataDiscovery/Hurr_ED_Center/Easterly_Waves/Trade_Winds/Trade_Winds.html

http://www.atmosphere.mpg.de/enid/4a11eacea4207e22ea1ae346c68a2d3b,55a304092d09/1ml.html
Look at the Coriolis effect shown in the animation below.

http://www.bigelow.org/virtual/handson/coriolis.mov
http://www.baesi.org/TRG/coriolis/coriolis2.mov
http://www.cloudwall.com/wind/turn/spinning.htm

Below are some web sites to look at factors that influence climate and extreme weather conditions that have occurred around the world.

http://www.noaanews.noaa.gov/stories2006/s2753.htm

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/prelude_to_ensofaq.shtml

http://www.ncdc.noaa.gov/oa/climate/severeweather/extremes.html
extreme weather conditions and climate changes

http://www.usatoday.com/weather/tg/wetnino/wetnino.htm

http://www.cpo.noaa.gov/cpo/news/story_092006-hurricanesclimatechange.pdf
great web site on the influence of climates on hurricanes

The following website includes an excellent activity on El Nino:

http://sealevel.jpl.nasa.gov/education/make-your-own-el-nino.html

http://sealevel.jpl.nasa.gov/education/el-nino-poster.html

http://sealevel.jpl.nasa.gov/education/el-nino-skit.html

Stage 3: Learning Plan

Key learning tasks needed to achieve unit goals

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Activity 1: What is a Hurricane?
This is a role playing activity designed as a "hook" to get students thinking about the importance of weather forecasting on their lives. Students will explore severe weather in greater depth in Activity 16, so there is not need to focus on the science of hurricanes at this time.

Activity 2: Predicting Weather with Folklore
This activity is designed to address common misconceptions about the accuracy of weather forecasting based on folklore. The point to be made in this activity is that while some folklore has no predictive value, some beliefs can be useful because they are based on the same scientific principles meteorologists use every day. While weather forecasting is not always accurate, our probability of making a correction prediction is intimately bound to our continued exploration and understanding of the science behind atmospheric processes.

Activity 3: How Can The Local State of the Atmosphere Be Described?
This activity asks students to gather and display data that describes the local state of the atmosphere for a given time. This data is analyzed and used to discover patterns that can be used to predict future weather events. Students will be collecting data on variables of which they may have little or no knowledge. There is no need to define terms at this point. Subsequent activities will develop the concepts as needed.

Activity 4: How Can Different Types Of Clouds Be Identified?
This activity is designed to have students identify and classify clouds according to height and form. Students should be able to use the key provided to identify clouds in the sky. It is not necessary for students to memorize cloud types or be able to make identification without a key. Cloud types will be used in a future activity to help predict weather, so students should begin familiarizing themselves with them now.

Activity 5: How Do Meteorologists Organize Their Weather Data Using Station Models?
Students are asked to create station models in this activity. Station Models are graphic representations of local weather information that allow the student to see, in an easy to read format, the atmospheric variables they have been collecting. In later activities, station models will be used to interpret weather patterns on meteorological maps.

Activity 6: How Does the Sun Heats Earth's Surface?
In previous activities, students collected data on variables that described the state of the atmosphere at their location. This activity explores how different Earth surfaces affect air temperature. The big idea is that the Sun's energy warms Earth's surface, which in turn heats the air above it. Different Earth materials absorb heat at different rates. In later activities students learn that this differential heat absorption sets up pressure differences that cause air movement and cloud formation.

Activity 7: How Do Temperature and Pressure Differences Affect Air Movement on Earth's Surface?
This activity builds upon the idea that different Earth surfaces heats at different rates and in doing so create pressure differences that in turn create winds. Students will see that local land and sea breezes are caused by differentially heated air moving from high to low pressure. The student activity in part 1 demonstrates that air rises when heated. In part 2, the teacher demonstration relates hot rising air to low surface pressure. In part 3 students begin to see that air moves as a response to pressure differences. Students begin to see how air can move horizontally in part 4. Convection cells are introduced and students are asked to relate their findings from activity 6 to help explain land and sea breezes.

Activity 8: What Ingredients Are Needed To Make A Cloud?
This activity is designed to have students discover the necessary ingredients and conditions that must exist for a cloud to form. Part 1 begins by relating clouds to the convection process and then having students determine that cloud formation depends on the presence of water vapor that cools and condenses on the available particles. For demonstration purposes, ice cubes are used to cool the air. However in actual circumstances, air is cooled by a pressure decrease with altitude. This concept is explored in part 2.

Activity 9: What Happens To Air when It Is Cooled?

This activity is related to the previous cloud's activity in that it helps students understand the conditions required for condensation to occur. It develops the idea that the amount of water vapor in the air is related to the dew point and air must be cooled to the dew point for condensation to occur.

Activity 10: What Is Relative Humidity?
Clouds form when the air temperature drops to meet the dew point. When this happens the relative humidity is said to be 100 %. Part 1 is designed to introduce the relationship between relative humidity, dew point, and air temperature. Students typically have difficulty distinguishing between the amount of water vapor air *can* hold and the amount of water vapor air *actually has* at a given temperature. Calculation of relative humidity is easier once these ideas have been mastered.

Activity 11: How Do Clouds Form From Rising Air?
Part 1 of this activity is an application of previous understandings about cloud development. Students are required to determine the height that convective clouds form. They need to know how properties of air change with altitude as well as how condensation forms. In part 2, students apply the principles of cloud formation to fog.

Activity 12: Where Does The Water In The Air Come From?
Water is necessary for cloud formation. Therefore this activity presents an opportunity for students to build a model water cycle to explore where the water comes from for cloud formation. An emphasis should be placed on how energy flows within the cycle. This information is a necessary prerequisite for understanding global energy transfer in future activities. Also, it should be emphasized that heat energy can be transferred by the processes of radiation and convection.

Activity 13: How Can Local Atmospheric Data Be Used To Forecast Weather?
In this activity, students analyze the daily weather data they have been collecting. They will look at the weather graphs they created to find relationships between atmospheric variables and weather patterns. They should see, for example, that low pressure trends are usually associated with precipitation. They will learn to use a set of rules to forecast local weather.

Activity 14: How Can Weather Maps Be Used To Make An Extended Weather Forecast?
Students in previous activities have explored local atmospheric variables and then used patterns in these variables to forecast short-term local weather. However, additional information is needed about large-scale weather patterns to increase accuracy and make an extended forecast. This activity shows the effect mid-latitude cyclones have on local weather and how satellite pictures can aid forecasting by tracking these cyclones over time.

Activity 15: A Closer Look at Weather Stations
This activity is an extension of activity 14 and explores how cyclones and associated fronts are formed from moving air masses. Also, the different types of weather associated with fronts are explored in more detail. Students are given a device called the Weathercycler to help them find the weather at different parts of the system.

Activity 16: How Do Mid-Latitude Cyclones and Hurricanes Distribute Earth's Heat?

This activity explores how mid-latitude cyclones and hurricanes transfer heat energy from lower to higher latitudes. Students study characteristics of thunderstorms, tornadoes and northeasters and see how the heat stored by the process of evaporation is transferred over the Earth's surface and released by condensation in storm systems.

Activity 17: Global Temperature and Latitude
Students learned in activity 16 that heat moves from the equator to the poles. Students in this activity will see that without this heat movement global temperatures would differ significantly from what they are today. Students will explore how average yearly temperatures change with latitude. Then they will describe Earth's heat budget in terms of the difference between heat loss and gain at different locations.

Activity 18: Winds and Ocean Currents as Heat Moves
Students in previous activities learned that storms could move heat energy around the globe. This activity explores the role of winds and ocean currents as primary heat movers. Global wind systems are described as convection cells that are influenced by Earth's rotation. Students should know the direction of the westerly and trade winds since these winds are most likely to affect them personally. Rising air at the equator accounts for rain. Sinking air at approximately 30°north and south latitudes is dry and in many cases associated with deserts. Ocean currents are traced and related to wind systems. The heat capacity of water and the effect of oceans on climate also are explored.

Name: School:

Date: District:

Weather & Climate Summative Assessment

Section 1

Monday

Early one November morning in Dover, Delaware, Marie and her brother Don got up and started their normal routine to get ready for school. Don let the dog out and noticed that it was foggy outside. Don ran to tell Marie how dense the fog was. Marie turned on the weather channel to see what to wear. The meteorologist reported the current weather conditions:

"The temperature is: 12˚ C/57˚ F, dew point: 12˚ C/57˚ F,
Barometric pressure: 1026 mb, wind speed and direction: 9 km/hr, NNE."

Don exclaimed, "I bet school will start late today because of the fog!"

Marie yelled, "Yeah right, just get ready for school!"

Don said, "**It's really foggy** outside! Even the weatherman says it will take extra time to get to work and school today."

Tuesday

Don got up at the usual time on Tuesday morning and let the dog out. As he opened the back door, the dog disappeared into the mist again, and he figured that it must have been foggy all night. Don ran back into the house and clicked on the television to check the weather and listened as the meteorologist gave the following report:

"The temperature is: 14˚ C/61˚ F, dew point: 14˚ C/61˚ F,
barometric pressure: 1026 mb, wind speed and direction: 8km/hr, NNE."

When Don let the dog back in, the dog shook and water flew everywhere even though it was not raining. Marie suggested they turn on the local news to see if school was delayed before going out and waiting at the bus stop. There was a two-hour delay. The fog lifted at 10:00 a.m.

Wednesday

Marie and Don noticed there was heavy fog for the third day in a row, when they let the dog out. They watched the weather report anticipating another late school opening on Wednesday morning. The report was:

The temperature is: 14˚ C/61˚ F, dew point: 14˚ C/61˚ F,
barometric pressure: 995 mb, and wind speed and direction: 20km/hr, SSW.

1. Why was it foggy in Dover, Delaware, on Monday, Tuesday, and Wednesday mornings?

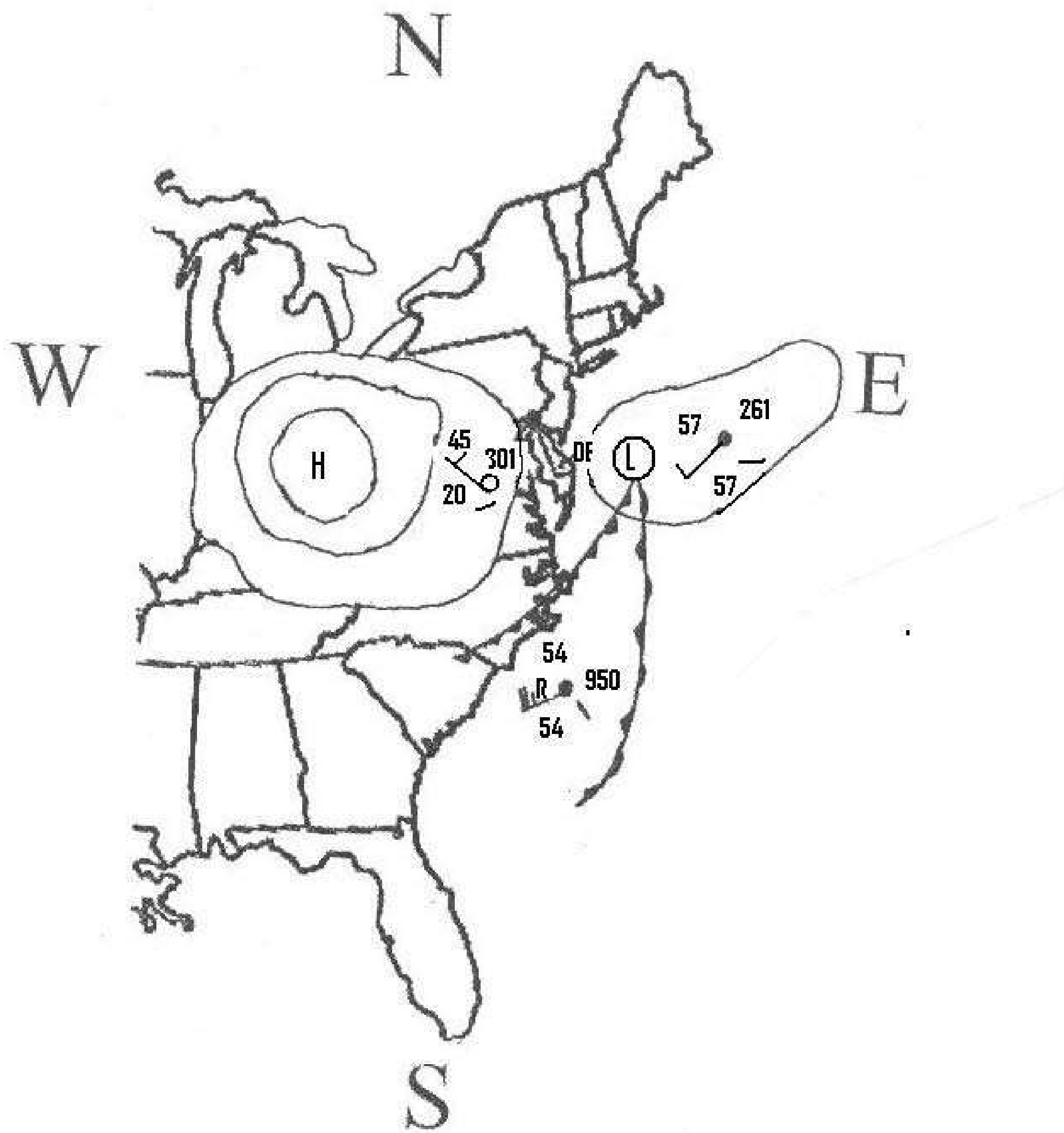
2. Explain why it was no longer foggy at 11o'clock on Tuesday.

3. Construct a data table to represent the weather for Monday, Tuesday, and Wednesday mornings.

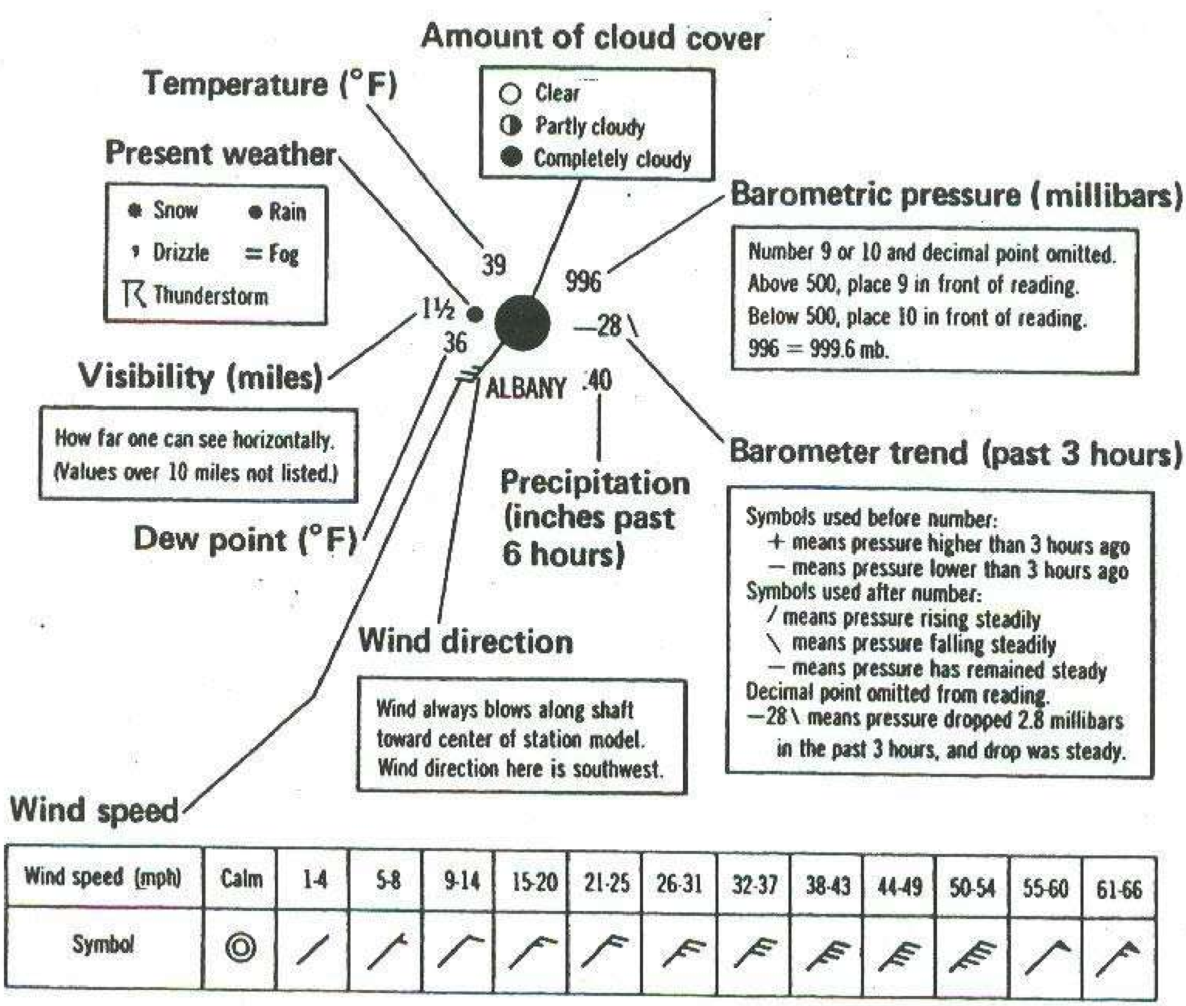
Thursday

On Thursday morning, Marie and Don looked at the newspaper to predict if school would be late due to fog. They studied the map below.

THURSDAY'S WEATHER MAP



4. Refer to Thursday’s weather map. Predict Thursday’s weather for Delaware. Explain your prediction using data from the map. A sample station model is provided below to help you interpret data from Thursday’s weather map.

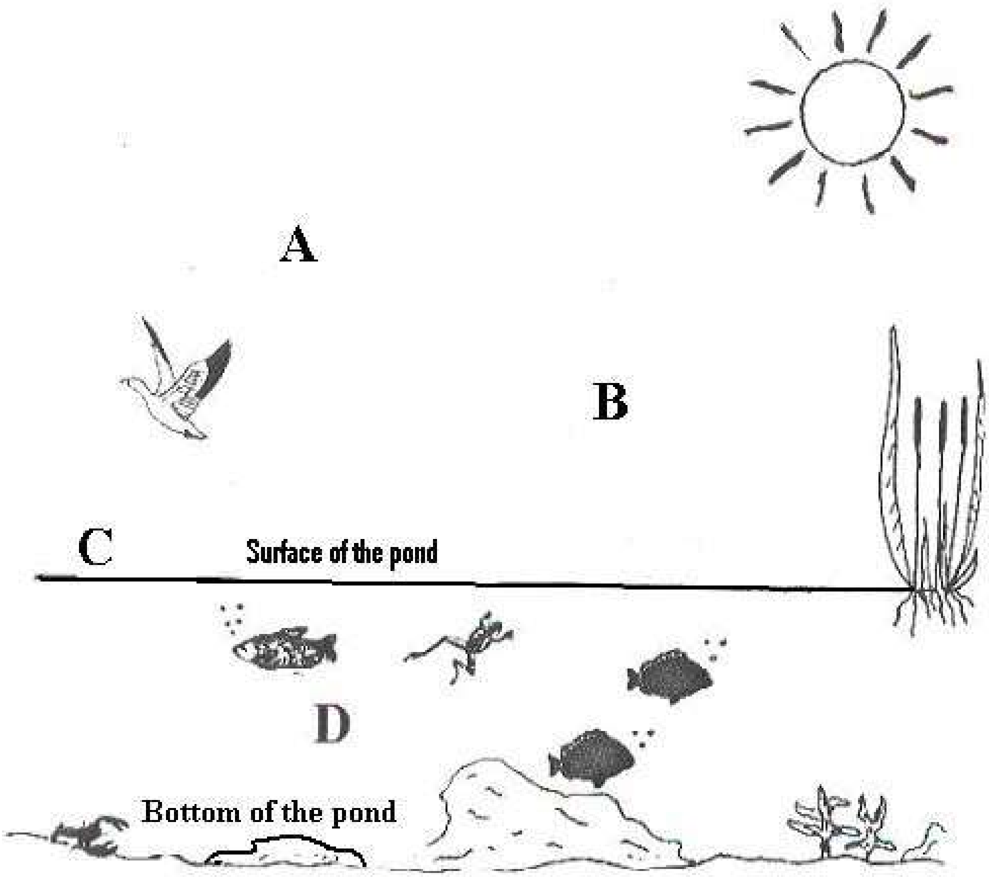


SAMPLE STATION MODEL

5. Look back at your Thursday weather map. Which pressure system will determine Friday's weather conditions? Explain why.

Continue on with Section 2 of the Test on the next page.

