Wallingford Public Schools - MIDDLE SCHOOL COURSE OUTLINE

Course Title: Grade 7 General Science

Department: Science	**Grade(s)**: 7

Course Description

Students will explore physical, life, and earth science topics and the impact of science and technology on society. The physical science strand focuses on kinetic and potential energy and energy transformation. Students will also investigate simple machines such as inclined planes, pulleys and levers and the relationship between work, force and distance. The life science strand investigates organelles, cells and body systems with an emphasis on the digestive, respiratory and circulatory systems. Earth science strand focuses on plate tectonics, weathering, and erosion and their impact on the Earth's surface. Students will also explore how technology such as dehydration, pickling, and irradiation has allowed humans to improve food production and preservation.

Required Instructional Materials	**Completion/Revision Date**
• Current and sufficient laboratory materials and equipment for each of the learning strands • Appropriate safety equipment – goggles, aprons, eyewash, safety shower, etc. • Information technologies – Internet and library resources	Approved by Board of Education June 16, 2005 Revised January 2007.

Mission Statement of the Curriculum Management Team
The mission statement of the Science Curriculum Management Team is to promote scientific literacy emphasizing the process, content, and interdisciplinary nature of science.

Enduring Understandings for the Course
• Inquiry is the integration of process skills, the application of scientific content and critical thinking to solve problems.
• Science is the method of observation and investigation used to understand our world.
• Energy provides the ability to do work and it can exist in many forms.
• Energy can change from one form to another and some energy may be 'lost' as heat.
• Energy is needed to do work.
• Work is the process of making objects move through the application of force.
• Work is only done when an object moves, no matter how much force is applied.
• Simple machines make work easier by changing force and distance.
• All cells have some basic parts, yet plant, animal, and bacteria cells differ.
• Cells undergo processes similar to those of the larger organism such as digestion, metabolism, excreting waste, respiration, transportation, etc.
• Matter (cells) can be described and classified for understanding.
• Plants and animals are dependent upon each other for the exchange of carbon dioxide and oxygen.
• Living organisms and their parts (organelles, cells, body systems, etc.) have specialized

structures that perform specific functions to help maintain homeostasis.
• Cells found in a particular organ have similar structures.
• An organism is composed of many organ systems that are interdependent to perform life processes.
• The Earth is in constant change.
• Volcanic activity and the folding and faulting of rock layers during the shifting of the Earth's crust affects the formation of mountains, ridges and valleys.
• Glaciations, weathering and erosion change the Earth's surface by moving earth materials from place to place.
• Technology allows us to improve food production and preservation, thus improving our ability to meet the nutritional needs of growing populations.

LEARNING STRAND

1.0 Scientific Reasoning and Communication Skills

NOTE: This learning strand should be taught through the integration of the other learning strands. This learning strand is not meant to be taught in isolation as a separate unit.

ENDURING UNDERSTANDING(S)

- Inquiry is the integration of process skills, the application of scientific content and critical thinking to solve problems.
- Science is the method of observation and investigation used to understand our world.

ESSENTIAL QUESTION(S)

- How is inquiry used to solve problems or gather data to better understand a situation?
- How do scientists gather observations to find answers to questions?
- How does new knowledge gained create new questions?
- What are the characteristics of a controlled experiment?

LEARNING OBJECTIVES The student will:

1.1 Identify questions that can be answered through scientific investigation.
1.2 Examine the credibility of scientific claims in different sources.
1.3 Design and conduct appropriate types of scientific investigations to answer different questions.
1.4 Formulate a hypothesis in the 'If…., then…because…' format.
1.5 Identify independent and dependent variables, as well as those variables that are kept constant.
1.6 Understand that some experimental designs contain a control group.
1.7 Use appropriate tools and techniques to make observations, gather data, and organize information (tables and charts).
1.8 Use mathematical operations to analyze and interpret data including calculating the average for multiple trials.
1.9 Conduct measurements using the appropriate metric device and unit.
1.10 Identify and construct appropriate graphs illustrating the relationship between variables.
1.11 Draw conclusions based on observations and/or data and identify possible sources of error.
1.12 Provide explanations to investigated problems or questions.
1.13 Communicate about science in different