Section 2



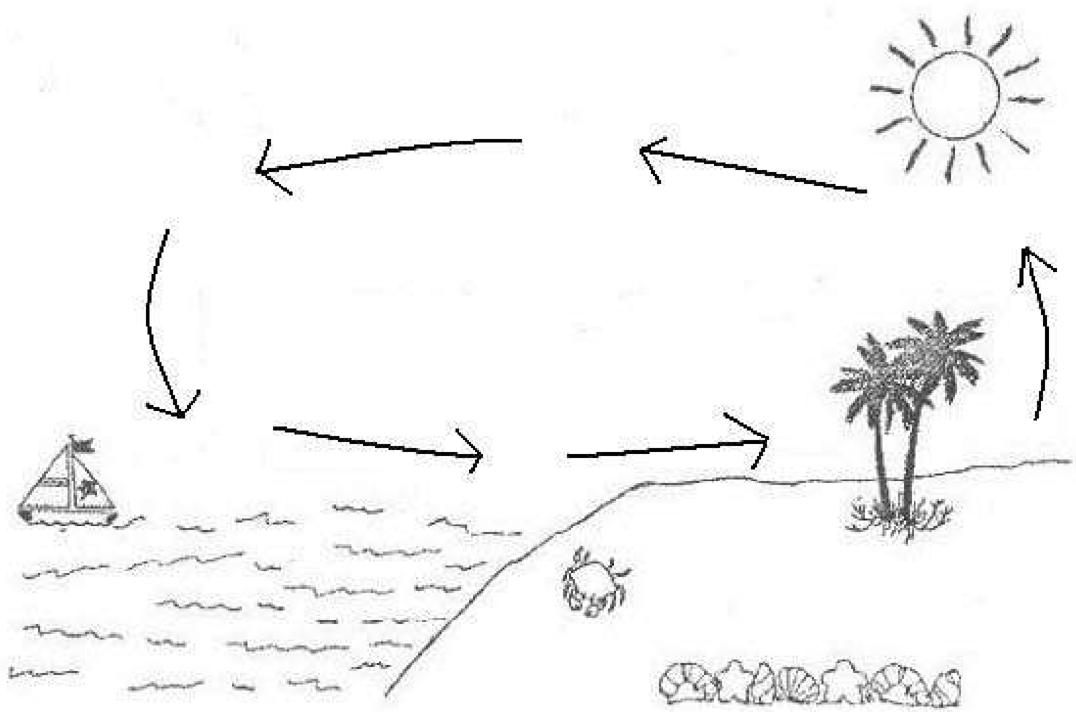
Cross section of pond

6. Choose the letter that shows where evaporation takes place from the pond. Explain what happens to **water particles** in the pond when heated by the sun.

8. Describe how weather and climate are different.

9. Last winter the newspaper reported the mildest January on record in Delaware. Many people concluded from the report that the climate in Delaware must have changed. Based on your knowledge of weather and climate, do you agree or disagree? Explain why.

7. It is a summer day at this beach. Look at the air movement shown by the arrows in the diagram. Use your knowledge of how temperature affects the density of air to explain why the air moves in this way.



8th Grade Weather & Climate Unit
Summative Assessment Rubrics

1. Why was it foggy in Dover, Delaware, on Monday, Tuesday, and Wednesday mornings?

This item measures the student's understanding that there is a pattern and relationship between weather data and atmospheric conditions.

Criterion for a complete response:

1. States that the dew point and air temperature are the same or the humidity is 100%.

Code	Response
	Complete Response
20	States dew point and temperature are the same.
21	States humidity is 100%.
29	Any other correct response.
	Partially Correct Response
10	States condensation is taking place, but does not make connection between humidity or dew point and temperature.
19	Any other partially correct response.
	Incorrect Response
70	States atmospheric pressure "causes fog".
71	States wind "causes fog".
72	States temperature "causes fog".
76	Repeats the questions or some other response already given.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

2. Explain why it was no longer foggy at 11 o'clock on Tuesday.

This item measures the student's understanding of the sun driving the physical changes in the earth's atmosphere.

Criterion for a complete response:

1. As the sun heats the earth's atmosphere, water droplets are changed back to water vapor i.e. evaporation takes place.

Code	Response
	Complete Response
20	Explains the sun heats the earth's atmosphere and water changes from drops to vapor.
21	Explains the sun heats the earth's atmosphere and evaporation takes place.
29	Any other correct response.
	Partially Correct Response
10	Explains that the sun heats the atmosphere but does not include the phase change of water or evaporation.
11	Explains phase change but does not include the role of the sun's energy.
12	Explains evaporation but does not include the role of the sun's energy.
13	Explains temperature and dew point are separate but does not include the role of the sun's energy.
19	Any other partially correct response.
	Incorrect Response
70	Indicates that wind moves vapor away.
71	Indicates that sun lifts water droplets or vapor.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

3.	Construct a data table to represent the weather for Monday, Tuesday, and Wednesday mornings.

This item measures the student's ability to organize and represent data in a data table.

Criteria for a complete response:

1. Constructs a complete data table with 3 sets of daily measurement categories of data, i.e. temperature, pressure, dew point/or humidity, wind direction, and wind speed.
2. Measurements must be correctly paired.
3. Data table must contain appropriate labels, headings, and units.

Code	Response
	Complete Response
20	Meets above criteria.
29	Any other correct response.
	Partially Correct Response
10	Includes headings and units in data table, **but** measurements are not correlated with correct day.
11	Omits headings **or** units in data table and makes no more than two errors in data entry.
19	Any other partially correct response.
	Incorrect Correct Response
70	Makes several errors in data table or labels.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

Reasonable Example: This is a sample of one data table. There are more ways to make a correct data table.

4. Refer to Thursday's weather map. Predict Thursday's weather for Delaware. Explain your prediction using data from the map.

This item measures the student's ability to read and interpret weather maps, and predict weather patterns.

Criterion for a complete response:

1. Makes a weather prediction supported by evidence from the map, e.g., anywhere from partly cloudy to clear, barometer anywhere from 261-301.
   Note: Due to the low pressure system moving off the coast and the high pressure system moving toward Delaware, a complete response would be a prediction using data from the high **or** a prediction using data "between" the two systems.

Code	Response
	Complete Response
20	Meets criterion above.
29	Any other correct response.
	Partially Correct Response
10	Accurately lists indicators of the weather (wind speed, difference between dew point and temperature, rise in barometric pressure) but does not make a weather prediction (fair, clear, or partly cloudy).
11	Indicates clear/fair/partly cloudy weather, but does not support with evidence (barometric pressure rising or dew point and temperature dissimilar.)
19	Any other minimally correct response.
	Incorrect Response
70	States incorrect weather description , example: cloudy, foggy.
71	States readings from the station model.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

5.	Look back at your Thursday weather map. Which pressure system will determine Friday's weather conditions? Explain why.

This item measures the student's ability to read and interpret weather maps, and predict weather patterns.

Criteria for a complete response:

1. Identifies high-pressure system as the system affecting Friday's weather.
2. States that weather systems generally move from West to East (prevailing westerlies.)

Code	Response
	Complete Response
20	Meets both criteria.
21	Meets criteria, but states pressure system moves West to East rather than weather system.
29	Any other correct response.
	Partially Correct Response
10	Identifies high-pressure system.
11	States weather systems generally move West to East.
19	Any other partially correct response.
	Incorrect Response
70	Identifies the low-pressure system.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

6. Choose the letter that shows where evaporation takes place from the pond. Explain what happens to water particles in the pond when heated by the sun.

This item measures student's ability to use the particulate model to explain evaporation and to identify where evaporation takes place in the pond.

Criteria for a complete response:

1. Identifies C as the correct location.
2. Explains that as the sun heats the pond, the water particles move faster and some of the particles move into the atmosphere as water vapor.

Code	Response
	Complete Response
20	Meets criteria above.
29	Any other correct response.
	Partially Correct Response
10	Identifies correct location, but discusses only the increased movement of water particles, not indicating movement into the atmosphere.
11	Identifies correct location, but discusses only the movement of particles into the atmosphere, not increased movement and particles.
12	Identifies the wrong or no location, but discusses the increased movement of water particles, not indicating movement into the atmosphere.
13	Identifies the wrong or no location, but discusses the movement of particles into the atmosphere, not indicating increased movement of particles.
14	Identifies the wrong or no location, but discusses both increased movement of particles and movement of particles into the atmosphere.
19	Any other partially correct response.
	Incorrect Response
70	Identifies wrong or no location, with flawed or no explanation.
71	Identifies correct location, with flawed or no explanation.
72	Explains the water cycle only.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

7.	It is a summer day at this beach. Look at the air movement shown by the arrows in the diagram. Use your knowledge of how temperature affects the density of air to explain why the air moves in this way.

This item measures the student's understanding of convection current. Heated air is less dense and rises; cooler air is more dense and sinks and rushes to take the place of the hotter rising air.

Criteria for a complete response:

1. Explains that the air over the land is warmer, less dense, and rises over the land.
2. Explains that the air over the water is cooler, more dense and sinks.
3. Explains that the cooler, more dense air from the ocean moves toward the land to replace the warm air that has risen.

Code	Response
	Complete Response
20	Meets above criteria.
29	Any other correct response.
	Partially Correct Response
10	Explains the movement of air in terms of temperature differences, but omits density.
11	Explains the movement of air in terms of density differences, but omits temperature.
19	Any other partially correct response.
	Incorrect Response
70	States land is cool and water is warm.
71	States all winds move from West to East.
72	States warm air rises and cold air sinks.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

8. Describe how weather and climate are different.

This item measures the student's ability to distinguish daily weather from the climate of an area.

Criteria for a complete response:

1. Describes weather as immediate atmospheric conditions that change daily.
2. Describes climate as long-term weather conditions for a particular location and/or is more stable and predictable than weather.

Code	Response
	Complete Response
20	Meets the criteria.
29	Any other correct response.
	Partially Correct Response
10	Describes weather correctly, but description of climate omits "for a particular location."
11	Describes weather correctly, but omits or confuses climate.
12	Describes climate correctly, but omits or confuses weather.
19	Any other partially correct response.
	Incorrect Response
70	Discusses weather in terms of temperature, but omits other weather factors.
71	States climate occurs over a short period of time, e.g. month to month, year to year.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

9. One winter the newspaper reported the mildest January on record in Delaware. Many people concluded from the report that the climate in Delaware must have changed. Based on your knowledge of weather and climate, do you agree or disagree? Explain why.

This item measures the student's ability to apply their knowledge of weather and climate to evaluate the validity of a claim.

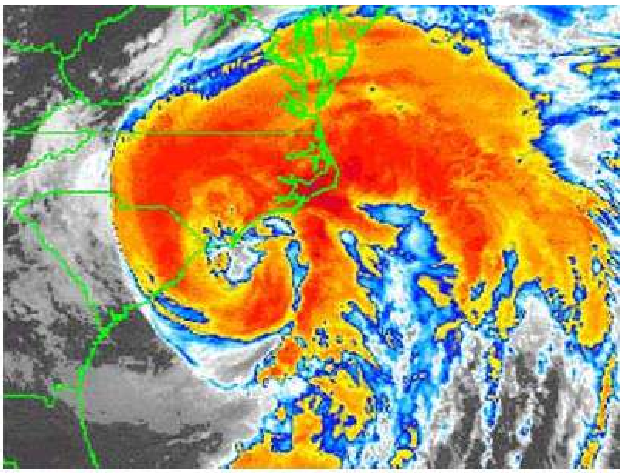
Criteria for a complete response:

1. Disagrees with the public's conclusion that Delaware's climate has changed.
2. Explains that climatic changes can not be based on data from a single month.

Code	Response
	Complete Response
20	Meets above criteria.
29	Any other correct response.
	Partially Correct Response
10	Disagrees, but explanation is vague, e.g. you would need more data.
19	Any other partially correct response.
	Incorrect Response
70	Takes a position with no explanation of the position.
71	Indicates some knowledge of greenhouse effect/global warming without using this information to respond to the question.
72	Agrees with idea of a climate change.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

INVESTIGATION #1: *THE EFFECTS OF HURRICANES ON HUMAN LIVES*

It is 9:00 AM and the sky is very dark. The wind is howling and the rain is falling heavily from the clouded sky. Trees are bending, debris is flying through the air, and water is flooding the roads. You are right in the middle of a large hurricane!



NOAA, Hurricane Bertha

A hurricane is a large storm that originates near the equator of the Earth. It is a storm that is characterized by powerful winds and lots of precipitation. Hurricanes frequently affect residents of Delaware. Many hurricanes make landfall in Florida or in the Carolinas. As they move up the east coast, Delaware experiences high winds and a lot of rainfall.

- Why do Hurricanes start in a region near the equator?
- How are human lives impacted by a hurricane?
- When is it time to issue a hurricane warning or watch?

GOALS: In this lab investigation, you will …

- Describe the environmental, economic, and human impact of huricanes.
- Examine satellite imagery pictures and use these images to monitor a storm system.
- Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.

INVESTIGATION OVERVIEW: **A synopsis of this lesson is as follows…**

The purpose of this investigation is for you to become more aware of the importance and potential high stakes of weather forecasting in everyday life. You will complete hurricane journal entries as you analyze the events surrounding the potential arrival of a category 4 hurricane in Pensacola, Florida. You will follow the development of a real hurricane and debate important issues surrounding the event. Your task is to advise the mayor as to whether or not they should evacuate residents when a hurricane threatens the city.

CONNECTIONS

Scientific Content -

- Mid-Latitude Tropical Cyclones are classified by their wind speeds. A tropical storm has wind speed between 39 miles per hour (mph) and 73 mph. A hurricane has wind speeds of 74 mph or greater.
- Hurricanes are violent, unpredictable storms that impact greatly on the environment and the people with whom they come in contact. A hurricane warning is issued for a specified coastal area when there is a threat of hurricane conditions within 24 hours or less. A hurricane watch is issued for a coastal area when there is a threat of hurricane conditions within 36 hours.
- A storm surge is an abnormal rise in the sea along the shore as a result of the winds and low pressure of a hurricane.
- Meterorologists carefully observe and monitor storms from their early beginnings. Through the use of this data, they can predict where and how the storm will impact a particular region. This prediction can save human lives and minimize economic disasters as a result of the storm damage.

Scientific Process –

- You will be observing data, analyzing the potential danger to island residents and making a decision on whether to evacuate residents of Pensacola Beach due to an impending hurricane.

Math/Graphing –

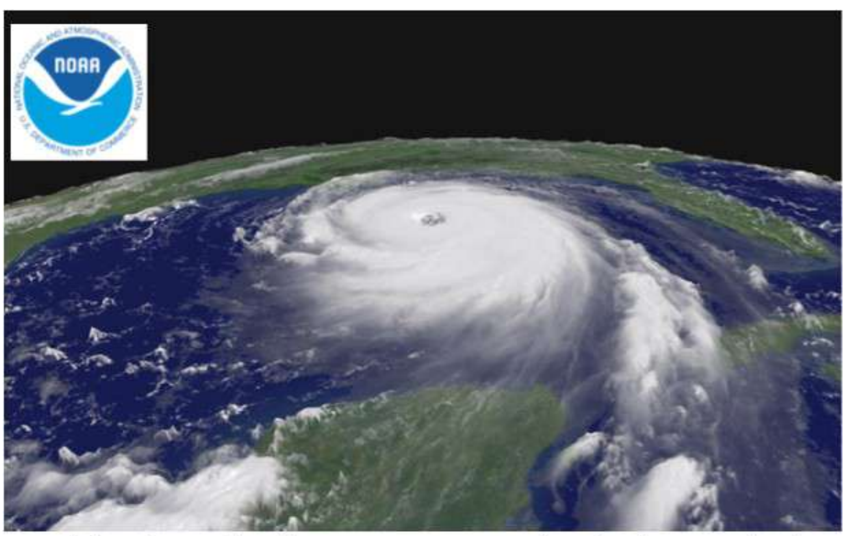
- You will plot hurricane locations on a map of the Gulf of Mexico and Atlantic Ocean area using latitude and longitude.

MAKING SENSE OF WEATHER … WHAT IS A HURRICANE?

A hurricane is a powerful, large, swirling low pressure system that forms over the warm Atlantic ocean. This storm uses heat energy from the ocean to produce wind that moves in a rotating manner. The wind speeds must reach 74 miles per hour (mph) to be classified as a hurricane. Similar storms that form in the Pacific ocean are called typhoons. The strongest hurricanes that affect the east coast or the Gulf of Mexico usually begin as a low pressure system west of Africa. As the storms travel west, moved by surface winds, they may gain strength from the warm ocean water and moist air in this region.

When a hurricane hits land, strong winds, tornadoes, high waves and heavy rains can cause a great deal of damage. Flooding can destroy crops and buildings as well as kill humans and animals. When a hurricane moves over land, its supply of energy disappears and the storm will lose power.

A hurricane watch is issued when a hurricane is likely to hit land within 36-48 hours. As the hurricane gets closer to land, the forecasting becomes more accurate. If the storm worsens when it is 24 hours away from land, a hurricane warning is issued. At this time, people need to secure their property and may need to evacuate and go to a safer place.



A hurricane is a huge storm system that is characterized by its large size and high wind speeds.

Scientists use the Saffir-Simpson scale of storm intensity to rate the hurricanes into five catagories.

Category	Wind Speed	Observed damage	Storm Surge
1	74-95 mph	Branches break off, power lines down	4-5 ft
2	96-110 mph	Small trees down, roof tiles blown off	6-8 ft
3	111-130 mph	Widespread damage; leaves off trees and trees down, small building damage	9-12 ft
4	131-155 mph	Severe damage to windows, roofs, doors.Flooding, heavy damage to buildings near coast	13-18 ft
5	Over 155 mph	Small buildings destroyed, Major damage to all buildings, evacuations required for people living within 10 miles of shoreline.	Over 18 ft

USA TODAY Weather

To see the USA Today Weather Animation, log onto their website:

http://www.usatoday.com/weather/storms/hurricane/ghurricane_scale/flash.htm

HURRICANE OLIVIA

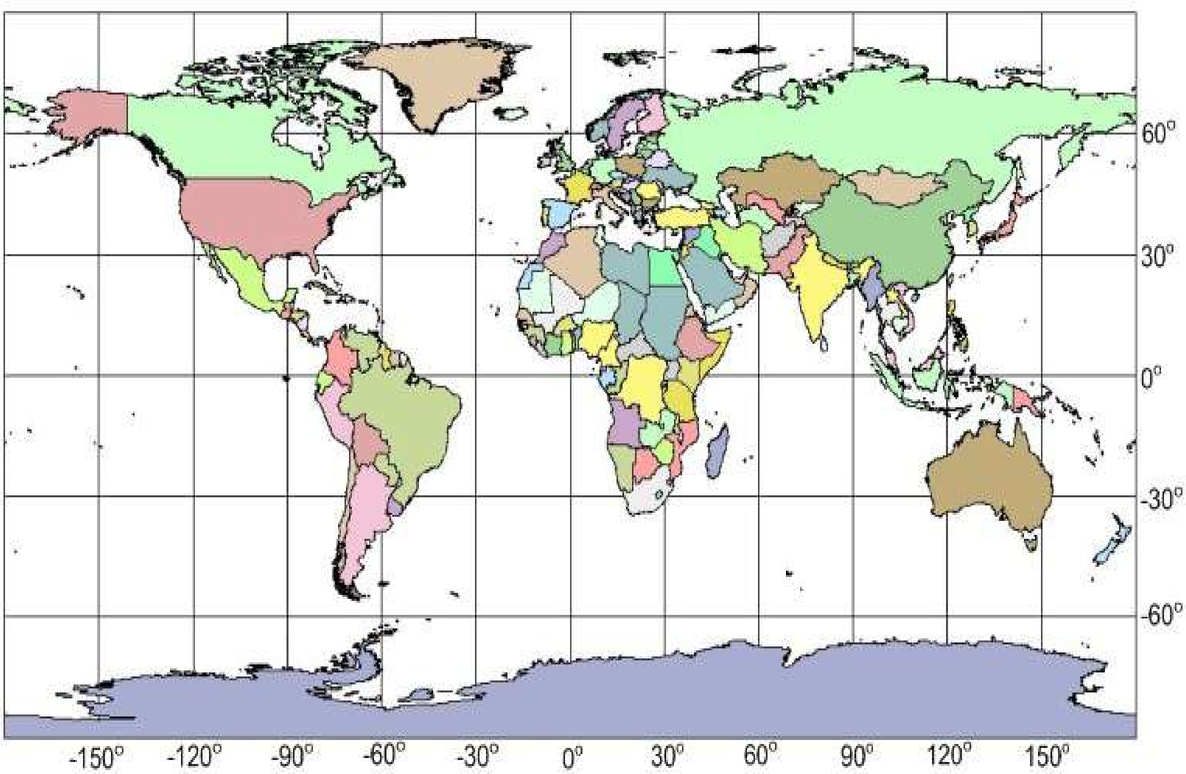
What do you know about hurricanes? In your journal, answer the following questions:

Journal Entry 1 – What personal experience do you have with a hurricane?

Journal Entry 2 – What kind of damage might occur as a result of a hurricane?

Journal Entry 3 – Hurricanes are large storm systems. Describe in your own words the size of a hurricane.

Draw a circle on the world map representing the size of a typical hurricane.



World Map generated by ESRI software

You are an advisor to the mayor of Pensacola Beach Florida and you have been notified that a potential hurricane has been moving in your general direction. While currently it poses no threat to your community you want to follow it closely and be prepared to answer the mayor's questions.