INSTRUCTIONAL SUPPORT MATERIALS

- Sufficient laboratory instrumentation

SUGGESTED INSTRUCTIONAL STRATEGIES

- Performance tasks
- Open-ended labs
- Inquiry
- Modeling
- Hands-on, minds-on lab activities
- Computer created spreadsheets and graphs
- See other learning strands for integration

SUGGESTED ASSESSMENT METHODS

- Lab reports
- Open-ended questions
- Teacher observations
- Essays and/or compositions
- Research based projects
- Computer created spreadsheets and graphs
- See other learning strands for integration

formats, using relevant science vocabulary, supporting evidence and clear logic. 1.14 Gather information using a variety of print and non-print sources. 1.15 Cite sources for print and non-print sources such as information located on the internet. 1.16 Apply computer-based tools to present and research information.	

LEARNING STRAND

2.0 Energy Transformations and Simple Machines

ENDURING UNDERSTANDING(S)

- Energy provides the ability to do work and it can exist in many forms.
- Energy can change from one form to another and some energy may be 'lost' as heat.
- Energy is needed to do work.
- Work is the process of making objects move through the application of force.
- Work is only done when an object moves, no matter how much force is applied.
- Simple machines make work easier by changing force and distance.

ESSENTIAL QUESTION(S)

- What are different forms of energy?
- How does energy change from one form or type to another?
- What is the relationship between potential and kinetic energy?
- How do simple machines make work easier?
- How does friction affect work?
- How do scientists explain work?
- How do science and technology affect the quality of our daily lives?

LEARNING OBJECTIVES – The student will:

2.1 Identify different forms of energy around us (such as electrical, solar, heat, sound, mechanical, chemical, etc.).
2.2 Identify different forms of energy transformations.
2.3 Describe how different types of stored (potential) energy can be used to make objects move (kinetic energy).
2.4 Explain the relationship between force, distance and work.
2.5 Calculate work done in lifting heavy objects (W=FxD).
2.6 Examine how increases and decreases in friction affect work.
2.7 Explain how simple machines such as inclined planes, pulleys and levers are used to create mechanical advantage.
2.8 Identify real-life examples of inclined planes, pulleys and levers.

INSTRUCTIONAL SUPPORT MATERIALS

- *Energy, Machines, and Motion* science kit, STC, Lessons 1, 6, 8 and 11-16
- *Levers and Pulleys science kit*, FOSS
- wooden dowels, small and large washers, wooden blocks, coarse sandpaper, fine sandpaper, wax paper, paper clips, string, masking tape
- Spring scale, meter sticks, pulleys, string, inclined planes, wedges/fulcrum, ramps, weights

SUGGESTED INSTRUCTIONAL STRATEGIES

- Revisit molecular movement in solids, liquids and gases – and understand that all phase changes require energy (see 6th grade)
- Concept map using terms such as energy, force, kinetic energy, potential energy, transformations, motion, etc.
- Identify and explain transformations of energy such as metabolism of sugar (chemical energy to mechanical or heat) , dynamite (chemical to light or heat), photosynthesis (solar to chemical), fossil fuels (chemical to heat or mechanical), hydroelectric (mechanical to electric), etc.
- Brainstorm situations where potential energy is transferred to kinetic energy - elastic bands, bow and arrow, skier on hill, roller coaster, etc.

	• Classify various forms of energy as either kinetic or potential • Explore Olympic sports through the lens of energy and forces • Released CAPT performance task 'Slipping and Sliding' – design an investigation testing what surface would be best to prevent boxes from slipping • Classify common items as different simple machines –scissors, baseball bat, flag pole, crowbar, car jack, seesaw, bottle opener, screw, can opener, bagel slicer, ramp, wheelbarrow, wheel and axle, diving board, boat oars, etc. • Invention convention – apply understanding of simple machines to create a new 'gadget' • Design an apparatus using simple machines to lift a student a small distance off the ground using one finger **SUGGESTED ASSESSMENT METHODS** • Tests/quizzes • Lab reports • Poster/ PowerPoint presentation on energy transformations • Illustrations with labels • Write a story and illustrate at least two energy transformations

LEARNING STRAND

3.0 Structures of Cells

ENDURING UNDERSTANDING(S)

- All cells have some basic parts, yet plant, animal, and bacteria cells differ.
- Cells undergo processes similar to those of the larger organism such as digestion, metabolism, excreting waste, respiration, transportation, etc.
- Matter (cells) can be described and classified for understanding.
- Plants and animals are dependent upon each other for the exchange of carbon dioxide and oxygen.
- Living organisms and their parts (organelles, cells, body systems, etc.) have specialized structures that perform specific functions to help maintain homeostasis.

ESSENTIAL QUESTION(S)

- How do scientists use tools to better understand the microscopic world?
- What are cells composed of?
- What do all cells have in common?
- How are cells different?
- How do living things (cells) use energy?
- How does the structure of cells (organelles) help it perform its function?
- How do materials enter and exit the cell?
- What types of materials enter and leave the cell?
- How are photosynthesis and cellular respiration connected?

LEARNING OBJECTIVES – The student will:

3.1 Identify the basic parts and functions of a simple compound microscope.
3.2 Apply appropriate microscope techniques when observing specimens (creating wet and dry slides, focusing, switching powers, calculate magnification, cleaning, etc.).
3.3 Describe the basic structures of an animal cell, including nucleus, cytoplasm, mitochondria, and cell membrane, and how they function to support life.
3.4 Compare and contrast plant, animal, and bacterial cells.
3.5 Explain the structure and function of the chromosomes found in the nucleus.
3.6 Describe how the cell membrane helps the cell to maintain a balance between the internal and external environments of the cell (osmosis).
3.7 Explain the process of cellular respiration.
3.8 Summarize the relationship between photosynthesis and cellular respiration (oxygen / carbon dioxide cycle).
3.9 Relate the structure of common cells to their functions (skin, nerve, muscle, blood cells, sperm, etc.).
3.10 Understand that cells reproduce, resulting in growth, replacement, repair, and

INSTRUCTIONAL SUPPORT MATERIALS

- *Microworlds* science kit, STC
- Microscopes, prepared slides of skin, nerve, muscle, sperm, and other animal and plant cells
- Blank slides, cover slips, iodine, methylene blue, bleach, alcohol, lens paper, Anacharis
- TV and video scope
- Plant and animal cell models
- Color pictures of cells
- Salt, balances, potatoes
- www.cellsalive.com
- http://www.ibiblio.org/virtualcell/index.htm (Virtual cell.com)

SUGGESTED INSTRUCTIONAL STRATEGIES

- Performance tasks
- Inquiry investigations
- Modeling
- WebQuest
- Guest speaker – doctor/nurse, lab technician, etc.
- Use the microscope to observe animal and plant cells and organelles such as cell walls, membranes, nucleus, chloroplasts, chromosomes, mitochondria
- Observe the Elodea/Anacharis (plant)

reproductive cells.	under the microscope and prepared cheek cells (animal) • Make to-scale labeled drawings of preserved and live slides • Assess accuracy of labeled microscope drawings • Make a diagram/concept map that illustrates the connections between processes that occur in the cell to the same processes that occur in the larger human body (ex. Brain and nucleus control the body, mitochondria and stomach, circulatory system and ER, etc.) • Cell analogies - compare the structure and function of the cell organelles to a town, school, factories • Edible cell models or three dimensional model • Illustrate a selectively permeable membrane and the movement of materials such as water, waste, CO_2, H_20, and nutrients from a high to low concentration • Demonstrate osmosis using a dialysis tubing, soak celery in colored water, soak raisins in water • Potato lab investigating the effect of distilled water, slightly salt water and a very salt water solution on the mass of potatoes – diagram the osmosis of water based on the % of water in the solution • Cell game – design a game using cell concepts • Cell bingo **<u>SUGGESTED ASSESSMENT METHODS</u>** • Lab reports • Open-ended questions • Teacher observations • Essays and/or compositions • Models • Projects and presentations • Illustrations of structure and function, osmosis, etc.

LEARNING STRAND

4.0 Functions of the Human Body

ENDURING UNDERSTANDING(S)

- Cells found in a particular organ have similar structures.
- An organism is composed of many organ systems that are interdependent to perform life processes.
- Living organisms and their parts (organelles, cells, body systems, etc.) have specialized structures that perform specific functions to help maintain homeostasis.