Read the Associated Press release for September 30, 1995 (Saturday)
http://weathereye.kgan.com/expert/hurricane/olivia_born.html

The mayor has heard about the storm and would like to know the following:

1. Where is the storm currently heading?

2. *What preparations are being made in other Gulf communities?*

Review the facts about your community.
http://weathereye.kgan.com/expert/hurricane/olivia_weareat.html

3. *What could happen to Pensacola Beach if a hurricane hits?*

4. *How would evacuation be affected if a hurricane hits the beach?*

Read the Associated Press release for October 1, 1995 (Sunday) Day 2
http://weathereye.kgan.com/expert/hurricane/olivia_fishing.html

Storm Location: Latitude 20.7 º North and Longitude 91.7 º West

5. *The mayor wants to know if plans should be made to evacuate residents. What will you tell him?*

Read the Associated Press release for October 2, 1995 (Monday) Day 3
http://weathereye.kgan.com/expert/hurricane/olivia_day3.html
Storm Location: Latitude 20.9 º North and Longitude 92.4 º West

6. *The mayor wants to know how the storm is currently affecting Mexico.*

7. *What preparation if any would you recommend?*

Read the Associated Press release for October 3, 1995 (Tuesday) Day 4
http://weathereye.kgan.com/expert/hurricane/olivia_day4.html
Storm Location: Latitude 21.1 º North and Longitude 92.5 º West

8. *What are you going to tell the mayor about the status of the storm today? How has it changed?*

9. *How has your hurricane preparation plans changed?*

Read the Associated Press release for early morning October 4, 1995 (Wednesday) Day 5
http://weathereye.kgan.com/expert/hurricane/olivia_day5.html

10. *The mayor wants to know about the storm's intensity and potential damage. What will you tell him?*

11. He wants your opinion on whether he should call for a voluntary or mandatory evacuation of the island. Before you can decide however the city's tourism director and police chief send you a memorandum. **Read the memos and give your opinion to the mayor.**
http://weathereye.kgan.com/expert/hurricane/island_overview.html
http://weathereye.kgan.com/expert/hurricane/island_andhurricanes.html

Read the Associated Press release for 9 am October 4, 1995
http://weathereye.kgan.com/expert/hurricane/olivia_day5a.html

12. *What is the current status of the storm?*

13. *What would be the consequences if residents stayed and the hurricane made a direct hit?*

14. *What would be the consequences if residents evacuated and the storm turned in another direction and never hit the town?*

15. *What is your final recommendation to the mayor? Should residents be forced to evacuate or should they be able to make up their own minds? Be sure to support your decision.*

Look at the satellite picture of Pensacola Beach taken days after October 4, 1995.

16. *Describe the situation on the island when this picture was taken.*

Your teacher will show pictures of Pensacola Beach in the days after October 4, 1995.

17. Summarize for the mayor the effects the hurricane had on your town.

18. Why is it important is it to be able to predict weather accurately?

Summary of Investigation …

In your journal, write a concise summary of this investigation. Be sure to address the following questions and use your data to support your responses.

- ✓ What is a hurricane?
- ✓ How are human lives impacted by a hurricane?
- ✓ When should a watch or warning be issued in case a hurricane is in your area?
- ✓ How is technology used to study hurricanes?

Applying what you have learned …

In 1900, one of the deadliest hurricanes in history hit Galveston, Texas. Hurricane Ike was responsible for an estimated 8,000- 12,000 death. Damage to property was 30 million dollars.

1. Why do you think the death toll was so great?

2. Using what you learned in this investigation, how could a present day hurricane of this strength result in far fewer deaths?

Investigating Further …

NOAA WP-3 Orion Turboprop *Hurricane Hunter* Aircraft

Hurricane hunters are a daring group of pilots who stalk hurricanes in planes filled with weather instruments. Their mission is to fly directly into the eye, measure the power of the hurricane, and send back information to weather centers. Did you know hurricane hunters carry life preservers and life rafts with them and survival gear in case of a crash landing in the ocean?

In 1944 an Army Air Force pilot named Colonel Joseph Duckworth intentionally flew his two-seat plane directly into the eye of a hurricane over Texas. This flight, along with the poor forecasts of impending storms, prompted the military to begin flying into hurricanes for scientific purposes. The information gathered by these brave individuals has increased knowledge of storm systems and has enabled scientists to better predict storms.

Today, pilots from the US Air Force Reserve and the National Oceanic and Amospheric Administration (NOAA) are the only ones to fly into and above hurricanes to study them. Occasionally, research scientists from universities join these flights.

Find out more about these courageous pilots by reaseaching the Internet.

http://www.usatoday.com/weather/hurricane/2003-07-16-flying-hurricanes_x.htm

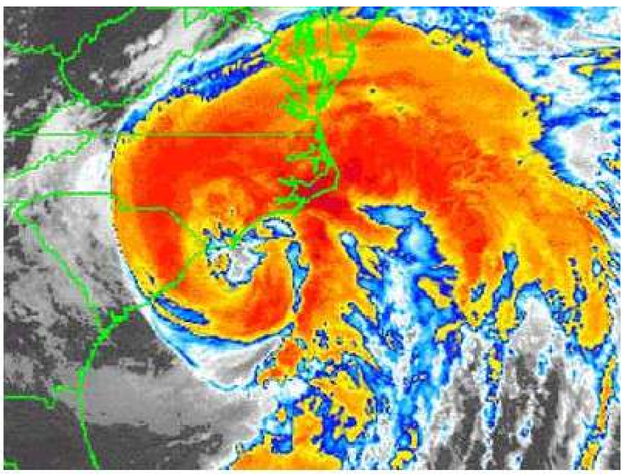
http://www.usatoday.com/weather/storms/hurricanes/2008-08-30-hurricane-hunter_N.htm

Prestige Academy Charter School

TEACHER'S GUIDE

INVESTIGATION #1: *THE EFFECTS OF HURRICANES ON HUMAN LIVES*

It is 9:00 AM and the sky is very dark. The wind is howling and the rain is falling heavily from the clouded sky. Trees are bending, debris is flying through the air, and water is flooding the roads. You are right in the middle of a large hurricane!



NOAA, Hurricane Bertha

A hurricane is a large storm that originates near the equator of the Earth. It is a storm that is characterized by powerful winds and lots of precipitation. Hurricanes frequently affect residents of Delaware. Many hurricanes make landfall in Florida or in the Carolinas. As they move up the east coast, Delaware experiences high winds and a lot of rainfall.

- Why do Hurricanes start in a region near the equator?
- How are human lives impacted by a hurricane?
- When is it time to issue a hurricane warning or watch?

Additional Hurricane Footage that could be used in the lesson introduction:

Select *Natural Disasters*, then *Hurricanes*, then selected video clips

GOALS: In this lab

Investigation, you will …

- Describe the environmental, economic, and human impact of hurricanes.
- Examine satellite imagery pictures and use these images to monitor a storm system.
- Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.

MAIN IDEAS: The important concepts and skills covered in this lesson are …

- Evaluating the explanations proposed by others involves examining and comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.
- Conflicting data or conflicting interpretations of the same data suggest the need for further investigation. Continued investigation can lead to greater understanding and the resolution of the conflict.
- The practice of science and the development of technology are critical pursuits of our society.
- Global weather data from ground measurements, satellites and radar are recorded on maps, analyzed, and used to predict local weather.

INVESTIGATION OVERVIEW: A synopsis of this lesson is as follows…

The purpose of this investigation is for students to become more aware of the importance and potential high stakes of weather forecasting in everyday life. Students will complete hurricane journal entries as they analyze the events surrounding the potential arrival of a category 4 hurricane in Pensacola, Florida. Students will follow the development of a real hurricane and debate important issues surrounding the event. Their task is to advise the mayor as to whether or not they should evacuate residents when a hurricane threatens the city.

CONTEXT: **The concepts that we have been developing and how this lesson serves as the 'next step' can be explained as follows …**

This investigation is meant to "hook" students into thinking about weather from multiple perspectives. It is meant to provide the reason for studying weather systems and the power of being able to predict weather. Later, the topic of climate will arise and students will be asked to decide if a storm system, such as a hurricane, impacts the weather or the climate of a region. The next investigation will enable students to begin collecting the weather data that will enable them to predict weather on a local and global scale.

Role playing can be used in the activity to get students thinking about the importance of weather forecasting on their lives. Students will explore severe weather later in the unit, so there is no need to focus on the science of hurricanes at this time.

CONNECTIONS

Scientific Content -

- Mid-Latitude Tropical Cyclones are classified by their wind speeds. A tropical storm has wind speed between 39 miles per hour (mph) and 73 mph. A hurricane has wind speeds of 74 mph or greater.
- Hurricanes are violent, unpredictable storms that impact greatly on the environment and the people with whom they come in contact. A hurricane warning is issued for a specified coastal area when there is a threat of hurricane conditions within 24 hours or less. A hurricane watch is issued for a coastal area when there is a threat of hurricane conditions within 36 hours.
- A storm surge is an abnormal rise in the sea along the shore as a result of the winds and low pressure of a hurricane.
- Meterorologists carefully observe and monitor storms from their early beginnings. Through the use of this data, they can predict where and how the storm will impact a particular region. This prediction can save human lives and minimize economic disasters as a result of the storm damage.

Scientific Process –

- Students will be observing data, analyzing the potential danger to island residents and making a decision on whether to evacuate residents of Pensacola Beach due to an impending hurricane.

Math/Graphing –

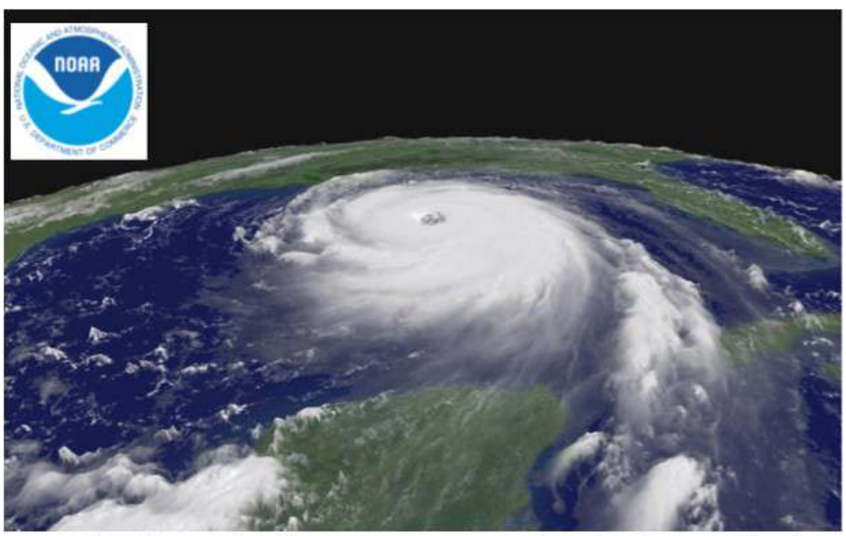
- Students will plot hurricane locations on a map of the Gulf of Mexico and Atlantic Ocean area using latitude and longitude.

MAKING SENSE OF WEATHER … WHAT IS A HURRICANE?

A hurricane is a powerful, large, swirling low pressure system that forms over the warm Atlantic ocean. This storm uses heat energy from the ocean to produce wind that moves in a rotating manner. The wind speeds must reach 74 miles per hour (mph) to be classified as a hurricane. Similar storms that form in the Pacific ocean are called typhoons. The strongest hurricanes that affect the east coast or the Gulf of Mexico usually begin as a low pressure system west of Africa. As the storms travel west, moved by surface winds, they may gain strength from the warm ocean water and moist air in this region.

When a hurricane hits land, strong winds, tornadoes, high waves and heavy rains can cause a great deal of damage. Flooding can destroy crops and buildings as well as kill humans and animals. When a hurricane moves over land, its supply of energy disappears and the storm will lose power.

A hurricane watch is issued when a hurricane is likely to hit land within 36-48 hours. As the hurricane gets closer to land, the forecasting becomes more accurate. If the storm worsens when it is 24 hours away from land, a hurricane warning is issued. At this time, people need to secure their property and may need to evacuate and go to a safer place.



A hurricane is a huge storm system that is characterized by its large size and high wind speeds.

Scientists use the Saffir-Simpson scale of storm intensity to rate the hurricanes into five catagories.

Category	Wind Speed	Observed damage	Storm Surge
1	74-95 mph	Branches break off, power lines down	4-5 ft
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5	Over 155 mph	Small buildings destroyed, Major damage to all buildings, evacuations required for people living within 10 miles of shoreline.	Over 18 ft

To see the USA Today Weather Animation, log onto their website:
http://www.usatoday.com/weather/storms/hurricane/ghurricane_scale/flash.htm

MAKING SENSE OF WEATHER … (FOR TEACHERS)

For most of us, daily weather affects our lives in ways we often take for granted. What often gets our attention is the violent weather associated with tornadoes, hurricanes, and thunderstorms. In this section, we will use this fascination with the destructive power of these big storms as a way to engage students. We hope to capture our student's imagination about weather phenomena and in doing so try to stimulate their thinking about the science behind the weather. Our expectations are that our students ultimately will be able to use their meteorological knowledge to make fairly accurate predictions. We will further explore and expand upon the violent weather theme in the latter part of this unit.

The purpose of this investigation is for students to become more aware of the importance and potential high stakes of weather forecasting in everyday life.
Students will be challenged to act as an advisor to the mayor of Pensacola, Florida about an impending hurricane. They should quickly realize that they are ill equipped to advise the mayor and must learn more about this hurricane, and weather in general, in order to complete the task. Throughout the exploration the students are given news bulletins and letters from other people connected with the city of Pensacola. It is a challenge that is intended to provoke thought about why the study of weather phenomena is important.

News bulletins and staff memorandums that can be found at the following web site:
http://weathereye.kgan.com/expert/hurricane/index.html

Let's Investigate …

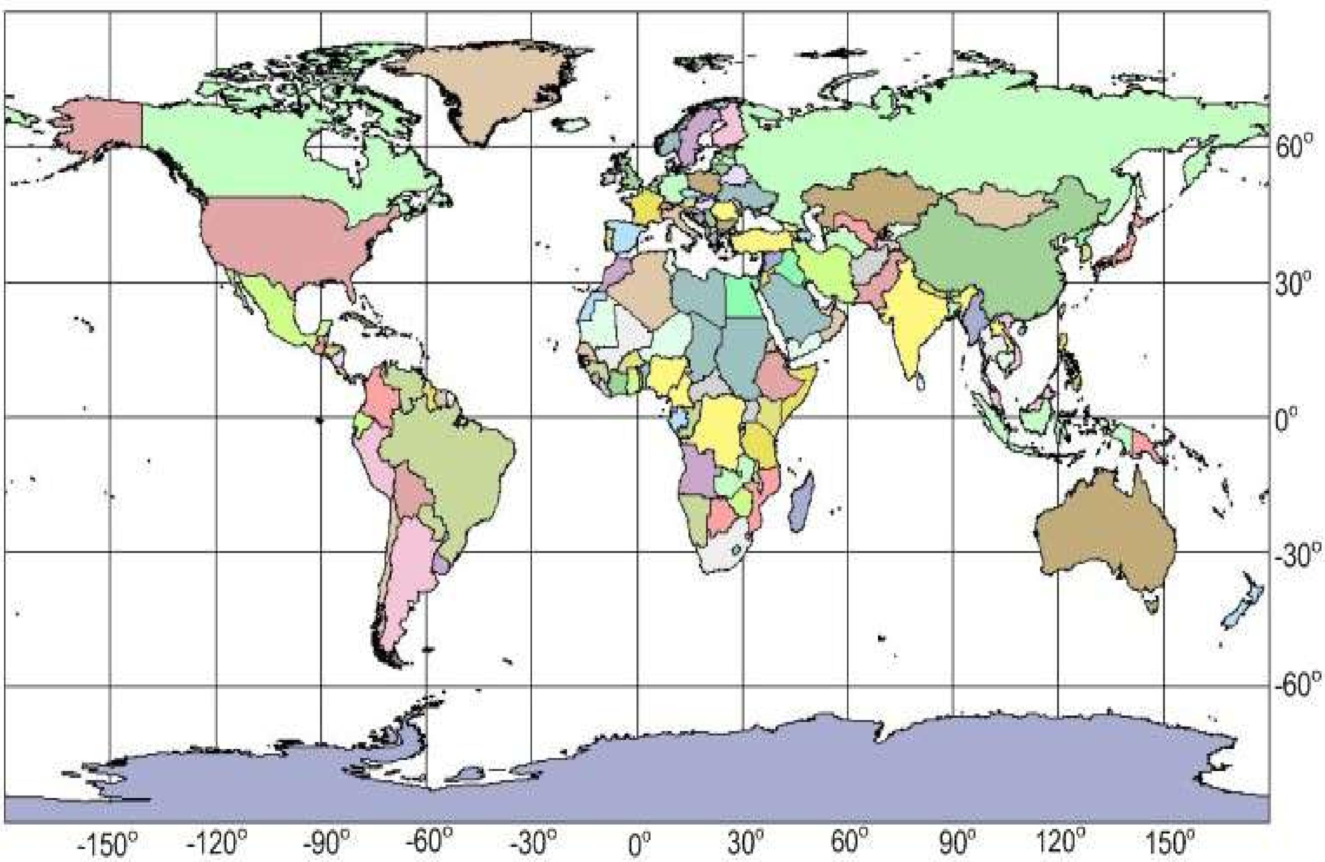
Part A – Setting the Stage

Have students complete the following journal entries about hurricanes. This will lead them into an analysis of events surrounding the potential arrival of a category 4 hurricane in Pensacola, Florida.

Journal Entry 1 – What personal experience do you have with a hurricane?

Journal Entry 2 – What kind of damage might occur as a result of a hurricane?

Journal Entry 3 – Hurricanes are large storm systems. Describe in your own words the size of a hurricane. Draw a circle on the world map to represent the size of a typical hurricane.



Word Map generated by ESRI software

Show picture of Fran below (1996) and point out the immense area covered by the hurricane.

To see a larger version of this image, log on to this website:
http://goes.gsfc.nasa.gov/pub/goes/960904.fran.persp.jpg

Part B – Hurricane Olivia

Tell students they will follow the development of a real hurricane and debate important issues surrounding the event. They will be the mayor's advisor and must recommend how the city of Pensacola, Florida should prepare for the storm. They will have to read several "daily" updates to the mayor and evaluate everyone's concerns. In the end, they must advise the mayor if the area should be evacuated or if the area can withstand the storm.

Have students complete the following section and discuss their entries. Read or distribute the Pensacola geography and days 2 – 5 accounts from the links below. Introduce and discuss the memorandums as they appear in day 5. Students are asked a series of questions about the hurricane and are required to decide weather they will advise the mayor to order a voluntary or mandatory evacuation of the island. A teacher directed discussion should follow each day's storm analysis.

The important point to stress during this activity is the importance of weather forecasting in today's world. Successful forecasting of major storms can prevent, or minimize the effects of, major economic and health catastrophes.

Read or distribute from the website the “daily” news bulletins.

Day 1 (September 30, 1995)

http://weathereye.kgan.com/expert/hurricane/olivia_born.html

Pensacola geography

http://weathereye.kgan.com/expert/hurricane/olivia_weareat.html

Day 2 (October 1)

http://weathereye.kgan.com/expert/hurricane/olivia_fishing.html

Day 3 (October 2)

http://weathereye.kgan.com/expert/hurricane/olivia_day3.html

Day 4 (October 3)

http://weathereye.kgan.com/expert/hurricane/olivia_day4.html

Day 5 early morning (October 4)

http://weathereye.kgan.com/expert/hurricane/olivia_day5.html

MEMO from tourism director

http://weathereye.kgan.com/expert/hurricane/island_overview.html

MEMO from police chief

http://weathereye.kgan.com/expert/hurricane/island_andhurricanes.html

Day 5 9:00 am (October 4)

http://weathereye.kgan.com/expert/hurricane/olivia_day5a.html

HURRICANE OLIVIA

You are an advisor to the mayor of Pensacola Beach Florida and you have been notified that a potential hurricane has been moving in your general direction. While currently it poses no threat to your community you want to follow it closely and be prepared to answer the mayor's questions.

Read the Associated Press release for September 30, 1995. (Saturday)

The mayor has heard about the storm and would like to know the following:

19. Where is the storm currently heading? The storm is heading toward the Louisiana coast (40 miles northwest of Merida, Mexico) This is Day 1 and the latitude and longitude are 22º North Latitude and 89 º West Longitude. It is the 15th named storm of the season.

20. *What preparations are being made in other Gulf communities? Grand Isle, Louisiana is preparing to evacuate by Sunday if the storm continues on this course. Mexico (northeast portion) issued a storm warning.*

Review the facts about your community.

21. *What could happen to Pensacola Beach if a hurricane hits? Pensacola Beach is a barrier island and waves hit full strength, therefore Pensacola Beach could easily be under water (up to 10-17 feet above normal). The bridge connecting Pensacola Beach to the rest of Florida could easily be damaged if winds are too strong.*

22. *How would evacuation be affected if a hurricane hits the beach? It may be very difficult to evacuate if water and wind damage the bridge connecting Pensacola Beach to the rest of Florida.*

Read the Associated Press release for October 1, 1995 (Sunday) Day 2

Storm Location: Latitude 20.7 º North and Longitude 91.7 º West

23. *The mayor wants to know if plans should be made to evacuate residents. What will you tell him? The storm is moving west/southwest slowly toward Mexico. Do not evacuate, but watch very closely.*

Read the Associated Press release for October 2, 1995 (Monday) Day 3

Storm Location: Latitude 20.9 º North and Longitude 92.4 º West

24. *The mayor wants to know how the storm is currently affecting Mexico. There are heavy rains falling on the coastal area.*

25. *What preparation if any would you recommend? Close the floodgates in New Orleans. Watch the storm.*

Read the Associated Press release for October 3, 1995 (Tuesday) Day 4

Storm Location: Latitude 21.1 ºNorth and Longitude 92.5 ºWest

26. *What are you going to tell the mayor about the status of the storm today? How has it changed? The hurricane is now 80 mph and shifted direction to the north (Louisiana to Florida must watch).*

27. *How has your hurricane preparation plans changed? Be ready to evacuate.*

Read the Associated Press release for early morning October 4, 1995 (Wednesday) Day 5

28. *The mayor wants to know about the storm's intensity and potential damage. What will you tell him? The storm is now a category 3 (80-120 mph) and could damage buildings and flooding from the "storm surge". It increases to a category 4.*

29. He wants your opinion on whether he should call for a voluntary or mandatory evacuation of the island. Before you can decide however the city's tourism director and police chief send you a memorandum. **Read the memos and give your opinion to the mayor.** Tourism director-Let the people make up their own minds. Businesses need tourists and the storm will probably miss us.
    - Police Chief- LEAVE!
    - Emergency manager- Our barrier island is at risk.
    - Mayor's assistant- If you decide to order a mandatory evacuation, it must be very soon. The inland roads are already congested with people trying to evacuate.