ESSENTIAL QUESTION(S)

- How does the structure of cells (organelles) help it perform its function?
- How are humans structured to ensure efficiency and survival?
- How do the cells, tissues, and organs, and organ systems work together to serve the organism as a whole?
- How is the relationship between structure and function evidenced?

LEARNING OBJECTIVES – The student will:

4.1 Recognize that tissues and organs in multi-cellular organisms are made of specialized groups of cells which work together to perform specific functions.

4.2 Analyze how the human muscular/skeletal system supports the body and allows movement.

4.3 Describe the structures and functions of the human digestive, respiratory, and circulatory systems and explain how they function together to bring oxygen and nutrients to the cells and expel waste materials.

4.4 Explain how the human body metabolizes and absorbs major nutrients (protein, carbohydrates, water, fats, vitamins, minerals).

4.5 Explain the flow of oxygen and carbon dioxide through the body.

4.6 Explore the structure and functions of the nervous, immune and endocrine systems.

CSDE Embedded Task – Feel The Beat

INSTRUCTIONAL SUPPORT MATERIALS

- *Human Body Systems* science kit, STC
- *Human Body Systems and Health,* Holt, 2002.
- Lugol solution, benedicts solution, HCl, pepsin, amylase, oyster crackers, tennis balls, oil, marshmallows, corn starch, potato buds, starch solution, corn syrup, hot pots, test tubes and racks, gloves, etc.
- Models of human body systems
- Preserved specimens/slides

SUGGESTED INSTRUCTIONAL STRATEGIES

- Construct a concept map linking digestive, circulatory, and respiratory systems
- Construct a working model showing interdependence between heart and lungs
- Explore the useful and limiting characteristics of models – complete a graphic organizer
- Create a multimedia presentation showing a cookie traveling through the human body. Describe the changes that occur to the cookie in the body
- Illustrate/diagram the movement of carbon dioxide and oxygen in the body
- Explore asthma, heart attacks, emphysema, impacts of nicotine, etc.
- Design an experiment to measure how much air you exhale – describe the relationship between structure and function
- Explore different diseases and how they affect specific body systems
- WebQuests

	• Guest speaker – school nurse, doctor • Comparative analysis – owl pellets and the skeletal system, worm dissection and digestive system, rat (mammal) • Test foods for different nutrients and the effect of enzymes **SUGGESTED ASSESSMENT METHODS** • Lab reports • Open-ended questions • Teacher observations • Essays and/or compositions • Models • Projects and presentations • Illustrations • Body mapping – identify the organs and functions of different systems (pre or post assessment)

LEARNING STRAND

5.0 Plate Tectonics, Weathering and Erosion

ENDURING UNDERSTANDING(S)

- The Earth is in constant change.
- Volcanic activity and the folding and faulting of rock layers during the shifting of the Earth's crust affects the formation of mountains, ridges and valleys.
- Glaciations, weathering and erosion change the Earth's surface by moving earth materials from place to place.

ESSENTIAL QUESTION(S)

- How does the Earth today compare with the Earth of millions of years ago?
- How do external and internal sources of energy affect the Earth's systems?
- What processes are responsible for shaping the Earth?
- How do weathering and erosion affect Earth's surface?
- What factors affect weathering?
- What factors affect erosion?
- How does water erosion and deposition change Earth's features?

LEARNING OBJECTIVES – The student will:

5.1 Explain how the Earth's crustal plates are influenced by convection currents in the mantle to produce major geologic events (mountain building, earthquakes, volcanic eruptions, ocean basin formation, sea floor spreading, and subduction).

5.2 Describe evidence of plate movement (fossils, plate boundaries, faults, folded rock, etc.)

5.3 Examine how the boundaries of the Earth's crustal plates can be inferred from the location of earthquakes and volcanoes.