Read the Associated Press release for 9 am October 4, 1995

30. *What is the current status of the storm? The storm is headed toward Pensacola and many residents are leaving.*

31. *What would be the consequences if residents stayed and the hurricane made a direct hit? Roofs would be torn off and storm surge damage would take place.*

32. *What would be the consequences if residents evacuated and the storm turned in another direction and never hit the town? Everyone would be safe. The tourism business would be hurt.*

33. *What is your final recommendation to the mayor? Should residents be forced to evacuate or should they be able to make up their own minds? Be sure to support your decision. Student answers will vary.*

Look at the satellite picture of Pensacola beach taken days after October 4, 1995

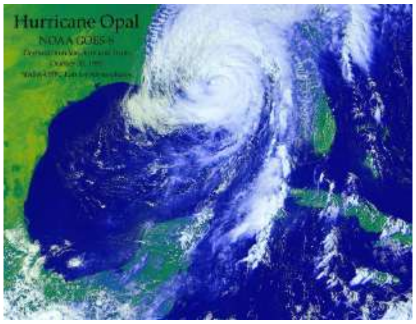
34. *Describe the situation on the island when this picture was taken. The storm is heading right to Pensacola Beach.*

Your teacher will show pictures of Pensacola Beach in the days after October 4, 1995.

35. Summarize for the mayor the effects the hurricane had on your town. The town is a mess! There is 2 billion dollars in damage and buildings are washed away. The storm surge was 20 feet. There is sand in the town, and boats are swamped or beached.

36. Why is it important is it to be able to predict weather accurately? Answers will vary, but It is very important to predict weather accurately to save lives and prevent damage to the city.

Part C – What really happened



After students have made their final recommendation to the town's mayor, show them the actual track of Opal using the Weather Underground site. Next, show the satellite picture of Opal and discuss with them their assessments of potential damage.

To see the Weather Underground storm track of Hurricane Opal, to the website:
http://www.wunderground.com/hurricane/at199515.asp

To access the satellite image of Hurricane Opal, log on to the website:
http://goes.gsfc.nasa.gov/pub/goes/opal.951004.color.jpg

Using the web site below, show the actual affects of hurricane "Opal" on Pensacola Beach. The username is Teacher. The password is Teach.

http://weathereye.kgan.com/expert/hurricane/private/aftermath1.html

Lead a discussion of the importance of being able to predict the weather and how this information could affect student's own lives.

Applying what you have learned …

In 1900, one of the deadliest hurricanes in history hit Galveston, Texas. Hurricane Ike was responsible for an estimated 8,000 -12,000 deaths. Damage to property was 30 million dollars.

3. Why do you think the death toll was so great? The dealth toll was great due to the lack of technology associated with predicting hurricanes today and the lack of ability to make an accurate forecast.

4. Using what you learned in this investigation, explain why a present day hurricane of this strength would probably result in far fewer deaths? Today, we are able to track hurricanes using satellites and other technology. This tracking allows us warn people in a more timely manner than in 1900. Although it does not always work (example-Hurricane Katrina) hurricane predictions have been known to save lives.

Hurricane Ike Footage can be used in conjunction with this question:

Select *Natural Disasters*, then *Hurricanes*, then selected video clips

Summary of Investigation …

In your journal, write a concise summary of this investigation. Be sure to address the following questions and use your data to support your responses.

- ✓ What is a hurricane?
- ✓ How are human lives impacted by a hurricane?
- ✓ When should a watch or warning be issued in case a hurricane is in your area?
- ✓ How is technology used to study hurricanes?

Investigating Further …

Hurricane hunters are a daring group of pilots who stalk hurricanes in planes filled with weather instruments. Their mission is to fly directly into the eye, measure the power of the hurricane, and send back information to weather centers. Did you know hurricane hunters carry life preservers and life rafts with them and survival gear in case of a crash landing in the ocean?

In 1944 an Army Air Force pilot named Colonel Joseph Duckworth intentionally flew his two-seat plane directly into the eye of a hurricane over Texas. This flight, along with the poor forecasts of impending storms, prompted the military to begin flying into hurricanes for scientific purposes. The information gathered by these brave individuals has increased knowledge of storm systems and has enabled scientists to better predict storms.

Today, pilots from the US Air Force Reserve and the National Oceanic and Amospheric Administration (NOAA) are the only ones to fly into and above hurricanes to study them. Occasionally, research scientists from universities join these flights.

Find out more about these courageous pilots by reaseaching the Internet.

http://www.usatoday.com/weather/hurricane/2003-07-16-flying-hurricanes_x.htm

http://www.usatoday.com/weather/storms/hurricanes/2008-08-30-hurricane-hunter_N.htm

Weather and Climate Assessed Understandings

1. Energy from the sun drives weather phenomena.
2. The atmosphere has properties that can be observed and measured.
3. Data such as: barometric pressure, temperature, wind speed and direction, humidity, and dew point can be collected and analyzed and used to predict weather and climatic patterns.
4. Energy from the sun causes water to change state and to be continually recycled.
5. The unequal heating of the earth, due to such factors as direct radiation, density of the atmosphere, presence of water, etc., is what sets the atmosphere in motion.
6. Climate is the average of the weather over many decades in a location.

Question #1

1. Why was it foggy in Dover, Delaware, on Monday, Tuesday, and Wednesday mornings?

What standards does this item match?

Science Standard 5: Earth's Dynamic Systems

6. The atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.

What is expected of students?

Students are expected to examine the temperature, dew point, and barometric pressure for each morning and visualize a pattern. They are expected to know that when the temperature and dew point are the same, the air is saturated and cannot hold any more water vapor, at which time water droplets form.

Question #2

2. Explain why it was no longer foggy at 11:00 on Tuesday.

What standards does this item match?

Science Standard 5: Earth's Dynamic Systems

1. Water cycles from one reservoir to another through the processes of evaporation, transpiration, condensation and precipitation. Energy transfers and/or transformations are associated with each of these processes.

What is expected of students?

Students are expected to explain that light energy from the Sun is transferred to Earth's atmosphere and surface. This energy causes the particles to become more energetic and is transformed into heat energy. The heat energy is transferred to the water droplets where it causes the droplets to become more energetic and change from water droplets to water vapor through the process of evaporation.

Question #3

3. Construct a data table to represent the weather for Monday, Tuesday, and Wednesday mornings.

What standards does this item match?

Science Standard 1: The Nature and Application of Science and Technology

3. Understand that: In a scientific investigation, data collection involves making precise measurements and keeping accurate records so that others can replicate the experiment.

Be able to: Accurately collect data through the selection and use of tools and techniques appropriate to the investigation.

What is expected of students?

Students are expected to organize their data into a table. The table should be properly titled, the columns/rows properly titled, and the data inserted appropriately for all 3 days. Data should include temperature, pressure, dew point (or humidity), wind direction and wind speed. Data should have all proper units.

Question #4

4. Refer to Thursday's weather map. Predict Thursday's weather for Delaware. Explain your prediction using data from the map.

What standards does this item match?

6. The atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.

What is expected of students?

The map shows a high pressure system advancing toward Delaware and a low pressure system that already went through. So, students are expected to know that weather systems move from west to east across the United States. Because of this, the weather will soon be under a high pressure system and clear or partly cloudy. Pressure was 261 mb and is moving towards 301 mb, indicating clearing skies.

Question #5

5. Look back at your Thursday weather map. Which pressure system will determine Friday's weather conditions? Explain why.

What standards does this item match?

8. Energy from the Sun heats the Earth unevenly causing pressure differences and air movements (convection currents) resulting in changing weather patterns.

What is expected of students?

Students are expected to know that weather systems move from west to east across the United States. Because of this, the weather will soon be under a high pressure system and clear or partly cloudy.

Question #6

6. Choose the letter that shows where evaporation takes place from the pond. Explain what happens to water particles in the pond when heated by the Sun.

What standards does this item match?

Standard 5:

- Water cycles from one reservoir to another through the processes of evaporation, transpiration, condensation and precipitation. Energy transfers and/or transformations are associated with each of these processes.

Standard 3:

- 1. All matter consists of particles too small to be seen with the naked eye. The arrangement, motion, and interaction of these particles determine the three states of matter (solid, liquid, and gas). Particles in all three states are in constant motion. In the solid state, tightly packed particles have a limited range of motion. In the liquid state, particles are loosely packed and move past each other. In the gaseous state, particles are free to move.

What is expected of students?

Students are expected to know that the process of evaporation takes place at the interaction between the air and water, at location "C". They are expected to explain the process of evaporation using the particle model. The electromagnetic energy from the Sun is transferred to the water. The water absorbs the energy and transforms it into heat energy. The water particles move faster, get further apart and become more energetic. Some particles become so energetic that they move into the atmosphere as water vapor.

Question #7

7. It is a summer day at this beach. Look at the air movement shown by the arrows in this diagram. Use your knowledge of how temperature affects density of air to explain why the air moves in this way.

What standards does this item match?

Standard 5:

8. Energy from the Sun heats the Earth unevenly causing pressure differences and air movements (convection currents) resulting in changing weather patterns. Standard 3:

What is expected of students?

Students are expected to relate that energy from the Sun is transferred to the land and water. The land and water absorb this energy differently and transform it into heat energy. The land gives off heat energy to the air above it making the air warmer and less dense than the air elsewhere, creating a low pressure system over the land. Because the water does not give off the heat energy as rapidly as the land, it does not heat the air above. The air above the water is cooler and more dense that over the land. This air is sinking and creates a high pressure area over the water. Air flows from the high pressure to the low pressure area- from the water to the land.

Question #8

8. Describe how weather and climate are different.

What standards does this item match?

Standard 5:

6. The atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.
7. The climate at a location on Earth is the result of several interacting variables such as latitude, altitude and/or proximity to water.

What is expected of students?

Students are expected to relate that weather is a short-term condition for a particular location and that climate is a long-term condition for a particular location and is more stable than weather, which may change daily.

Question #9

9. One winter, the newspaper reported the mildest January on record in Delaware. Many people concluded from the report that the climate in Delaware must have changed. Based on your knowledge of weather and climate, do you agree or disagree? Explain why.

What standards does this item match?

Standard 5:

6. The atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.

7. The climate at a location on Earth is the result of several interacting variables such as latitude, altitude and/or proximity to water.

9. Ocean currents, global winds, and storm systems, redistribute heat energy on Earth's surface and therefore affect weather and long-term climatic patterns of a region.

What is expected of students?

Students are expected to disagree and relate that climate is the long-term weather of an area, not a monthly change. Climate cannot be said to change based on one month's data.

Data Table

To record student scores, make a data table similar to the one here.

Student	#1	#2	#3	#4	#5	#6	#7	#8	#9
Amber									
Brian									
Christy									
Dan D.									
Ellen E.									
# Complete									
# partial									
# Incomplete									

8th Grade Weather & Climate Unit
Summative Assessment Rubrics

1. Why was it foggy in Dover, Delaware, on Monday, Tuesday, and Wednesday mornings?

This item measures the student's understanding that there is a pattern and relationship between weather data and atmospheric conditions.

Criterion for a complete response:

1. States that the dew point and air temperature are the same or the humidity is 100%.

Code	Response
	Complete Response
20	States dew point and temperature are the same.
21	States humidity is 100%.
29	Any other correct response.
	Partially Correct Response
10	States condensation is taking place, but does not make connection between humidity or dew point and temperature.
19	Any other partially correct response.
	Incorrect Response
70	States atmospheric pressure "causes fog".
71	States wind "causes fog".
72	States temperature "causes fog".
76	Repeats the questions or some other response already given.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

2. Explain why it was no longer foggy at 11 o'clock on Tuesday.

This item measures the student's understanding of the sun driving the physical changes in the earth's atmosphere.

Criterion for a complete response:

1. As the sun heats the earth's atmosphere, water droplets are changed back to water vapor i.e. evaporation takes place.

Code	Response
	Complete Response
20	Explains the sun heats the earth's atmosphere and water changes from drops to vapor.
21	Explains the sun heats the earth's atmosphere and evaporation takes place.
29	Any other correct response.
	Partially Correct Response
10	Explains that the sun heats the atmosphere but does not include the phase change of water or evaporation.
11	Explains phase change but does not include the role of the sun's energy.
12	Explains evaporation but does not include the role of the sun's energy.
13	Explains temperature and dew point are separate but does not include the role of the sun's energy.
19	Any other partially correct response.
	Incorrect Response
70	Indicates that wind moves vapor away.
71	Indicates that sun lifts water droplets or vapor.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

3. Construct a data table to represent the weather for Monday, Tuesday, and Wednesday mornings.

This item measures the student's ability to organize and represent data in a data table.

Criteria for a complete response:

1 Constructs a complete data table with 3 sets of daily measurement categories of data, i.e. temperature, pressure, dew point/or humidity, wind direction, and wind speed.
2 Measurements must be correctly paired.
3 Data table must contain appropriate labels, headings, and units.

Code	Response
	Complete Response
20	Meets above criteria.
29	Any other correct response.
	Partially Correct Response
10	Includes headings and units in data table, **but** measurements are not correlated with correct day.
11	Omits headings **or** units in data table and makes no more than two errors in data entry.
19	Any other partially correct response.
	Incorrect Correct Response
70	Makes several errors in data table or labels.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

Reasonable Example: This is a sample of one data table. There are more ways to make a correct data table.

Day	**Temperature**	**Dew Point**	**Barometric Pressure**	**Wind Direction**	**Wind Speed**
Monday	12° C/57 ° F	12° C/57 ° F	1026 mb	NNE	9 km/hr
Tuesday	14° C/61	14° C/61			

4. Refer to Thursday's weather map. Predict Thursday's weather for Delaware. Explain your prediction using data from the map.

This item measures the student's ability to read and interpret weather maps, and predict weather patterns.

Criterion for a complete response:

1. Makes a weather prediction supported by evidence from the map, e.g., anywhere from partly cloudy to clear, barometer anywhere from 261-301. Note: Due to the low pressure system moving off the coast and the high pressure system moving toward Delaware, a complete response would be a prediction using data from the high **or** a prediction using data "between" the two systems.

Code	Response
	Complete Response
20	Meets criterion above.
29	Any other correct response.
	Partially Correct Response
10	Accurately lists indicators of the weather (wind speed, difference between dew point and temperature, rise in barometric pressure) but does not make a weather prediction (fair, clear, or partly cloudy).
11	Indicates clear/fair/partly cloudy weather, but does not support with evidence (barometric pressure rising or dew point and temperature dissimilar.)
19	Any other minimally correct response.
	Incorrect Response
70	States incorrect weather description , example: cloudy, foggy.
71	States readings from the station model.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

5. Look back at your Thursday weather map. Which pressure system will determine Friday's weather conditions? Explain why.

This item measures the student's ability to read and interpret weather maps, and predict weather patterns.

Criteria for a complete response:

1. Identifies high-pressure system as the system affecting Friday's weather.
2. States that weather systems generally move from West to East (prevailing westerlies.)

Code	Response
	Complete Response
20	Meets both criteria.
21	Meets criteria, but states pressure system moves West to East rather than weather system.
29	Any other correct response.
	Partially Correct Response
10	Identifies high-pressure system.
11	States weather systems generally move West to East.
19	Any other partially correct response.
	Incorrect Response
70	Identifies the low-pressure system.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

6. Choose the letter that shows where evaporation takes place from the pond. Explain what happens to water particles in the pond when heated by the sun.

This item measures student's ability to use the particulate model to explain evaporation and to identify where evaporation takes place in the pond.

Criteria for a complete response:

1. Identifies C as the correct location.
2. Explains that as the sun heats the pond, the water particles move faster and some of the particles move into the atmosphere as water vapor.

Code	Response
	Complete Response
20	Meets criteria above.
29	Any other correct response.
	Partially Correct Response
10	Identifies correct location, but discusses only the increased movement of water particles, not indicating movement into the atmosphere.
11	Identifies correct location, but discusses only the movement of particles into the atmosphere, not increased movement and particles.
12	Identifies the wrong or no location, but discusses the increased movement of water particles, not indicating movement into the atmosphere.
13	Identifies the wrong or no location, but discusses the movement of particles into the atmosphere, not indicating increased movement of particles.
14	Identifies the wrong or no location, but discusses both increased movement of particles and movement of particles into the atmosphere.
19	Any other partially correct response.
	Incorrect Response
70	Identifies wrong or no location, with flawed or no explanation.
71	Identifies correct location, with flawed or no explanation.
72	Explains the water cycle only.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

7. It is a summer day at this beach. Look at the air movement shown by the arrows in the diagram. Use your knowledge of how temperature affects the density of air to explain why the air moves in this way.

This item measures the student's understanding of convection current. Heated air is less dense and rises; cooler air is more dense and sinks and rushes to take the place of the hotter rising air.

Criteria for a complete response:

1 Explains that the air over the land is warmer, less dense, and rises over the land.
2 Explains that the air over the water is cooler, more dense and sinks.
3 Explains that the cooler, more dense air from the ocean moves toward the land to replace the warm air that has risen.

Code	Response
	Complete Response
20	Meets above criteria.
29	Any other correct response.
	Partially Correct Response
10	Explains the movement of air in terms of temperature differences, but omits density.
11	Explains the movement of air in terms of density differences, but omits temperature.
19	Any other partially correct response.
	Incorrect Response
70	States land is cool and water is warm.
71	States all winds move from West to East.
72	States warm air rises and cold air sinks.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

8. Describe how weather and climate are different.

This item measures the student's ability to distinguish daily weather from the climate of an area.

Criteria for a complete response:

1 Describes weather as immediate atmospheric conditions that change daily.
2 Describes climate as long-term weather conditions for a particular location and/or is more stable and predictable than weather.

Code	Response
	Complete Response
20	Meets the criteria.
29	Any other correct response.
	Partially Correct Response
10	Describes weather correctly, but description of climate omits "for a particular location."
11	Describes weather correctly, but omits or confuses climate.
12	Describes climate correctly, but omits or confuses weather.
19	Any other partially correct response.
	Incorrect Response
70	Discusses weather in terms of temperature, but omits other weather factors.
71	States climate occurs over a short period of time, e.g. month to month, year to year.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

9. One winter the newspaper reported the mildest January on record in Delaware. Many people concluded from the report that the climate in Delaware must have changed.
Based on your knowledge of weather and climate, do you agree or disagree? Explain why.

This item measures the student's ability to apply their knowledge of weather and climate to evaluate the validity of a claim.

Criteria for a complete response:

1 Disagrees with the public's conclusion that Delaware's climate has changed.
2 Explains that climatic changes can not be based on data from a single month.

Code	Response
	Complete Response
20	Meets above criteria.
29	Any other correct response.
	Partially Correct Response
10	Disagrees, but explanation is vague, e.g. you would need more data.
19	Any other partially correct response.
	Incorrect Response
70	Takes a position with no explanation of the position.
71	Indicates some knowledge of greenhouse effect/global warming without using this information to respond to the question.
72	Agrees with idea of a climate change.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank

Prestige Academy Charter School

Unit Title: Transformation of Energy **Grade Level(s): 8th**

Subject/Topic Areas: Waves, Heat Energy, Energy Transfers and transformations

Key Vocabulary: Transfer, Transform, Kinetic Energy, Potential Energy, Law of Conservation of Energy, Energy chain, Conduction, Radiation, Convection, Heat Energy, Particle Model, Equilibrium, Mechanical Wave, Electromagnetic Wave, Frequency, Amplitude, Energy chain

Designed By: V. Patel **Time Frame: 21 Class Meetings**
Date: 04/01/2012

SUMMARY OF PURPOSE:
Energy is a powerful concept used by scientists, engineers, mechanics, teachers, athletes, farmers, musicians, cooks, and anyone else who tries to understand how things work in their lives. By following the flow of energy through natural phenomena, students will gain a better appreciation of how interconnected many natural processes are. Energy concepts will help students understand why things happen, and enable them to make predictions about natural phenomena. There are three important concepts presented to the students in this unit. Understanding these 'big ideas' of energy will help students apply energy concepts to real-life situations. Students will learn that:

- Energy comes in different forms, and can change from one form to another.
- Energy can be transferred from one object to another.
- Energy cannot be created or destroyed.