5.4 Describe different types and results of weathering (including chemical, mechanical, etc.)

5.5 Analyze the effects of glacial weathering, erosion, and deposition.

5.6 Identify local features formed as a result of continental glaciation.

5.7 Investigate the effects of river erosion and deposition (including slope, water flow, food planes, valleys)

5.8 Relate river and glacial weathering, erosion and deposition to the rock cycle.

INSTRUCTIONAL SUPPORT MATERIALS

- *Catastrophic Events* science kit, STC, lessons 10, 13-16, 18, 19, and 22
- *Earth's Changing Surfaces,* Prentice Hall
- ***www.usgs.gov/*** (US Geological Survey)

SUGGESTED INSTRUCTIONAL STRATEGIES

- Create an illustration explaining how convection currents cause changes in the Earth's crust
- Compare the model of the Earth's interior to a hard-boiled egg
- Model convection currents using colored water of different temperatures (connect to 6th grade weather)
- Explore how scientists determine the structure of the Earth's interior
- Use manipulatives to model crustal movement along faults
- View a video of Pangaea
- Inquiry investigation looking at the surface area of antacid tablets to see what variable effects how long it takes to dissolve (erode)
- Inquiry investigation using stream tables
- Analyze how human activities can accelerate or magnify many naturally occurring changes such as erosion
- Plot earthquakes on a world map using real-time data
- Video on Ring of Fire, sea floor spreading,

	erosion, human impact on erosion, etc. • Explore the San Andreas fault and the implications for California • Research the glacial formation of CT and Long Island Sound and their existing features • Review the possible environmental conditions during the formation of sedimentary, metamorphic and igneous rocks **SUGGESTED ASSESSMENT METHODS** • Tests/quizzes • Lab reports • Open-ended questions • Teacher observations • Essays and/or compositions • Models • Projects and presentations • Illustrations

LEARNING STRAND

6.0 Preserving Our Food

ENDURING UNDERSTANDING(S)

- Technology allows us to improve food production and preservation, thus improving our ability to meet the nutritional needs of growing populations.
- Food preservation technologies present both risks and benefits to the health and well-being of humans.

ESSENTIAL QUESTION(S)

- What are the necessary conditions/resources for bacteria growth?
- How do we preserve/manufacture food with a longer shelf life?
- Why do we preserve foods?
- How do science and technology behind food preservation affect the quality of our lives?

LEARNING OBJECTIVES – The student will:

6.1 Explain how freezing or heat (pasteurization) reduces the rate at which food spoils (such as: reproductive and metabolic rate of bacteria, dormancy, population size of bacteria, etc.).

6.2 Explore how dehydrated food is produced and why it is beneficial. (nutritional label of dehydrated food, reduces mass, longer shelf life, reduce waste of fresh food in summer, etc.).

6.3 Explain how acidic solutions (pickling) and the phase change of condensation (canning) extends the shelf life of foods.

6.4 Evaluate the pros and cons of irradiating food.

INSTRUCTIONAL SUPPORT MATERIALS

- http://www.fda.gov/ (Food and Drug Administration)
- http://www.ael.org/page2.htm?&index=339&pd=1&pv=x (Hands-on Science Projects, The Science of Food Preservation)
- Dehydrator, freezer, refrigerator
- Pickling jars, vinegar, assorted foods (cucumbers, peppers, bananas, grapes)

SUGGESTED INSTRUCTIONAL STRATEGIES

- Complete a graphic organizer comparing characteristics of viruses, bacteria, and plant and animal cells – revisit this graphic organizer at the end of the unit and add additional characteristics
- Review the molecular speed and arrangement in solids, liquids and gases and phase changes
- Fill a soda can with hot water vapor and cause the can to implode in cold water (condensation)
- Make dehydrated fruit in the class using a dehydrator – compare to manufactured dehydrated foods – hydrate foods by soaking in water – review osmosis – investigate how much water an apple can lose when water is removed
- Investigate how pickled foods are made – see osmosis in action – measure the pH of different foods
- Research food additives – look at food labels for these additives read food labels
- Debate the pros and cons of irradiating food – graphic organizer and/or position paper
- Explore how technological advances related

	to food preservation/production affects human health and society's ability to meet the nutritional needs of growing populations - such as bovine growth hormone, chemicals used for preservation, pasteurization, canning, how is cheese or yogurt made, etc. • WebQuest • Guest speaker from restaurant, food service/cafeteria manager, department of health, food manufacturing company • Explore the form used by health department inspections • Concept diagrams • Research how food is preserved for the military and astronauts • Summarize articles on current issues related to food preservation **SUGGESTED ASSESSMENT METHODS** • Lab reports • Open-ended questions • Teacher observations • Essays and/or compositions • Models • Projects and presentations • Illustrations • Tests/quizzes • 'Recipe' on how to use a particular food preservation method and the science behind the method • Persuasive essay/debate on the pros and cons of a particular type of food preservation

Guide for Laboratory/Inquiry Investigation

Grades 6-8 Wallingford Public Schools
Approved by Science Management Team April 5, 2005

Title
The title is logical, creative and descriptive of the laboratory activity. Each word begins with a capital letter.