Students have already been exposed to different forms of energy prior to this unit; energy associated with motion (kinetic energy), energy associated with the height of a mass (gravitational potential energy), electrical and magnetic energy, solar (radiant) energy, and heat energy. In this unit, students will learn more about the properties of kinetic energy, heat energy, and electromagnetic waves, as well as the big ideas of energy transfer and energy transformation . Volumes of evidence tell us that energy cannot be created or destroyed (the Law of Conservation of Energy). This property of energy is central to our use of energy principles. If it was not true, we would probably not study energy at all. As important as this law is, teaching the 'Conservation of Energy' to 8th graders is an ambitious goal. The problem is, life has taught students that energy is created and destroyed, all around them, every day. This perception is incorrect, of course, but it will not be easy to get students to recognize this. Energy that appears to be 'lost' has actually been transferred elsewhere, often undergoing a transformation in the process.

Stage 1: Desired Results

Common Core/ Delaware Standards

This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1 and 3 found on the following web site:
http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard 1: The Nature and Application of Science and Technology
Understandings and Abilities of Scientific Inquiry
Students should know and be able to:

1. Understand that: Scientific investigations involve asking testable questions. Different kinds of questions suggest different scientific investigations. The current body of scientific knowledge guides the investigation.
    - Be able to: Frame and refine questions that can be investigated scientifically, and

generate testable hypotheses.

2. Understand that: A valid investigation controls variables. Different experimental designs and strategies can be developed to answer the same question.
    - Be able to: Design and conduct investigations with controlled variables to test hypotheses.
3. Understand that: In a scientific investigation, data collection involves making precise measurements and keeping accurate records so that others can replicate the experiment.
    - Be able to: Accurately collect data through the selection and use of tools and techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students.
4. Understand that: There is much experimental and observational evidence that supports a large body of knowledge. The scientific community supports known information until new experimental evidence arises that does not match existing explanations. This leads to the evolution of the scientific body of knowledge.
    - Be able to: Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.
5. Understand that: Evaluating the explanations proposed by others involves examining and comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Conflicting data or conflicting interpretations of the same data suggest the need for further investigation. Continued investigation can lead to greater understanding and resolution of the conflict.
    - Be able to: Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.
6. Understand that: Scientific habits of mind and other sources of knowledge and skills are essential to scientific inquiry. Habits of mind include tolerance of ambiguity, skepticism, openness to new ideas, and objectivity. Other knowledge and skills include mathematics, reading, writing, and technology.
    - Be able to: Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Science, Technology, and Society

Students should know that:

1. Advances in technology can expand the body of scientific knowledge. Technological tools allow people to observe objects and phenomena that otherwise would not be possible. Technology enhances the quality, accuracy, speed and analysis of data gathered.

Students should be able to:

- Identify different forms of alternative energy (i.e., solar, wind, ocean waves, tidal and hydroelectric systems). Research and report on the use of this alternative form of energy. Discuss and compare findings to describe the advantages and disadvantages of different kinds of alternative energy.

Students should know that:

2. Science and technology in society are driven by the following factors: economical, political, cultural, social, and environmental. Increased scientific knowledge and technology create changes that can be beneficial or detrimental to individuals or society through impact on human health and the environment.

Standard 3: Energy and its Effects

The Forms and Sources of Energy

Students should know that:

1. Energy from the Sun takes the form of electromagnetic waves such as infrared, visible, and ultraviolet electromagnetic waves. The radiation from the sun consists of a range of energies in the electromagnetic spectrum.

Students should be able to:

- Relate that the sun is the source of almost all of the Earth's energy and that this energy travels to the Earth in the form of electromagnetic waves.
- Explain that the electromagnetic waves from the sun consist of a range of wavelengths and associated energies. Explain that the majority of the energy from the sun reaches Earth in the form of infrared, visible, and ultraviolet waves. Use diagrams to demonstrate the differences in different types of electromagnetic waves.
- Plan and conduct an experiment to identify the presence of UV and IR waves in sunlight or other sources of electromagnetic waves. Use evidence to explain the presence of each.

Students should know that:

2. Mechanical energy comes from the motion (kinetic energy) and position (potential energy) of objects. Gravitational potential energy and elastic potential energy are important forms of potential energy that contribute to the mechanical energy of objects.

Students should be able to:

- Explain that kinetic energy is the energy an object has because of its motion and identify that kinetic energy depends upon the object's speed and mass.
- Design and carry out investigations to determine how changing the mass of an object or changing its speed changes its kinetic energy.
- Explain that gravitational potential energy (GPE) is the energy of position (above the Earth's surface) and that it depends on the object's mass and height above the ground. Relate that lifted objects have GPE and that the size of an object's GPE depends on its mass and the vertical distance it was lifted. Make a graph to demonstrate and describe how the GPE changes as the height of an object is increased or decreased.
- Explain that the mechanical energy of an object is the sum of its kinetic energy and its potential energy at any point in time. Identify the mechanical energy of objects in different circumstances and identify whether the mechanical energy consists of KE, PE or both (i.e., a ball at rest at the top of an incline and in its motion part of the way down the incline, or a model plane driven by a "rubber band" motor, etc.).
- Interpret graphical representations of energy to describe how changes in the potential energy of an object can influence changes in its kinetic energy.
- Explain that the mechanical energy of an object is a measure of how much the object can change the motion of other objects or materials (e.g.,, a ball (or air) having a large kinetic energy can do more damage than a ball (or air) with less kinetic energy).

Students should know that:

3. Sound energy is the energy that takes the form of mechanical waves passing through objects or substances. The energy delivered by a wave in a given unit of time is determined by the amplitude and frequency of the wave.

Students should be able to:

- Explain that sound energy is mechanical energy that travels in the form of waves. Use the particle model to explain why sound waves must travel through matter, and that sound travels more effectively through solids and liquids than through gases. Model and describe how sound energy travels through solids, liquids, and gases.

- Use the properties of sound waves and the particle model to describe how the pitch of two waves can be different and how the loudness of two waves can be different.
- Explain that heat energy and sound energy both make the particles of a substance move. Use models to explain how the particles respond differently to these types of energy. Use models to explain why sound travels much faster through substances than heat energy does.

Students should know that:

4. Heat energy comes from the random motion of the particles in an object or substance. Temperature is a measure of the motion of the particles. The higher the temperature of the material, the greater the motion of the particles.

Students should be able to:

- Use the particle model to explain heat energy as the combined random kinetic energy of particles that make up an object and while the heat energy and temperature of an object are related, they are different quantities.
- Describe how the motion of water particles in a glass of cold water is different from the motion of water particles in a glass of hot water.

Forces and the Transfer of Energy

Students should know that:

1. When the forces acting on an object are balanced, its motion will not change. Unbalanced forces will cause the object's motion to change. Changes in motion depend upon the size and direction of the total unbalanced force exerted on the object.

Students should be able to:

- Explain that the transfer of energy from one object to another is caused by the exertion of a force. Create an energy chain to show how forces can change the mechanical energy of an object. Describe how the distance over which the forces act will influence the amount of energy transferred (and when appropriate, the amount of energy transformed).
- Give examples of how mechanical energy can be transferred to (or away from) an object, and describe the changes that can take place in the motion of the object because of this energy transfer, (e.g., pulling on a trailer to start it moving or using friction to slow an object and bring it to rest).

Students should know that:

2. Gravity is a force that acts between masses over very large distances. Near the Earth's surface, gravity pulls objects and substances vertically downward.
    - The force of gravity can act across very large distances of space. Through the force of gravity planets pull on their moons, and pull on each other. The sun pulls on all planets, moons and other celestial bodies in the solar system. Use an understanding of how forces change the motion of objects to explain how gravity is responsible for creating the orbital motion of planets and moons.

Students should know that:

3. When energy from the sun is transferred to objects and substances, it can be transformed into a variety of energy forms.

Students should be able to:

- Use the particle model to explain how mechanical waves can transport energy without transporting mass. Give examples that support the transfer of energy without any net transfer of matter.
- Explain that the frequency and amplitude are two characteristics of waves that determine the mechanical energy carried and delivered by a sound wave per unit of time. Use diagrams to explain how each of these properties will influence the KE of

the particles in the substance when a sound wave passes through the substance.

- The energy delivered by a wave depends on more than just the frequency. Give an example of a high frequency sound wave that delivers small quantities of energy every second and explain how this is possible. Give an example of a low frequency sound wave that delivers large quantities of energy every second and explain how this is possible.

Students should know that:

2. Light energy radiates from a source and travels in straight lines. Light is reflected, refracted, transmitted, and absorbed differently by different materials. To see an object, light energy emitted or reflected from the object must enter the eye.

Students should know that:

3. The addition or removal of heat energy from a material changes its temperature or its physical state.

Students should be able to:

- Use the particle model to explain how heat energy is transferred through solid materials (conduction). Give examples of materials that are good "conductors" of heat energy and examples of materials that are poor conductors of heat energy, and how both types of materials are used in typical homes.

Students should know that:

4. Heat energy is transported by conduction, convection, and radiation. Heat energy transfers from warmer substances to cooler substances until they reach the same temperature.

Students should be able to:

- Use the particle model to describe the difference between heat energy transfer in solids and heat energy transfer in liquids and gases (i.e., the differences between conduction and convection).
- Use the particle model to explain why heat energy is always transferred from materials at higher temperatures to materials at lower temperatures. Explain why heat energy transfer ceases when the equilibrium temperature is reached. Explain that when this temperature is reached, the materials are in thermal equilibrium.
- Conduct simple investigations to demonstrate that heat energy is transferred from one material to another in predictable ways (from materials at higher temperatures to materials at lower temperatures), until both materials reach the same temperature.
- *Explain how the addition or removal of heat energy can change an object's temperature or its physical state. Conduct simple investigations involving changes of physical state and temperature. Relate that there is no change in temperature when a substance is changing state.*

Energy Interacting With Materials; the Transformation and Conservation of Energy

Students should know that:

1. Energy can be transformed from one form into another. Energy transformations often take place while energy is being transferred to another object or substance. Energy transformations and energy transfers can be used to explain how energy flows through a physical system (e.g., photosynthesis, weathering, electrical circuits).

Students should know that:

- Identify that energy can exist in several forms, and when it changes from one form into another the process is called energy transformation.

- Explain that energy transformation and energy transfer are different processes, and that energy transformations can take place during an energy transfer. Give examples of energy transformations that take place during an energy transfer.
- Give examples of energy transfers that do not include energy transformations. Give examples of energy transformations that take place without any energy transfer.
- Use energy chains to trace the flow of energy through physical systems. Indicate the energy transfers and the energy transformations that are involved in the processes (e.g., the lighting of an electric lamp in a region serviced by a hydroelectric (or coal fueled) electric power plant, or the sediment that clouds a stream after a heavy rainfall).

Students should know that:

2. When a substance absorbs heat energy, or when a different form of energy is absorbed by the substance and is transformed into heat energy, the substance usually expands. The particles within the substance do not expand but the space between the particles increases.

Students should be able to:

- Recognize that when light enters an eye, the energy carried by the light waves carries information and allows living things to see.

Students should know that:

3. Materials may absorb some frequencies of light but not others. The selective absorption of different wavelengths of white light determines the color of most objects.

Students should be able to:

- Trace the flow of the energy carried by the light when the light strikes a material and is reflected from, transmitted through, and/or absorbed by the material. Describe the energy transfers and transformations that take place when light energy is absorbed by a material
- Conduct investigations to show that materials can absorb some frequencies of electromagnetic waves, but reflect others or allow them to transmit through the material. Use this selective absorption process to explain how objects obtain their color, how materials like sunscreen can serve to protect us from harmful electromagnetic waves, and how selective absorption contributes to the Greenhouse Effect.
- Trace what happens to the energy from the Sun when it reaches Earth and encounters various materials, such as, atmosphere, oceans, soil, rocks, plants, and animals. Recognize that these materials absorb, reflect and transmit the electromagnetic waves coming from the sun differently.
- Conduct investigations to determine how the physical properties of materials (e.g., size, shape, color, texture, hardness) can account for the effect the materials have on sunlight and the degree of change observed in the materials (e.g., dark cloth absorbs more heat than light cloth, clear water transmits more light than murky water, and polished materials reflect more light than dull materials).

The Production, Consumption and Application of Energy

Students should know that:

1. Energy sources can be renewable or finite. Most energy used by industrial societies is derived from fossil fuel sources. Such sources are inherently limited on the Earth and are unevenly distributed geographically. Renewable energy sources vary in their availability and ease of use.

Students should be able to:

- Identify different forms of alternative energy (i.e., solar, wind, ocean waves, tidal and hydroelectric systems). Research and report on the use of this alternative form of energy.

Discuss and compare findings to describe the advantages and disadvantages of different kinds of alternative energy.

Students should know that:

2. Technological advances throughout history have led to the discovery and use of different forms of energy, and to more efficient use of all forms of energy. These technological advances have led to increased demand for energy and have had both beneficial and detrimental effects on society.

Students should know that:

3. Responsible use of energy requires consideration of energy availability, efficiency of its use, the environmental impact, and possible alternate sources

Key Concepts/Big Ideas

- **Observation and Evidence** **Energy transfers and transformations can be observed by the changes they impart on other objects.**

- **Reasoning and Explanations** **Conservation of Energy can be explained using energy chains that show the energy transfers and transformations in a system.**

- **Control and Conditions** **Energy conservation can be observed and evaluated by keeping certain variables and conditions controlled.**

- **Structure of Materials** **The structure of materials affects the energy transfers, transformations, and change of states; all of which can be described using the particle model.**

- **Properties of Materials** **Certain properties of materials directly affects the rate at which energy is transferred and transformed.**

- **Change** **Energy can be described as "the ability to create change," so by observing the change that takes place in a system, one can describe the energy transfers and transformations that must have taken place to produce this change.**

- **Interactions** **Interactions between objects and between particles result in energy transfers and transformations.**

- **Systems** **Energy chains can be used to analyze systems.**

- **Interaction of Science And Technology** **New technologies allow us to better understand energy transfers and energy transformations. Newer technologies also allow us to make certain energy transfers and transformations more efficient.**

- **Models** **Energy chains are models that diagram how energy flows in systems. The particle model is also used to describe how the structure of matter impacts the energy transfers and energy**

transformations.

- **Patterns** **Using conservation of energy principles, the energy transfers and transformations for predictable patterns. For example, the transfer of heat energy between different temperatures and volumes of water is predictable.**

Enduring Understandings

Students will understand that…

Enduring Understanding: Energy takes many forms. These forms can be grouped into types of energy that are associated with the motion of mass (kinetic energy), and types of energy associated with the position of mass and with energy fields (potential energy).

Enduring Understanding: Changes take place because of the transfer of energy. Energy is transferred to matter through the action of forces. Different forces are responsible for the transfer of the different forms of energy. e

Enduring Understanding: Energy readily transforms from one form to another, but these transformations are not always reversible. The details of these transformations depend upon the initial form of the energy and the properties of the materials involved. Energy may transfer into or out of a system and it may change forms, but the total energy cannot change.

Enduring Understanding: People utilize a variety of resources to meet the basic and specific needs of life. Some of these resources cannot be replaced. Other resources can be replenished or exist in such vast quantities they are in no danger of becoming depleted. Often the energy stored in resources must be transformed into more useful forms and transported over great distances before it can be helpful to us.

Essential Questions

- Why do things have energy?
- How can energy be transferred from one material to another? What happens to a material when it receives energy?
- What happens to the energy in a system; where does this energy come from, how is it changed within the system, and where does it ultimately go? How does the flow of energy affect the materials in a system?
- What is a "responsible" use of energy? Are there alternative forms of energy that will serve our needs, or better ways of using traditional forms of energy?

Real World Context

Defining Energy?

Energy is a very abstract concept, and finding a meaningful definition of energy, especially for 8th graders isn't possible. The standard definition that 'energy is the ability to do work' is inadequate. This describes what energy can do, assuming one understands what 'work' means in physics. It does not define what energy is. In fact, we usually define energy in terms of its effects on objects and substances, without ever defining what energy is. Not being able to even define energy is the first of many clues that our task of teaching energy to students at this level is formidable, and we need to be very careful what we expect them to learn and understand. Fortunately, even without a definition of energy, students know that energy plays a major role in their lives. They can recognize what energy does, even if they do not yet understand what energy is. We can use the students' experiences to piece together an understanding of energy. To benefit from their experiences, the students must first understand the three 'big ideas' listed above.

Energy Transformation

Energy exists in several forms. Most energy forms can be broadly grouped into two categories: the energy associated with the motion of a mass and the energy associated with the position of a mass, but this will not be apparent to 8th graders. It will be enough to expect them to identify the different forms: energy of motion (kinetic energy), energy of position (potential energy), electrical and magnetic energy, chemical energy, different components of solar energy (especially light), and heat energy. Students will also need to know that energy can be transformed from one form to another, but recognize that this process cannot always be reversed, especially when heat energy is involved.

Energy Transfer

The effects of energy are apparent when the energy influences the properties of objects or substances. Objects have energy, and when objects push or pull on each other, often energy is transferred from one of the objects to the other. Understanding the transfer of energy is important because it allows us to follow how energy 'flows' through a physical or biological system. Energy that appears to disappear usually is transferred to other objects or substances. (When a child stops pedaling a bicycle, it coasts to rest. The kinetic energy of the child and bicycle doesn't just 'go away' when the child stops pedaling. Most of it is transferred to the surrounding air.) Through an understanding of the transfer property of energy, students are more willing to accept that energy does not disappear. They become more sensitive to the transfer of kinetic energy to the particles that make up an object or substance. Acknowledging this transfer is the first step in developing a meaningful understanding of thermal (heat) energy.

The Conservation of Energy

Scientists believe that all the energy that will ever exist in our universe already exists. No more energy will ever be created, and when it appears to be 'used up' energy is really just being transferred away, changed from one form to another or both. This concept, that energy cannot be created or destroyed, is called the 'Law of the Conservation of Energy', a very unfortunate choice of words since this has nothing to do with conserving energy resources of any kind. Strictly speaking, only the total energy in the entire universe is guaranteed to remain constant. The amount and types of energy in your backyard, in your home, and even in your own body, can and do change all the time. When we are investigating physical systems smaller than the universe, this law can be restated in more practical terms:

> Whenever any change happens in the world around us, energy is transferred from objects to other objects or substances. Sometimes the transferred energy changes form, but the amount of energy that leaves one object never increases or decreases in size when it is transferred to other objects. All the energy transferred can be accounted for. The important point is that all the energy can always be accounted for, all the time.

Energy Misconceptions

Energy, by its very nature is a complex and abstract concept. An 8th grader cannot see, hold or directly measure energy. The only way an 8th grader is going to know about energy is by experiencing what it does. In this respect, the students have been collecting data on energy for many years. Kinetic energy hurts when a baseball hits you in the arm, and heat energy feels good or bad, depending upon circumstances. Electrical energy is 'used' to make things work for us, but can also kill us if we are careless with its use. In the mind of an 8th grader, there is an unquestionable 'potential' associated with the energy of a roller coaster at the top of the coaster's run. They can almost feel the energy in a fully drawn bow (and arrow). How many times have students waited for the release of huge quantities of chemical potential energy while watching the detonator clock on an explosive device count down zero in an action movie? These experiences have contributed to a rich database through which energy concepts can be presented in a contextually appropriate way to the students. Unfortunately, many of these same life experiences have predictably contributed to student misconceptions of energy concepts. By recognizing these pitfalls that lead to student misinterpretations, we can design strategies to confront student misconceptions and build a better understanding of our 'big ideas'.

Problems with Understanding the Different Forms of Energy

Students will have no trouble acknowledging that energy comes in different forms. Our problem here is that their understanding of any of these forms is limited. We should start with the premise that 8th graders are unlikely to begin this unit with an adequate understanding of any of the forms of energy we discuss. Do you find it difficult to believe this premise? Look at just a few examples.

- The energy associated with the motion (kinetic energy) of an object, arguably the simplest form of energy, is not what it appears to be. This energy depends on the *square* of the object's speed (even a trained eye cannot see the *square* of the speed when observing a moving object). Even high school physics students have trouble accepting that a car traveling at 50 mph has four times the energy it would have at 25 mph, and few of these older students understand the repercussions of that factor of four on the motion of the car.
- Ironically, one of the most misunderstood forms of energy, heat energy, is potentially easier to explain than most other forms. But heat energy suffers from historical misconceptions that simply refuse to go away. Students arrive in 8th grade convinced that heat is warmth and indistinguishable from temperature. Like the rest of us, students interpret 'heat' through their nervous systems. Our sense of 'feel' gives us a very narrow and often misleading view of heat energy. If we are not successful in broadening the students' understanding of heat energy, they will not be able to explain where the energy of a shout ended up, or where the light energy carried by a flashlight beam went to. They will not know what happened to the energy expended by a swimmer who just completed 10 laps in a pool. So they will conclude that all of this energy just got 'used up'. It must be gone because the students are incapable of recognizing how these different forms of energy transformed into another form (heat energy), while being transferred to other substances. Without understanding what heat energy actually represents, the students will be unprepared to embrace the most important concept of the unit, the Law of the Conservation of Energy.

Problems with Understanding Energy Transfer

Some energy transfers will be obvious to students. Whenever an object pushes or pulls on another object, the second object usually speeds up or slows down. Either case represents an energy transfer between the objects; and students will not have difficulties visualizing this transfer. Problems arise when energy is transferred to matter that is too small to see. Most of the kinetic energy of objects eventually is transferred to the particles of other objects and substances. The presence of kinetic energy in a driven golf ball is undeniable. That happens to this kinetic energy when the golf ball rolls to rest a few seconds later? Even without seeing the air around the ball move or without feeling the vibrations spreading through the ground as the ball lands, most of us understand that the golf ball's energy is transferred to the particles of air and the ground. Getting 8th graders to understand and believe this transfer process will not be trivial.

Problems with Understanding Conservation of Energy

Let's start with a sobering premise: 8th graders are not going to be easily convinced that energy cannot be created or destroyed. This is counterintuitive to the students because energy appears to be created and in particular, destroyed in their lives every day. Through their eyes, energy is easy to 'create'.

Kinetic energy is created with the throw of a ball, light is created by lamps with the flick of a switch, and plenty of heat can be created by burning a pile of dead wood. They find it just as easy to identify energy being 'used up' too. Baseballs eventually 'run out' of energy and roll to rest, batteries 'go dead' and the sounds of screaming in a packed gymnasium 'die out' immediately when the crowd becomes quiet. Even that pile of firewood burns out, and the surrounding area turns cool again. In the mind of a student, energy is created and destroyed all the time. So what can we do to correct these perceptions?

This problem with believing that energy cannot be created or destroyed is aggravated by the fact that we seldom deal with closed energy systems. It is important to distinguish between energy entering a system and energy being created. It is even more important to distinguish between energy leaving a system and energy being destroyed. Too often, the Law of the Conservation of Energy, that is, the concept that energy cannot be created or destroyed is communicated as a statement that the energy of a 'system' of objects remains constant. Unfortunately, this is almost never true, and 8th graders know as much.

Learning Targets/Goals

Students will know…

- Scientific investigations involve asking testable questions. Different kinds of questions suggest different scientific investigations. The current body of scientific knowledge guides the investigation.
- A valid investigation controls variables. Different experimental designs and strategies can be developed to answer the same question.
- In a scientific investigation, data collection involves making precise measurements and keeping accurate records so that others can replicate the experiment.
- There is much experimental and observational evidence that supports a large body of knowledge.
- The difference between an observation and an inference.
- How to use models and scientific data to build understanding of physical systems.
- Draw logical conclusions from the results of investigations, and extend understanding of important science concepts to real-life situations.
- Scientific habits of mind and other sources of knowledge and skills are essential to scientific inquiry. Other knowledge and skills include mathematics, reading, writing, and technology.
- Advances in technology can expand the body of scientific knowledge. Technology enhances the accuracy, speed and analysis of data gathered.
- There is a difference between qualitative and quantitative data.
- Speed is a quantity that can be calculated from measured variables.
- The speed of a released object increases predictably as it moves downward.
- Energy can be transferred from one object to another.
- The kinetic energy of an object depends on the object's speed and mass.
- An object receives a form of stored energy when it has been lifted up above the floor, called gravitational potential energy. This stored energy can transform into kinetic energy as the object moves downward.
- When the kinetic energy of an object seems to disappear, it has been transformed into a different form of energy; typically either a form of stored energy or heat energy.
- Under the right conditions, the stored energy of an object can transform into kinetic energy, and this kinetic energy can then transform back into stored energy.
- Whenever an object moves through the air, part of its kinetic energy is transferred to the particles of air.
- Identifying the energy transfers and energy transformations that take place in everyday phenomena helps us better understand the world in which we live.

(Energy chains are useful tools for organizing the description of energy flow in everyday phenomena.)

- The particles that make up materials are in constant but random motion. The collective random kinetic energy of particles is called heat energy. This form of kinetic energy will not make the object move. Even large quantities of heat energy in an object cannot make the object move.
- If heat energy is concentrated, the temperature and other properties of the object will noticeably change.
- Sliding friction is a force that transforms the kinetic energy of objects into heat energy.
- The transfer of heat energy into or out of our skin will influence whether something feels hot, warm, cool, or cold.
- The temperature of an object is **not** determined by how the object feels to our touch. The temperature of an object is linked to the motion of the individual particles that make up the object. The greater the average kinetic energy of its particles, the higher its temperature.
- The temperature of an object is an indicator of the motion of its particles (more precisely, their average kinetic energy).
- The temperature change of a substance is determined by how much energy it receives (or transfers away) and its mass.
- When heat energy is transferred out of a substance, its temperature usually drops. When heat energy is transferred into a substance, its temperature will usually rise. How much the temperature rises or falls when a given amount of heat energy is transferred depends on the mass of the substance (or put differently, the number particles in the substance).
- When two substances are mixed together, heat energy will be transferred from the substance at higher temperature to the substance at lower temperature until the combination reaches a single temperature. This final temperature is called the equilibrium temperature.
- Heat energy must be transferred to ice just to melt it. When heat energy is transferred to ice, some of the ice will melt, but the temperature of the remaining ice stays a constant 0°C
- Heat energy passes through solids in a process called conduction. The heat energy moves through the solid, but matter does not move through the solid.
- The Particle Model can be used to explain conduction as a process where heat energy is passed from particle to particle through collisions.
- When a solid, liquid or gas receives heat energy and its temperature increases, it will expand. As the substance expands, its density decreases.
- When the density of part of a liquid or gas changes, the difference in density within these substances will result in motion within the liquid or gas. Less dense material will rise, and more dense material will sink.
- When heat energy is transported through a liquid or gas by mass flow in these substances, the process is called convection.
- Waves are vibrations or disturbances that transport energy.
- Some waves can only travel through matter and other waves can travel through matter or through empty regions of space.
- Waves transport energy; they do not transport mass.
- Mechanical waves travel through solids, liquids and gases.
- Some waves are spread over extended intervals in space and deliver energy continuously. Other waves are of short duration and deliver pulses of energy.
- Mechanical waves can be characterized by their frequencies, wavelengths and speeds.
- Mechanical waves include vibrations that can be heard, and vibrations with frequencies too low or to high to be heard.

- Electromagnetic waves have a broad range of characteristics, depending on their wavelength or frequency.
- Sunlight consists primarily of waves that we can see (visible light), infrared waves, and ultraviolet waves.
- When a wave strikes a surface, the energy carried by the wave will either reflect off of the surface, or pass into the surface. The energy that passes into the surface will either pass through the material or be absorbed by the material.
- The characteristics of the wave (wavelength and frequency) and the properties of the material determine how much of the energy carried by the wave reflects from, transmits through, or is absorbed by the material.

Students will be able to… (21st century skills)

- Explain that kinetic energy is the energy an object has because of its motion and identify that kinetic energy depends upon the object's speed and mass.
- Design and carry out investigations to determine how changing the mass of an object or changing its speed changes its kinetic energy.
- Explain that gravitational potential energy (GPE) is the energy of position (above the Earth's surface) and that it depends on the object's mass and height above the ground. Relate that lifted objects have GPE and that the size of an object's GPE depends on its mass and the vertical distance it was lifted. Make a graph to demonstrate and describe how the GPE changes as the height of an object is increased or decreased.
- Explain that the mechanical energy of an object is the sum of its kinetic energy and its potential energy at any point in time. Identify the mechanical energy of objects in different circumstances and identify whether the mechanical energy consists of KE, PE or both (i.e., a ball at rest at the top of an incline and in its motion part of the way down the incline, or a model plane driven by a "rubber band" motor, etc.
- Interpret graphical representations of energy to describe how changes in the potential energy of an object can influence changes in its kinetic energy.
- Explain that the mechanical energy of an object is a measure of how much the object can change the motion of other objects or materials (e.g.,, a ball (or air) having a large kinetic energy can do more damage than a ball (or air) with less kinetic energy).
- Use the particle model to explain heat energy as the combined random kinetic energy of particles that make up an object and while the heat energy and temperature of an object are related, they are different quantities.
- Describe how the motion of water particles in a glass of cold water is different from the motion of water particles in a glass of hot water.
- Explain that sound energy is mechanical energy that travels in the form of waves. Use the particle model to explain why sound waves must travel through matter, and that sound travels more effectively through solids and liquids than through gases. Model and describe how sound energy travels through solids, liquids, and gases.
- Explain that heat energy and sound energy both make the particles of a substance move. Use models to explain how the particles respond differently to these types of energy. Use models to explain why sound travels much faster through substances than heat energy does.
- Relate that the sun is the source of almost all of the Earth's energy and that this energy travels to the Earth in the form of electromagnetic waves.
- Explain that the electromagnetic waves from the sun consist of a range of wavelengths and associated energies. Explain that the majority of the energy from the sun reaches Earth in the form of infrared, visible, and ultraviolet waves. Use diagrams to demonstrate the differences in different

types of electromagnetic waves.

- Plan and conduct an experiment to identify the presence of UV and IR waves in sunlight or other sources of electromagnetic waves. Use evidence to explain the presence of each.
- The force of gravity can act across very large distances of space. Through the force of gravity planets pull on their moons, and pull on each other. The sun pulls on all planets, moons and other celestial bodies in the solar system. Use an understanding of how forces change the motion of objects to explain how gravity is responsible for creating the orbital motion of planets and moons.
- Give examples of how mechanical energy can be transferred to (or away from) an object, and describe the changes that can take place in the motion of the object because of this energy transfer, (e.g., pulling on a trailer to start it moving or using friction to slow an object and bring it to rest).
- Use diagrams to trace and describe the transfer of energy through a physical system (for example, the erosion effects of water flowing down an unprotected slope).
- Use the particle model to explain how mechanical waves can transport energy without transporting mass. Give examples that support the transfer of energy without any net transfer of matter.
- Explain that the frequency and amplitude are two characteristics of waves that determine the mechanical energy carried and delivered by a sound wave per unit of time. Use diagrams to explain how each of these properties will influence the KE of the particles in the substance when a sound wave passes through the substance.
- The energy delivered by a wave depends on more than just the frequency. Give an example of a high frequency sound wave that delivers small quantities of energy every second and explain how this is possible. Give an example of a low frequency sound wave that delivers large quantities of energy every second and explain how this is possible.
- Use the particle model to explain how heat energy is transferred through solid materials (conduction). Give examples of materials that are good "conductors" of heat energy and examples of materials that are poor conductors of heat energy, and how both types of materials are used in typical homes.
- Use the particle model to describe the difference between heat energy transfer in solids and heat energy transfer in liquids and gases (i.e., the differences between conduction and convection).
- Use the particle model to explain why heat energy is always transferred from materials at higher temperatures to materials at lower temperatures. Explain why heat energy transfer ceases when the equilibrium temperature is reached. Explain that when this temperature is reached, the materials are in thermal equilibrium.
- Conduct simple investigations to demonstrate that heat energy is transferred from one material to another in predictable ways (from materials at higher temperatures to materials at lower temperatures), until both materials reach the same temperature.
- Explain how the addition or removal of heat energy can change an object's temperature or its physical state. Conduct simple investigations involving changes of physical state and temperature. Relate that there is no change in temperature when a substance is changing state.
- Identify that energy can exist in several forms, and when it changes from one form into another the process is called energy transformation.
- Explain that energy transformation and energy transfer are different processes, and that energy transformations can take place during an energy transfer. Give examples of energy transformations that take place during an energy transfer.
- Give examples of energy transfers that do not include energy transformations. Give examples of energy transformations that take place without any energy transfer.
- Use energy chains to trace the flow of energy through physical systems. Indicate the energy transfers and the energy transformations that are involved in the processes (e.g., the lighting of an electric lamp in a region serviced by a hydroelectric (or coal fueled) electric power plant, or the

sediment that clouds a stream after a heavy rainfall).

- Recognize that when light enters an eye, the energy carried by the light waves carries information and allows living things to see.
- Trace the flow of the energy carried by the light when the light strikes a material and is reflected from, transmitted through, and/or absorbed by the material. Describe the energy transfers and transformations that take place when light energy is absorbed by a material.
- Conduct investigations to show that materials can absorb some frequencies of electromagnetic waves, but reflect others or allow them to transmit through the material. Use this selective absorption process to explain how objects obtain their color, how materials like sunscreen can serve to protect us from harmful electromagnetic waves, and how selective absorption contributes to the Greenhouse Effect.
- Trace what happens to the energy from the Sun when it reaches Earth and encounters various materials, such as, atmosphere, oceans, soil, rocks, plants, and animals. Recognize that these materials absorb, reflect and transmit the electromagnetic waves coming from the sun differently.
- Conduct investigations to determine how the physical properties of materials (e.g., size, shape, color, texture, hardness) can account for the effect the materials have on sunlight and the degree of change observed in the materials (e.g., dark cloth absorbs more heat than light cloth, clear water transmits more light than murky water, and polished materials reflect more light than dull materials).
- Use the properties of water and soil to explain how uneven heating of Earth's surface can occur. Conduct an investigation that shows how water and soil are heated unequally by sunlight. Describe how this can be used to explain unequal heating of the Earth's surface, producing atmospheric movements that influence weather.
- Use the particle model to explain why a material expands (takes up more space) as its temperature increases. Recognize that this expansion is due to the increase in the motion of the particles, and that the particles themselves remain the same size.
- Identify different forms of alternative energy (i.e., solar, wind, ocean waves, tidal and hydroelectric systems). Research and report on the use of this alternative form of energy. Discuss and compare findings to describe the advantages and disadvantages of different kinds of alternative energy

Stage 2: Evidence of Student Achievement

Transfer Task

Performance Task

A performance assessment for Transformation of Energy can be found at the following website:

http://www.doe.k12.de.us/programs/sci_assess/default.shtml

Key Ideas:

- The ability to transfer or retain heat is dependent on the property of the material(s).
- The understanding that a material which is good at keeping a hot beverage hot and a cold beverage cold is a good insulator for the same reason- the material slowly transfers heat.

Student expectations:

- Measure temperature in degrees Celsius.
- Measure time using a stopwatch.
- Follow a simple plan to investigate.
- Summarize and draw conclusions.
- Apply knowledge about insulators.

Rubrics for Transfer Tasks

Performance Task: Rubrics for the performance assessment can be found on the following web site: http://www.doe.k12.de.us/programs/sci_assess/default.shtml

	4	3	2	1
Description of work submitted in by student.	Each question of the lab packet is attempted and work is legible.	Work is submitted late. Each question is attempted and work is legible.	Work is submitted in on time/late and work is neat and legible however, much of the lab packet is left blank.	Work is sloppy, packet is in poor condition (unprofessional) and incomplete.

The above grading rubric is used to grade student work for lab packets and the following grading rubric is used for student work completed as a journal log.

Summary of all activities: Students write a summary of each activity in their journal in which they

- State a purpose
- Explain what they did
- Explain what they learned
- Discuss energy effects

This is graded with a score sheet. Students score self and teacher scores as well using a rubric. These summarizes will include analysis of graphs and data collected throughout the unit.

Poster from Activity 1-4: Assign students one activity to make a poster which includes the following:

- Title in correct form/ The effect of independent variable on the Dependent variable
- List independent variable, dependent variable, constants, control

• Draw set up • Label potential energy • Label kinetic energy • Label and identify transfer of energy • Label and identify transformation of energy Have a poster contest with the above posters.
Formative Assessments:(e.g., tests, quizzes, prompts, work samples, observations) All copies can be found in Appendix A.
Summative Assessments: Comprehnsive exams Aligned to standards (Summative assessment and rubric is included at the end of this document.)

Student Self-Assessment and Reflection
Reflection: Students will keep a journal throughout the unit and include warm up questions, notes and all lab activities and information presented in class. A final version of a lab may be turned in separately, however the raw data and information will be put in the journal. Students will reflect on each activity and write a summary to elaborate on the key concepts learned in the activity. Students will take a pre test and post test for this unit. Presently, a new TOE assessment is being written. The application question(s) at the ends of the activities are transfer tasks and can be used as a self-assessment.

Instructional Resources
Resource: Delaware Department of Education *Transformation of Energy*. Revised 2006. **Part 1:The Transfer of Energy and the Transformation of Energy (Mechanical Energy)** Activity 1: Let's Get the Ball Rolling! • Determine the speed of a released object as the release height is changed. • Review the calculation of average speed as distance divided by time. Activity 2: Knock 'Em Down • Establish a connection between the kinetic energy of an object and its speed and mass. • Establish a connection between the amount of "change" that occurs and the energy of the object. • Establish a relationship between release height, speed at the bottom of a ramp, and the kinetic energy of the object. Activity 3: Passing Energy Along • Recognize that mass and speed have a direct relationship on the amount of kinetic energy. • Describe gravitational potential energy and kinetic energy as the components of mechanical energy. • Describe how energy can be transferred between objects and how it can be transformed into other forms of energy. Activity 4: The Energy of Pendulums • Describe the energy transfer and transformations that take place as a pendulum swings back and forth. • Use the particle model to help explain the energy transfers and transformations. Activity 5: Bouncing Golf balls • Recognize that different materials transfer energy at different rates. • Explain how the physical characteristics of an object can influence that object's ability to transfer

and transform energy.

Activity 6: Where's the Energy Going?

- Construct an energy chain that describes the energy flow, transfer and transformation, of an everyday phenomena

Part 2: The Properties of Heat Energy

Activity 7: Smoke Signals

- Observe the role that forces play in the transfer of kinetic energy, and its transformation into heat energy

Activity 8: Hot Finger-Cold Finger

- The temperature of an object is NOT determined by how the object feels to our touch; the human sensation of "hot" and "cold" are often misleading due to the direction of the transfer of heat energy.
- The temperature of an object is linked to the motion of the individual particles that make up the object. The temperature is a measure of the average kinetic energy of these particles.

Activity 9: Heat Energy and Temperature

- Heat energy is the combined random kinetic energy of the particles that make up an object.
- The temperature of an object is an indicator of the motion of particles and is determined by how much energy it receives or transfers away, and it's mass.

Activity 10: Mixing and Melting

- When two substances are mixed together, heat energy will be transferred from the substance at a higher temperature to a substance with a lower temperature until the combination reaches a single temperature (the equilibrium temperature).
- Heat energy is involved in the change of state process (i.e. solid to liquid, liquid to gas, etc.). When heat energy is transferred into a substance, it may be used to increase the temperature of the substance <u>or</u> it may be used to change the state of the substance.

Activity 11: How Does Heat Energy Move?

- When heat energy passes through a solid, it is called conduction and when it passes through a liquid or gas, it is called convection.
- The particle model can be used to explain the how density varies with differences in the motion of particles of varying temperatures resulting in a flow of matter.
- Besides conduction and convection, objects can also transfer heat energy ("cool") by emitting electromagnetic radiation, usually in the infrared (IR) region.

Part 3: The Energy Transferred by Waves

Activity 12: An Introduction to Waves

- Explain that waves transfer energy without transporting mass.
- Describe waves as organized vibrations that transfer energy

Activity 13: Mechanical Waves and Energy

- Waves are grouped based on the kind of energy they carry and how they carry this energy. The two main types of waves are mechanical and electromagnetic.
- Sound waves and seismic waves are primarily used to illustrate mechanical energy being transferred by mechanical waves.
- The characteristics of the wave (wavelength and frequency) and the properties of the material determine how much of the energy carried by the wave reflects from, transmit through, or are absorbed by the material.

Activity 14: Electromagnetic Energy and the Transfer of Energy

- Electromagnetic waves have a broad range of characteristics, depending on their wavelength or frequency.
- The characteristics of the wave (wavelength and frequency) and the properties of the material determine how much of the energy carried by the wave reflects from, transmit through, or are absorbed by the material.

Visible, Infrared (IR), and Ultraviolet (UV) light are used to illustrate how energy is transferred by electromagnetic waves since they constitute the primary categories of radiation from the Sun.

Differentiation

The topic of energy is very difficult mainly due to the fact that we can not see energy. Take advantage of multiple approaches to each topic. The teacher's guide does this to some extent, but each class that you teach will require modifications to meet the needs of your students. Probe technology (especially temperature and EM probes) and graphing calculators are also valuable resources in presenting the content in a variety of fashions. Allow students to be creative with their energy chains; they may use pictures to describe the energy chain and/or they may use words. Allow students to use their creativity to show competency in the topic.

Energy is a powerful concept used by scientists, engineers, mechanics, teachers, athletes, farmers, musicians, cooks, and anyone else who tries to understand how things work in their lives. By following the flow of energy through natural phenomena, students will gain a better appreciation of how interconnected many natural processes are. Energy concepts will help students understand why things happen, and enable them to make predictions about natural phenomena. There are three important concepts presented to the students in this unit. Understanding these 'big ideas' of energy will help students apply energy concepts to real-life situations. Students will learn that:

- Energy comes in different forms, and can change from one form to another.
- Energy can be transferred from one object to another.
- Energy cannot be created or destroyed.

Students have already been exposed to different forms of energy prior to this unit; energy associated with motion (kinetic energy), energy associated with the height of a mass (gravitational potential energy), electrical and magnetic energy, solar (radiant) energy, and heat energy. In this unit, students will learn more about the properties of kinetic energy, heat energy, and electromagnetic waves, as well as the big ideas of energy transfer and energy transformation. Volumes of evidence tell us that energy cannot be created or destroyed (the Law of Conservation of Energy). This property of energy is central to our use of energy principles. If it was not true, we would probably not study energy at all. As important as this law is, teaching the 'Conservation of Energy' to 8th graders is an ambitious goal. The problem is, life has taught students that energy is created and destroyed, all around them, every day. This perception is incorrect, of course, but it will not be easy to get students to recognize this. Energy that appears to be 'lost' has actually been transferred elsewhere, often undergoing a transformation in the process.

Enrichment

- **What text/print/media/kit/web resources best support this unit?**

Stop Faking It books on Force & Motion as well as on Light.
ESPN *Sports Figures* Website and videos resources.