Problem Statement
The problem statement describes the direction and goal of the laboratory activity with a question that is clearly stated. The problem contains one independent variable and usually one or more dependent variables.

Hypothesis
A logical and complete thought that is supported with sound reasoning based on prior knowledge. Uses an "if..then" statement that addresses both the independent and dependent variable and lists several "variables that should remain constant".

Materials
A specific listing of all the equipment and materials that will be used to complete the activity with specific amounts, brands, sizes, kinds, sizes, styles etc..

Procedure
The procedure is a logical progression of steps taken to complete the activity. This procedure should be able to recreate the activity easily. The independent and dependent variables, as well as the "variables that remain constant", should be easily recognized. If necessary an actual control is used, it should be stated.

Data
This section is a summary or listing of all qualitative (observations) and quantitative (measurable) data presented in tabular form (data table). It should be neat and organized. Here is where a properly labeled and constructed graph would be located. Also, a written explanation of your data should include comparing and contrasting results, trends or patterns in data, discussion of variables and their effects on the results.

Conclusion
The conclusion clearly answers the questions presented using data to support the answer. Also includes discussions to provide explanations to justify the results. The hypothesis is restated and either supported or refuted. Discuss scientific errors and how they affected the results. Identifies a new problem that could be investigated.

Suggested Laboratory/Inquiry Grading Criteria

Grades 6-8 Wallingford Public Schools

Approved by Science Management Team April 5, 2005

Suggestions on how to use these criteria in the science classroom:

- **Teachers can use these criteria to develop an analytical rubric.**
- **Teachers may attach different point values to different criteria depending on the skill(s) emphasized during the laboratory investigation.**
- **Some labs may focus primarily on specific skills; teachers may then choose to use only some of these criteria to help assess a particular piece of student work.**
- **Student and peer-assessments can be devised to reflect these suggested criteria.**

Title

- Is the title logical and creative?

Problem

- Is the problem stated in the form of a question and clearly stated?
- Does it contain only one independent variable?
- Does it contain a responding dependent variable(s)?

Hypothesis

- Is the hypothesis logical and complete in thought?
- Did you support your hypothesis with logical reasoning that explains why you made the educated guess you did?
- Was it written in third person point of view (no I, you, we, us)?

Procedure

- Is each step in the procedure numbered?
- Does the procedure show a logical progression of step-by-step instructions?
- Are the independent and dependent variables easy to identify?
- Are variables other than the independent and dependent "remain constant" so that the only variable affecting the dependent variable is the independent?
- If a control is present is it easily identified?
- Is the sample size and/or number of trials appropriate? Was the experiment repeated in order to collect enough data to find average and/or reliable results?
- Description of what data will be 1.) measured (in metric units) 2.) recorded on data table 3.) when/how often

Data

- Were appropriate quantitative observations collected to make experiment valid?
- Were appropriate qualitative observations collected?
- Is all raw data neatly organized in some type of chart/data table?
- Are there proper labels for title, variables, and units?

Graphs

- Is the important data represented in an appropriate graph?
- Is the graph labeled with a title?
- Is the x-axis the independent variable with proper labels, units and scale?
- Is the y-axis the dependent variable with proper labels, units and scale?

Data Analysis

- Did you compare and contrast the results in your graph?
- Discuss the trends in data?
- Discuss variables and factors that may affect the results?
- Draw conclusions that can be taken from graph?

Conclusion

- Did the conclusion clearly answer problem?
- Use specific data to support the conclusion?
- Offer a discussion that provides explanation to justify results?
- Is hypothesis restated? Hypothesis supported or refuted?
- Identify at least three sources of scientific error?
- Explanation of how each source of error affected results?
- Identification of a new problem that could be investigated?