- **What tips to teachers of the unit can you offer about likely rough spots/student misunderstandings and performance weaknesses, and how to troubleshoot those issues?**

Heat energy is a difficult topic, especially when it comes to the topic of conduction and convection. Good planning is essential here as well as is being very aware of safety factors (the bars get hot and can cause burns; always wear eye protection when working with flames). Consulting additional reference materials will assist you in organizing and conducting this section smoothly.

Waves, especially the electromagnetic waves, are especially troublesome due to our inability, and lack of technology, to show or simulate these waves. This may be the first time that students have been exposed to the topic of electromagnetic waves and the electromagnetic spectrum. This section is meant to set the stage for later discussions in high school, so do not be concerned if 100% mastery is not achieved, Focus on the key understandings of this section such as the fact that waves transfer energy and not matter and that waves are an organized motion of particles (as opposed to the disorganized motion of particles that we call heat energy). Again, additional reference materials for increasing your knowledge base on this topic will be very helpful.

Stage 3: Learning Plan

Resource: Delaware Department of Education *Transformation of Energy*. Revised 2006.

Part 1:The Transfer of Energy and the Transformation of Energy (Mechanical Energy)

The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.
W – Help the students know Where the unit is going and What is expected? Help the teachers know Where the students are coming from (prior knowledge, interests)
H – Hook all students and Hold their interest?
E – Equip students, help them Experience the key ideas and Explore the issues?
R – Provide opportunities to Rethink and Revise their understandings and work?
E – Allow students to Evaluate their work and its implications?
T – Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O – Be Organized to maximize initial and sustained engagement as well as effective learning?

Activity 1: Let's Get the Ball Rolling!
- Determine the speed of a released object as the release height is changed.
- Review the calculation of average speed as distance divided by time.

Activity 2: Knock 'Em Down
- Establish a connection between the kinetic energy of an object and its speed and mass.
- Establish a connection between the amount of "change" that occurs and the energy of the object.

- Establish a relationship between release height, speed at the bottom of a ramp, and the kinetic energy of the object.

Activity 3: Passing Energy Along
- Recognize that mass and speed have a direct relationship on the amount of kinetic energy.
- Describe gravitational potential energy and kinetic energy as the components of mechanical energy.
- Describe how energy can be transferred between objects and how it can be transformed into other forms of energy.

Activity 4: The Energy of Pendulums
- Describe the energy transfer and transformations that take place as a pendulum swings back and forth.
- Use the particle model to help explain the energy transfers and transformations.

Activity 5: Bouncing Golf balls
- Recognize that different materials transfer energy at different rates.
- Explain how the physical characteristics of an object can influence that object's ability to transfer and transform energy.

Activity 6: Where's the Energy Going?
- Construct an energy chain that describes the energy flow, transfer and transformation, of an everyday phenomena

Part 2: The Properties of Heat Energy

Activity 7: Smoke Signals
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- The temperature of an object is NOT determined by how the object feels to our touch; the human sensation of "hot" and "cold" are often misleading due to the direction of the transfer of heat energy.
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Activity 10: Mixing and Melting
- When two substances are mixed together, heat energy will be transferred from the substance at a higher temperature to a substance with a lower temperature until the combination reaches a single temperature (the equilibrium temperature).
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substance or it may be used to change the state of the substance.

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- When heat energy passes through a solid, it is called conduction and when it passes through a liquid or gas, it is called convection.
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Visible, Infrared (IR), and Ultraviolet (UV) light are used to illustrate how energy is transferred by electromagnetic waves since they constitute the primary categories of radiation from the Sun.

ASSESSED UNDERSTANDINGS
8TH GRADE TRANSFORMATION OF ENERGY

1. Energy can be sorted into a variety of forms including gravitational potential energy (GPE), kinetic energy (KE), heat energy, and electromagnetic energy. Mechanical energy is the sum of both gravitational potential energy and kinetic energy. GPE depends upon the object's mass and height above the ground; KE depends upon the object's mass and speed.

2. Energy is not easily defined, so it is characterized by the change that is produced because of the flow of energy. Energy can be passed from one object to another (energy transfer) and changed from one form to another (transformation). Forces are responsible for the transfer and transformation of energy. In order to understand many systems it is important to trace the flow of energy. Energy chains can be used to show the flow of energy in a system.

3. Different materials transfer energy at different rates (characteristic of the material) and respond differently to the input of different forms of energy (i.e. selective absorption of electromagnetic energy). The rate of transfer of heat energy depends upon the substance's temperature, its mass, and the contact time. All substances will interact thermally when placed together (particles of each substance will collide and transfer energy) until they reach a common temperature (thermal equilibrium).

4. Heat energy is defined as the random, disorganized KE of particles. Temperature is a measure of the average KE of these particles, whereas heat energy refers to the total energy of all of the particles. Temperature is related to the concentration of heat energy, not the amount of heat energy.

5. Heat energy can be moved in three ways: conduction, convection, and radiation. In conduction, the particles vibrate and transfer energy by way of collisions between the particles that make up the substance. In convection, the particles still vibrate randomly, but transfer their energy through organized motion (convective currents) in the substance, producing a much more efficient form of energy transfer. In radiation, the heat energy is actually transformed into electromagnetic energy and transferred by way of an electromagnetic wave.

6. Waves transfer energy, not mass. Waves can be characterized by wave speed, frequency, wavelength, and amplitude. Waves separate into two distinct categories dependent upon their pattern of vibration. Compressional waves (or longitudinal waves) oscillate in the same direction as the direction of motion; longitudinal waves oscillate perpendicular to the direction of motion. When waves interact with materials, the wave may be reflected from the material, absorbed by the material, or transmitted through the material.

7. Mechanical waves are caused by highly organized vibrations of the particles that make up substances; a certain range of vibrations activate human hearing and is interpreted by the brain as sound. Electromagnetic waves are caused by vibrations in electric and magnetic fields; a certain range of these vibrations activate the human eye and is interpreted as visible light. Heat energy is often contrasted with the energy transferred by waves in that heat energy is the

disorganized/random movement of particles that transfers energy while waves are the highly organized movement of particles that transfers energy.

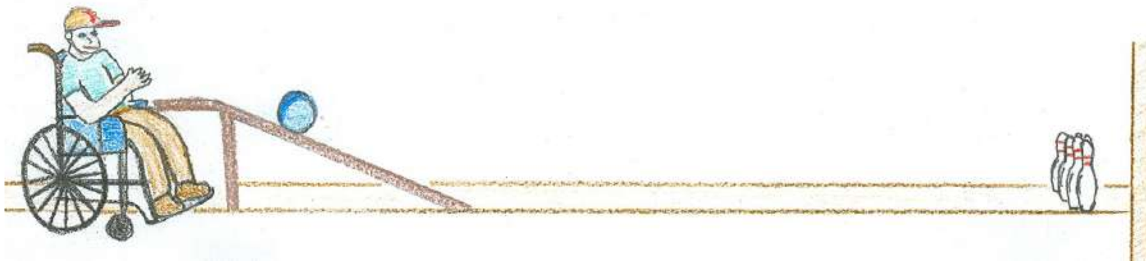
Question #1

Two mountain bike riders are at different locations on a section of the race course that contains a hill. The two riders have the same mass.

A. Which rider has more Gravitational Potential Energy (GPE)? Explain how you arrive at your answer.

B. If both riders are moving at the same speed, how would their Kinetic Energies (KE) compare? Explain your answer.

Question #2



When the physically disabled or very small children participate in bowling, they often use a ramp so that they do not have to roll the ball down the bowling alley themselves. The person can rest the ball on top of the ramp and give it a gentle push so that it rolls down the ramp and onto the alley. The ramp equipment is illustrated above.

A. In the space below, list the forms of energy that are present in this version of the sport. Start with the energy of the ball when it is released from rest on top of the ramp. End with the ball hitting the pins and everything coming to rest.

B. Use your response from Part A to draw an energy chain that describes where the energy was transferred and where it was transformed. Start with the energy of the ball when it is released from rest at the top of the ramp. End with the ball hitting the pins and everything coming to rest.

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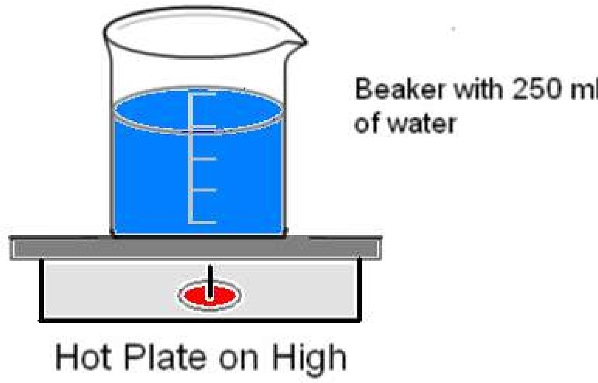
Question #3

A beaker of water rests on a hot plate that serves as a source of heat energy. The starting temperature of the water is 22°C. After 5 minutes, the temperature of the water is 55°C and after another 5 minutes the temperature increases to 80°C. The temperature of the room is 28°C



A. Use the Particle Model to explain heat energy.

B. Use the Particle Model to describe the difference between the water particles when the temperature of the water is 80°C and when the temperature of the water is 55°C.

C. Use your understanding of the Particle Model and of heat energy transfer by **conduction** and **convection** to describe how the energy from the hot plate reaches the water particles at the surface of the water. Be sure to include all heat energy transfers that take place between the hotplate and the top surface of the water.

The hot plate is turned off.

D. Explain what will happen to the temperature of the water in the beaker after 5 hours? Use the Particle Model, and your knowledge of heat energy transfer to justify your answer.

Question #4

A band of outlaws in the Old West plan to rob the train that comes through Sagebrush Canyon. One of the cowboys keeps his ear to the train rail while the others attempt to block the track so that the train has to stop.

The cowboy knows that some of the train's energy moves through the rail in the form of mechanical waves. Use your knowledge of energy and the Particle Model to explain why the cowboy has decided to put his ear to the metal rail to hear the approaching train instead of just listening for it in the air.

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Question #5

Sarah and her mother go to the beach during the summer. Sarah notices that the sand is very hot on a bright, sunny day. Her mother explains that the Sun heats the sand.

Describe how the Sun can heat the sand even though there is no heat energy coming from the Sun?

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Question #6

On a sunny, summer day Bob mows the grass at his house. He wore a shirt, but no sunscreen. When he takes off his shirt later, he notices that he is burned (red) in all of the areas that were not covered by the shirt.

Sunburn is caused by Ultraviolet (UV) waves interacting with skin. Use your knowledge of how energy is transferred by waves to explain why Bob got sunburn only in the uncovered areas of his body.

RUBRIC: QUESTION #1 (Part A)

This item measures the student's ability to relate Gravitational Potential Energy (GPE) with height.

Criteria for a complete response:

1. The student states that Rider A has the greater GPE.
2. The student explains that as height increases, so does the object's GPE. Or a comparable explanation that communicates the direct relationship between GPE and height above the ground.

Code	*Response*
	Complete Response
10	Meets the criteria for a complete response.
19	Any other completely correct response.
	Incorrect Response
70	Student only states that Rider A has the most GPE
71	Student states that Rider A has the most GPE, but provides an inadequate explanation of how GPE and height are related
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

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RUBRIC: QUESTION #1 (Part B)

This item measures the student's ability to relate mass and speed to Kinetic Energy (KE).

Criteria for a complete response:

1. The student states that both riders will have the same KE.
2. The student explains that KE depends upon mass and speed, so if the riders both have the same mass and the same speed, they must therefore have the same KE. Or a comparable explanation that communicates the relationship between KE, mass, and speed.

Code	*Response*
	Complete Response
10	Meets the criteria for a complete response.
19	Any other completely correct response.
	Incorrect Response
70	Student only states that both riders have the same KE
71	Student states that both riders have the same KE, but provides an inadequate explanation of how GPE and height are related
72	Student states that Rider B will have the greater KE because the rider is moving downhill.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

RUBRIC: QUESTION #2 (Part A)

This item measures the student's ability to identify the forms of energy in a real-life example.

Criteria for a complete response:

1. Response acknowledges all the following energy forms: gravitational potential energy (or GPE) of the ball, kinetic energy (or KE) of the ball, KE of the pins (after the collision with the ball), sound energy (SE) as the ball strikes the pins and creates vibrations [mechanical waves / sound] and heat energy (or HE).

Code	*Response*
	Complete Response
20	Meets the criteria for a complete response. Identifies GPE, KE, SE, and HE as the forms of energy.
29	Any other completely correct response.
	Partially Complete Response
10	Student identifies GPE, KE, and HE only
19	Student identifies a combination of any other three out of the four forms of energy.
	Incorrect Response
70	Student only identifies GPE and KE.
71	Student only identifies KE and HE.
76	Repeats the stem of the question.
79	Any other combination of two out of the four forms of energy..
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

RUBRIC: QUESTION #2 (Part B)

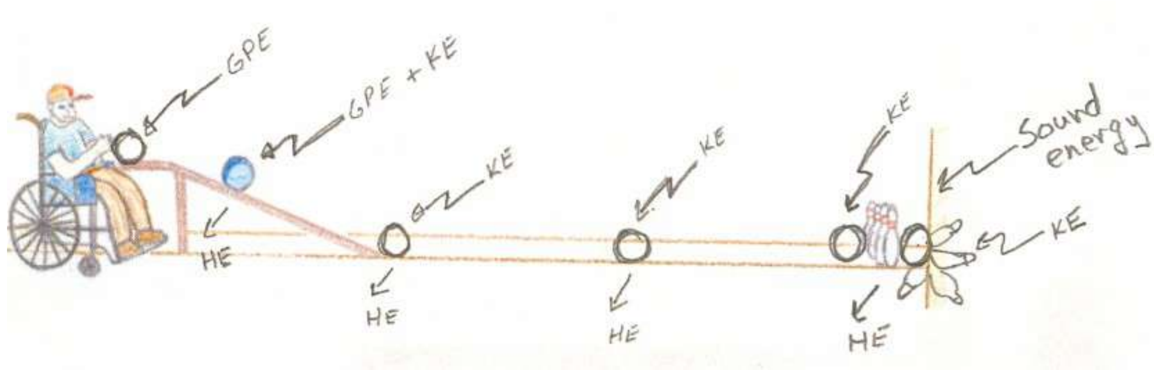
This item measures the student's ability to trace the flow of energy, using an energy chain, in a real-life example.

Criteria for a complete response:

1. Response includes all the following: Ball at top of ramp has GPE, as it rolls down the ramp the GPE is transformed into KE. When the ball reaches the bottom of the ramp and as it rolls down the alley, it only has KE, (as it rolls along the floor some of its KE is transformed to heat energy). When the ball strikes the pins it transfers some of its KE to the pins. This KE is then transferred away from the pins and the ball when they collide with the lane and gutters. This KE is ultimately transformed into mechanical waves (sound energy) and heat energy.
2. Student response may be in a graphical form.

Code	*Response*
	Complete Response
20	Meets the criteria for a complete response. Identifies GPE, KE, SE, and HE as the forms of energy and includes the correct energy transfers and transformations in the energy chain
29	Any other completely correct response.
	Partially Complete Response
10	Student identifies the four energy forms only
11	Student identifies most of the forms of energy and most of the energy transfers and transformations.
19	Any other partially correct energy chain response.
	Incorrect Response
70	Student only identifies only some of the energy forms (no attempt to acknowledge energy transfer or transformation)
71	Student only illustrates the example; little to no detail about energy forms or the flow of energy in the example.
76	Repeats the stem of the question.
79	Any other combination of two out of the four forms of energy.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

Example Responses:



Ramp ball has GPE

Rolling down ramp ball's GPE is transformed to Kinetic energy

Bottom of Ramp Kinetic energy

Kinetic energy of the ball transferred to pins and a transformation of some kinetic energy to sound and heat energy

pin's kinetic energy to floor/wall as heat energy

RUBRIC: QUESTION #3 (Part A)

This item measures the student's ability to use the Particle Model to describe heat energy as the random kinetic energy (motion energy) of particles.

Criteria for a complete response:

1. The student explains that all matter consists of tiny particles too small for to be seen.
2. The student communicates that "heat energy" is really the random, disorganized kinetic energy of these particles. This may be accomplished with the use of words and/or graphics. The student must relate random motion to heat energy to receive full credit for the response.

Code	*Response*
	Complete Response
10	Meets the criteria for a complete response.
19	Any other completely correct response.
	Incorrect Response
70	Student only states that matter consists of particles that are too small to be seen and are in motion.
71	Student states that that matter consists of particles that are too small to be seen and provides an inadequate or incomplete description of how the random motion of the particles is related to heat energy.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

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RUBRIC: QUESTION #3 (Part B)

This item measures the student's ability to relate temperature to the particles' motion and kinetic energy.

Criteria for a complete response:

1. The student explains that the water particles are moving faster (they have more kinetic energy / motion energy) at 80°C than at 55°C.
2. The student must establish a link between the motion of the water particles and the temperature of the water.

Code	*Response*
	Complete Response
10	Meets the criteria for a complete response.
19	Any other completely correct response.
	Incorrect Response
70	Student only states that the 80°C water particles are moving faster.
71	Student only states that the 55°C water particles are moving slower.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

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RUBRIC: QUESTION #3 (Part C)

This item measures the student's ability to communicate heat energy transfer by conduction and convection using the particle model.

Criteria for a complete response:

1. The student explains the heat energy transfer by conduction and convection in some combination of the following steps.

   a. The bottom of the hotplate is in contact with the bottom of the beaker. The particles that make up the hotplate surfaces transfer their energy, through collisions, to the particles that make up the bottom of the beaker.

   b. The particles that make up the bottom of the beaker then transfer their energy, through collisions, to the water particles at the bottom of the beaker.

   c. The water particles at the bottom of the beaker now have more motion energy and spread apart, due to collisions between the particles. Since the water particles are more spread out than in other areas of the beaker, this portion of the water is less dense than the other areas in the beaker. This difference in density creates a convective current where the more energetic, less dense water particles move from the bottom of the beaker to the top of the beaker.

Code	*Response*
	Complete Response
30	Meets the criteria for a complete response.
39	Any other completely correct response.
	Partially Correct Reponses
20	*Student correctly explains two of the three steps.*
29	*Any other explanation of two of the three steps.*
	Minimally Correct Response
10	*Student correctly explains only one of the three steps.*
19	*Any other explanation of one of the three steps.*
	Incorrect Response
70	Student vaguely discusses heat energy transfer, but makes no specific references to the steps in the process.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

RUBRIC: QUESTION #3 (Part D)

This item measures the student's ability to communicate heat energy transfer mechanisms that result in thermal equilibrium.

Criteria for a complete response:

1. Response indicates the following:
   a. The hot plate is no longer providing a source of heat energy to the water, but the water particles will continue to collide with the glass of the beaker and the air.
   b. These collisions will result in the transfer of the water particles' kinetic energy to the particles in the beaker and the air.
   c. The loss of kinetic energy will result in a decrease in temperature of the water in the beaker.
   d. This process will continue until the water is at room temperature (28°C).

Code	*Response*
	Complete Response
30	Meets the criteria for a complete response.
39	Any other completely correct response.
	Partially Correct Reponses
20	*Student includes only three of the four criteria in response.*
29	*Any other explanation of three steps.*
	Minimally Correct Response
10	*Student includes only two of the four criteria in response.*
19	*Any other explanation of two steps.*
	Incorrect Response
70	Student includes only one of the four criteria in response.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

RUBRIC: QUESTION #4

This item measures the student's ability to describe energy transfer by mechanical waves through different media.

Criteria for a complete response:

1. Response describes that the particles are closer together and/or more closely connected to one another in a solid (the metal rail) than in a gas (the air).
2. Response explains that energy is transferred by way of organized vibrations of particles (called a mechanical wave) and that it is easier to transfer energy through a solid because the connections between particles are stronger.

Code	*Response*
	Complete Response
20	Meets the criteria for a complete response.
29	Any other completely correct response.
	Partially Complete Response
10	Student describes the difference between the air and the metal rail using the Particle Model only.
11	Student discusses energy transfer through the rail in terms of vibrations or mechanical waves using the Particle Model, but does not contrast it to energy transfer through the air.
19	Any other partially correct energy chain response.
	Incorrect Response
70	Student only discusses the difference between air particles and the particles making up the metal rail.
71	Student responds that sound energy travels faster through solids and through gases, but provides not explanation.
76	Repeats the stem of the question.
79	Any other combination of two out of the four forms of energy.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

RUBRIC: QUESTION #5

This item measures the student's ability to discuss energy transfer by electromagnetic waves and the energy transformation to heat energy that usually results at the end of this simple energy chain.

Criteria for a complete response:

1. The student explains that only electromagnetic (EM) waves come from the Sun.
2. The student explains that when the EM waves interact with the sand, the electromagnetic energy is transformed into heat energy.

The student may also explain that there is nothing between the Sun and the Earth, so there are no particles for which conduction or convection to occur between. This additional information is desirable, but not necessary for a complete response.

Code	*Response*
	Complete Response
10	Meets the criteria for a complete response.
19	Any other completely correct response.
	Incorrect Response
70	Student only states that the sunlight is transformed into heat energy.
71	Student states that heat energy does come from the Sun or attempts to describe Infrared EM wave energy as "heat energy".
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

RUBRIC: QUESTION #6

This item measures the student's ability to discuss energy transfer by electromagnetic waves and selective absorption of waves.

Criteria for a complete response:

1. The student explains that only Ultraviolet (UV) electromagnetic waves come from the Sun and interact with the person's skin.
2. The student explains that the person's skin absorbed the UV waves, causing the sunburn in the areas that were not protected by the person's shirt.
3. The student explains that the person's shirt prevented the UV waves from reaching the person's skin in the areas that were protected by the person's shirt. The response should either take the stance that the UV waves were reflected by the shirt or that they were absorbed by the shirt; in either case it prevented the UV waves from being transmitted through the shirt to the person's skin.

Code	*Response*
	Complete Response
30	Meets the criteria for a complete response.
39	Any other completely correct response.
	Partially Correct Reponses
20	*Student includes only two of the three criteria in response.*
29	*Any other explanation of two of the three steps.*
	Minimally Correct Response
10	*Student includes only one of the three criteria in response.*
19	*Any other explanation of one of the three steps.*
	Incorrect Response
70	Student discusses how waves transfer energy, but does not address the question being asked.
71	Student discusses the sunburn in terms of heat energy transfer from the Sun.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crossed out/erased, illegible or impossible to interpret
99	Blank

INVESTIGATION #1: LET'S GET THE BALL ROLLING!

Athletes, such as those depicted above, frequently use the sloping ground to help them gain speed during an event. These athletes must be well aware of the changes in slope of the ground over the course of a run to be successful.

- What is speed? How is it measured?
- What force is responsible for increasing the speed of the skier and the downhill street luge athlete?
- What could they do to increase their speed at the start of the race?
- What could they do to increase their speed during the race?

GOALS: In this investigation, you will …

- Develop an appreciation for the need to collect several measurements of individual events to ensure a reliable result.
- Calculate the speed of a ball that has rolled down a ramp.
- Determine the relationship between the release height of a ball and the speed it reaches at the bottom of the ramp.

INVESTIGATION OVERVIEW: A synopsis of this lesson is as follows…

A ball is released from the top of a ramp. It rolls down the ramp onto a horizontal surface. When a hard ball rolls on a hard and level surface, its speed remains roughly constant. This speed is calculated using a distance predetermined (by the teacher) distance and the measured time needed for the ball to roll through this distance. The release height of the ball is then changed and the investigation repeated.

CONNECTIONS

Scientific Content

- The average speed of an object can be calculated by dividing the distance it travels by the amount of time needed to move through this distance. This relationship can be expressed by the equation

  Average speed = (distance traveled / time needed)

  or $S_{avg} = D / T$

- A free rolling object will speed up when rolling down an incline, but its speed will remain nearly constant on a level surface.
- When an object rolls down an incline, its speed at the bottom is determined by the height at which the ball was released.

Scientific Process

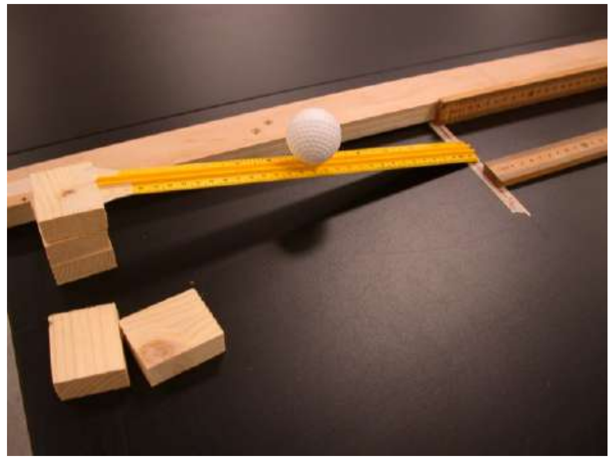
- Measuring short time intervals is difficult. A more reliable value for the time interval can be determined by repeating the experiment, taking several measurements, and using the average value of these measurements as the 'best value' of the time interval.

Math/Graphing

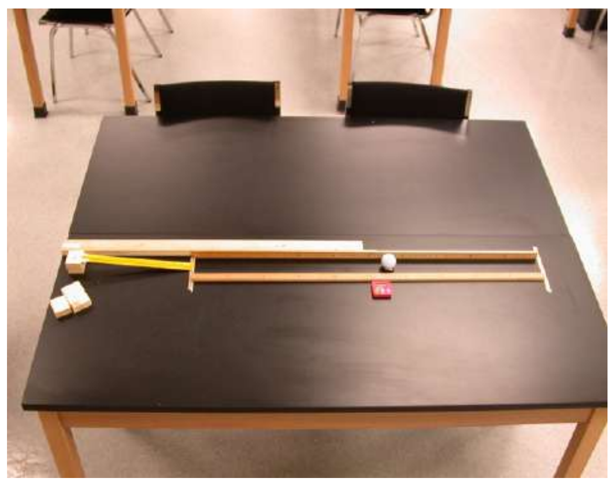
- Average quantities are calculated from a series of independent measurements.
- Line plot graphing is used to display the relationship between the release height and the speed of the ball at the bottom of the ramp.

Let's Investigate …

In this section, you will find questions after certain steps in the procedure. These questions are meant to promote understanding of the key concepts in this investigation. Write the answers to the questions in your science journal.



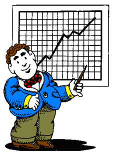
1. Gather 5 wooden blocks, one golf ball, some tape, and one ruler.
2. Start with one wooden block resting on the table and then set the ruler at the edge of the block. Tape both ends of the ruler down so that it will not slide off of the wooden block.



3. Mark off a pre-determined distance on the table top (100 cm works well) starting near the bottom of the ruler. This distance will be the <u>only</u> portion of the ball's motion that will be timed.
4. Release the ball from the top of the ramp and record only the time that it takes to cover your pre-determined distance.

5. Repeat the task 4 more times at that height and then calculate the average time that it took the ball to cover the pre-determined distance. Record your results.
6. Use your calculated average time to now calculate the average speed of the ball.

Record the height of the ramp, the average time, and the average speed on your data table.



7. Increase the height of the ramp by adding another wooden block and then repeat steps #4, 5, & 6 of the experiment.

8. Graph your results using a bar graph. Be sure to label your axes.

Investigation Reflection:

Question #1: Why will the speed of the ball traveling along the level tabletop be the same as the speed of the ball at the bottom of the ramp?

Question #2: Give a reason why the average time, calculated from 5 separate measurements, is more reliable than any single measurement of the time.

Question #3: What effect did increasing the release height have on the speed of the ball?

Question #4: Why do you think the speed of the ball depends upon its release height?

Summary of Investigation …

In your journal, write a concise summary of this investigation. Be sure to address the following questions and use your data to support your responses.

- ✓ How does height influence the speed of an object?
- ✓ How does collecting multiple measurements during an investigation lead to a more reliable result?

Applying what you have learned …

1. **Use what you have learned to explain why the water in streams flow swiftly in mountainous areas (like Colorado), but the water in streams in Delaware flows very slowly.**

Investigating Further …

THE SOAPBOX DERBY

The Annual All-American Soapbox Derby is held each year in Akron, Ohio. It has been called the “Greatest Amateur Racing Event in the World” and “The Gravity Grand Prix”. The event started when a Dayton, Ohio journalist promoted an event where young boys would build small cars from scrap materials to race them down an inclined street. He wrote about this first race in the newspaper and awarded a prize to the winner of this race.

Today’s soapbox derby cars are much more complex and follow strict rules about their construction. Great care goes into their construction so that they can gain as much speed as possible during their downhill trip. These current cars do share one important thing with their ancestors though – they all start from the top of a hill and use gravity to gain speed during the descent.

What other types of events depend upon the force of gravity and speed?

Research the soapbox derby competition at the library or via the Internet to gain more knowledge about this event and other events that depend upon gravity.

TEACHER'S GUIDE

INVESTIGATION #1: LET'S GET THE BALL ROLLING!

Athletes, such as those depicted above, frequently use the sloping ground to help them gain speed during an event. These athletes must be well aware of the changes in slope of the ground over the course of a run to be successful.

- What is speed? How is it measured?
- What force is responsible for increasing the speed of the skier and the downhill street luge athlete?
- What could they do to increase their speed at the start of the race?
- What could they do to increase their speed during the race?

GOALS: **In this investigation, you will …**

- Develop an appreciation for the need to collect several measurements of individual events to ensure a reliable result.
- Calculate the speed of a ball that has rolled down a ramp.
- Determine the relationship between the release height of a ball and the speed it reaches at the bottom of the ramp.

MAIN IDEAS: **The important concepts and skills covered in this lesson are …**

- The higher the release point of the ball on the ramp, the faster the ball will be rolling when it reaches the bottom of the ramp.
- Repeating a measurement several times and then averaging the results will yield a more reliable result than any single measurement.

INVESTIGATION OVERVIEW: A synopsis of this lesson is as follows…

A ball is released from the top of a ramp. It rolls down the ramp onto a horizontal surface. When a hard ball rolls on a hard and level surface, its speed remains roughly constant. This speed is calculated using a distance predetermined (by the teacher) distance and the measured time needed for the ball to roll through this distance. The release height of the ball is then changed and the investigation repeated.

CONTEXT: The role that this lesson plays in the concept development can be explained as …

In the next two or three investigations, we introduce the concept of energy and in particular, the energy of motion, kinetic energy. We want the students to recognize that the speed of the object and the mass of the object contribute to this 'energy of motion'. We also want to establish that kinetic energy and speed are different quantities. The first step in this process is reviewing the concept of speed. By completing this investigation, the class will establish a clear relationship between the height of the release point and the speed of the ball at the bottom. The higher the release point, the faster the ball moves upon reaching the bottom of the ramp. This relationship between release height and speed at the bottom is also the foundation for the concept of stored energy due to gravity, which will be introduced in upcoming investigations.

CONNECTIONS

Scientific Content

- The average speed of an object can be calculated by dividing the distance it travels by the amount of time needed to move through this distance. This relationship can be expressed by the equation

  Average speed = (distance traveled / time needed)

  or $S_{avg} = D / T$

- A free rolling object will speed up when rolling down an incline, but its speed will remain nearly constant on a level surface.
- When an object rolls down an incline, its speed at the bottom is determined by the height at which the ball was released.

Scientific Process

- Measuring short time intervals is difficult. A more reliable value for the time interval can be determined by repeating the experiment, taking several measurements, and using the average value of these measurements as the 'best value' of the time interval.

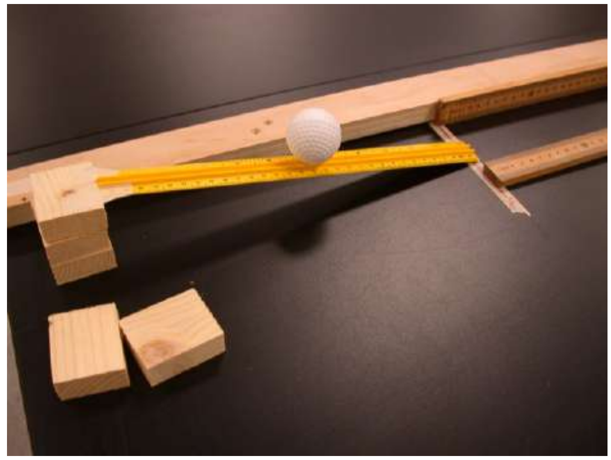
Math/Graphing

- Average quantities are calculated from a series of independent measurements.
- Line plot graphing is used to display the relationship between the release height and the speed of the ball at the bottom of the ramp.

Let's Investigate …

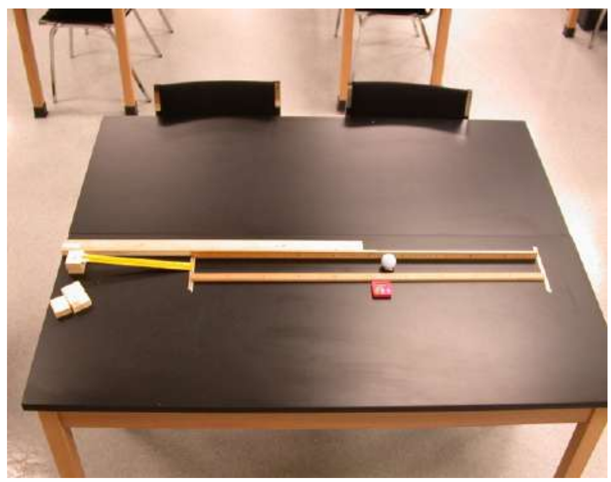
In this section, you will find questions after certain steps in the procedure. These questions are meant to promote understanding of the key concepts in this investigation. Write the answers to the questions in your science journal.

9. Gather 5 wooden blocks, one golf ball, some tape, and one ruler.



10. Start with one wooden block resting on the table and then set the ruler at the edge of the block. Tape both ends of the ruler down so that it will not slide off of the wooden block.

11. Mark off a pre-determined distance on the table top (100 cm works well) starting near the bottom of the ruler. This distance will be the <u>only</u> portion of the ball's motion that will be timed.



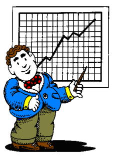
12. Release the ball from the top of the ramp and record only the time that it takes to cover your pre-determined distance.

13. Repeat the task 4 more times at that height and then calculate the average time that it took the ball to cover the pre-determined distance. Record your results.

14. Use your calculated average time to now calculate the average speed of the ball.

Record the height of the ramp, the average time, and the average speed on your data table.

15. Increase the height of the ramp by adding another wooden block and then repeat steps #4, 5, & 6 of the experiment.



16. Graph your results using a bar graph. Be sure to label your axes. (Students are more familiar with making bar graphs and since the data can be interpreted as discrete measurements a bar graph can be constructed in this case. It is also acceptable to make a scatter plot of the data.)

Investigation Reflection:

Question #1: Why will the speed of the ball traveling along the level tabletop be the same as the speed of the ball at the bottom of the ramp?

Answer: Gravity pulls all things downward. Because the tabletop is level and the ball only moves horizontally, gravity (which only acts vertically) does not speed the ball up or slow it down.

Question #2: Give a reason why the average time, calculated from 5 separate measurements, is more reliable than any single measurement of the time.

Answer: We time the ball 5 times at each height so that we minimize the effects of “error” in the lab activity. We start this activity thinking that the ball will roll uninterrupted known the ruler, and roll smoothly and straight, right through our measured distance. This will not happen. In fact, the ball will not roll along the exact same path twice. It may have been released a little differently, or from slightly different points. It may have rolled off the ruler onto the table differently, or even hit something on the table. Simply put, the ball does not roll the same way each time. Human reaction time using the stopwatch is also a source of “error”. To reduce the possibility that our results will be based on an unusual ‘roll’ of the ball or faulty use of the stopwatch, we do the experiment several times and average the results.

Question #3: What effect did increasing the release height have on the speed of the ball?

Answer: The higher the release point of the ball, the greater its speed at the bottom of the incline.

Question #4: Why do you think the speed of the ball depends upon its release height?

Answer: Student answers will vary to this question. Acceptable student answers probably include:

- The higher the release point, the more time gravity has to pull down on the ball, resulting in a greater speed of the ball at the bottom.
- The higher the release point, the more distance gravity has to pull down on the ball, resulting in a greater speed of the ball at the bottom.

Both of these answers are acceptable, and both are based on the premise that an unbalanced force can change the speed of the object. In this case, it is the force of gravity that pulls the ball down the ramp. Students have investigated how gravity speeds objects up while moving down a ramp in the 6th grade *Force & Motion* unit. In that introductory lesson to how forces change motion, they realize that the ramp (board, ruler, etc.) partially balances out the pull of gravity. So the steeper the board, the more gravity can act on the object to speed it up (less of it is balanced out by the ramp itself). Students may also add that the weight of an object is the force that it feels due to Earth's gravity and that this force pulls the objects downward. The purpose of this unit is to look at changes in motion from a different perspective, using the concept of energy.

Students have also had the experience of calculating average speed. They have investigated it qualitatively in 5th grade, but quantitatively in 6th grade. In the *Force & Motion* unit, the opening activity asks students to calculate the speed of a red buggy and a blue buggy. It may be helpful to reference this lesson prior to the start of our first TOE activity. The 6th grade activity was an opener to how forces change motion; in the 8th grade activity it is an opener into how speed factors into energy (mainly kinetic energy).

Summary of Investigation …

In your journal, write a concise summary of this investigation. Be sure to address the following questions and use your data to support your responses.

- ✓ How does height influence the speed of an object?
- ✓ How does collecting multiple measurements during an investigation lead to a more reliable result?

Applying what you have learned …

2. **Use what you have learned to explain why the water in streams flow swiftly in mountainous areas (like Colorado), but the water in streams in Delaware flows very slowly.**

Answer: In mountainous areas the slope of the river is very steep and consequently, the water can flow "downhill" very quickly similar to the ball rolling down the ramp elevated by 5 blocks. In Delaware, where the land is mostly flat, the slope of the stream is not great and thus the water does not attain a large amount of speed similar to the ball rolling down the ramp elevated by only one block. You will notice that Delaware does not have regions of extreme erosion caused by moving water. The Grand Canyon is a good example of how the water's motion energy can be used to "carve out" a path in rock. In Delaware, the streams and rivers are affected much more by tidal action than by the slope of the land. Erosion in Delaware is caused mainly by the daily tides, such is the case at the Indian River Inlet where tidal erosion has caused the bridge that spans the inlet to be replaced with a newer design.

Investigating Further …

THE SOAPBOX DERBY

The Annual All-American Soapbox Derby is held each year in Akron, Ohio. It has been called the “Greatest Amateur Racing Event in the World” and “The Gravity Grand Prix”. The event started when a Dayton, Ohio journalist promoted an event where young boys would build small cars from scrap materials to race them down an inclined street. He wrote about this first race in the newspaper and awarded a prize to the winner of this race.

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What other types of events depend upon the force of gravity and speed?

Research the soapbox derby competition at the library or via the Internet to gain more knowledge about this event and other events that depend upon gravity.

DATA Table

	1 block	2 blocks	3 blocks	4 blocks	5 blocks
Trial #1 time					
Trial #2 time					
Trial #3 time					
Trial #4 time					
Trial #5 time					
Average time					
Average Speed					

Prestige Academy Charter School

DATA Table **(TEACHER SAMPLE DATA PAGE)**

	1 block	2 blocks	3 blocks	4 blocks	5 blocks
Trial #1 time	1.31	0.85	0.62	0.56	0.46
Trial #2 time	1.31	0.81	0.62	0.54	0.48
Trial #3 time	1.55	0.83	0.68	0.56	0.53
Trial #4 time	1.43	0.81	0.66	0.59	0.54
Trial #5 time	1.34	0.76	0.70	0.55	0.49
Average time	1.39 s	0.81 s	0.66 s	0.56 s	0.50 s
Average Speed	71.94 cm/s	123.46 cm/s	151.52 cm/s	178.57 cm/s	200 cm/s

PRESTIGE ACADEMY

A COLLEGE PREPARATORY CHARTER SCHOOL
FOR BOYS
WILMINGTON, DELAWARE

GIVING BOYS A REAL CHANCE FOR A REAL FUTURE

October 2, 2011

Education Associate for Charter School Program
Delaware Department of Education
401 Federal Street, Suite 2
Dover, DE 19901

8^{th} Grade Science

Units of Instruction

<u>Overview:</u>

Curriculum development is an important part of what every teacher does, and at Prestige Academy Charter School, we spend a lot of time and energy documenting this work in a consistent and useful format. Prestige Academy Charter School teachers must develop curriculum aligned with the Delaware State Science Standards and Delaware Science Coalition Standards. The Delaware Science Initiative was founded to improve the instruction and learning of science so that all students would have the opportunity to meet the challenging performance expectations in the Delaware Science Content Standards. From the initiative, the Delaware Science Coalition began in 1995 as a collaborative of Delaware's school districts and science communities. Today, the Coalition supports science education in grades K-12 and is a collaborative effort between Delaware's school districts and charter school, and Delaware Department of Education (DDOE), higher education, business and industry, and community-based science organization. The Coalition continues to exist to support the highest quality science instruction for students and Delaware Schools.

While the Delaware State learning standards, objectives, and skills are not all-encompassing, they must be the starting point for all teacher planning and course curriculum. Prestige Academy Charter School teachers must ensure that every unit addresses Delaware State Science Standards and that each and every standard receives sufficient attention during the school year.

All curricula is comprised of **clear** and **measurable** standards. Clear and measurable standards are those that clearly define what students should know and are easily assessable. At Prestige Academy Charter School, our teachers and instructional leaders approach curriculum and instruction with urgency and a focus on achievement while making our lessons and day-to-day activities fun and engaging as to create a lifelong love of learning for our scholars.

The following units of study for 8th Grade Science were chosen because they clearly illustrate Prestige Academy Charter School's commitment to rigorous, engaging, standards-based instruction. Furthermore, the units chosen, Planetary Science, Weather and Climate, and Transformation of Energy, encompass numerous standards that are heavily assessed on the Delaware Comprehensive Assessment System (DCAS). Currently we have one master teacher serving boys in Grades 7 and 8, therefore creating a schedule whereby students in these grades receive more instruction in Math and ELA as a way to best prepare them for high school entrance exams. Some modifications to these units of study were made to accommodate our all-boys demographic including: more hands-on learning, collaborative partner work, and clearly communicated performance goals.

The following units of instruction reflect our commitment to science with each 8th Grade student receiving 180- 200 minutes of science instruction per week. In closing, please note that our teachers are using a modified version of the Delaware Science Coalition recommended units for Science. The units we have submitted reflect a deep dive into the most essential skills and standards for our scholars.

Enclosures:

8th Grade Unit 1- Planetary Science

8th Grade Unit 2- Weather and Climate

8th Grade Unit 3- Transformation of Energy