

Colquitt County 6th Grade Science Pacing Guide 2022-2023

Grading Timeline	1st -9 Weeks	2nd- 9 Weeks	3rd-9 Weeks	4th- 9 Weeks
Progress Report Window Open				
Progress Reports Home				
Report Card Window Open				
Report Card Home				
MAP/GMAS	August 17, 18, 19 - MAP Testing	December 5, 6, 7 - MAP Testing		April 18, 19, 20 - MAP Testing May 2-9 - GMAS Testing

Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May
Fall Semester August-December					Spring Semester January-May				
First 9 Weeks		Second 9 Weeks			Third 9 Weeks		Fourth 9 Weeks		
Unit 1 - 7 weeks Water on Earth <ul style="list-style-type: none"> - determine where all the water on Earth is. - explain how water is distributed on Earth. - investigate how the sun leads to the cycling of water. 		Unit 2b - 5 weeks Weather and Climate <ul style="list-style-type: none"> • explain the difference between local and global winds. • develop a model that shows the unequal heating and rotation of the Earth causing local and global wind systems. 			Unit 4a - 3 weeks Rocks and Minerals <ul style="list-style-type: none"> • investigate the characteristics of minerals. • classify rocks by their formation and characteristics. • explain how rocks change in the rock cycle. 		Unit 4c - 3 weeks Weathering, Erosion, and Deposition <ul style="list-style-type: none"> • identify the types of weathering (mechanical/physical and chemical). • identify the agents (causes) of erosion and how they transport. • identify different environments in which deposition can occur. 		

<ul style="list-style-type: none"> - identify what the subsurface topography of the ocean looks like. - create a model to represent the topography of the ocean floor. - investigate how to use maps to study the subsurface of the ocean. - analyze the salinity of different oceans. - represent in a chart the causes and effects of waves, currents, and tides in Earth's systems <p>Anchoring Phenomenon</p> <ul style="list-style-type: none"> • Water Water Everywhere • Suez Canal & Tides • Blood Falls • Spotted Lake - Evaporation <p>Topics</p> <ul style="list-style-type: none"> • Water cycle • Flow of Freshwater • Groundwater • Earth's oceans location • Ocean floor topography • Parts of the Ocean Floor • Waves, Currents, Tides 	<ul style="list-style-type: none"> • explain the difference and relationship between air pressure, weather fronts, and air masses. • investigate how air pressure, weather fronts, and air masses cause meteorological events such as tornadoes, thunderstorms, and hurricanes. • use and interpret weather data to show how moisture evaporating can cause weather events such as hurricanes. <p>Anchoring Phenomenon</p> <ul style="list-style-type: none"> • Fire Tornado • Water Spouts • Hurricane Michael • Lake Maracaibo Lightning Center <p>Topics</p> <ul style="list-style-type: none"> • How is wind created? • Global/local winds <i>(LABS: Atmosphere Layers Activity, Density Lab, Land vs. Water Temp)</i> • Humidity • Air masses • Types of Fronts • Storms 	<ul style="list-style-type: none"> • determine how minerals contribute to rock composition. <p>Anchoring Phenomenon</p> <ul style="list-style-type: none"> • Bismuth Mineral Lab <p>Topics</p> <ul style="list-style-type: none"> • layers of the earth & characteristics • How minerals form • Mineral Identification • 3 Types of Rocks • Rock: Classification, composition, and formation • Rock Cycle • how minerals and rocks are connected • Fossils found in sedimentary rocks <p><i>(LABS: Eating Rocks, Starburst Lab)</i></p> <p>**Unit Test - Illuminate</p> <p>Unit 4b - 3 weeks</p> <p>The Changing Earth</p> <ul style="list-style-type: none"> • identify the layers of the Earth. • compare and contrast the layers' temperature, thickness, density, and composition. 	<ul style="list-style-type: none"> • develop a model to show how human activity and natural processes have changed the surface of the Earth. <p>Anchoring Phenomenon</p> <ul style="list-style-type: none"> • Image of Weathering, Erosion, & Deposition <p>Topics</p> <ul style="list-style-type: none"> • Mechanical/Chemical weathering • Soil formation • Describe erosion and deposition • Mass movement • Erosion and deposition by wind and water <p><i>(LABS: Edible Soil Layer Lab, Cemetery/Stadium Walk)</i></p> <p>**Unit Test - Illuminate</p> <p>Unit 5 - 6 weeks</p> <p>Space/Sun-Earth & Moon</p> <ul style="list-style-type: none"> • develop a model of the phases of the moon. • compare the moon phases to the position of the sun, Earth, and moon. • explain what causes solar and lunar eclipses. • determine how the tilt of the Earth relates to the seasons.
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<p><i>(LABS: Ocean Floor Model, Tide Charting, STEM Water Filter)</i> **Unit Test (Illuminate)</p> <p>Unit 2a - 3 weeks Earth's Atmosphere</p> <ul style="list-style-type: none"> ● identify and order the layers of Earth's atmosphere. ● identify what can be found in each layer of the Earth's atmosphere - ● investigate the relationship between the ozone layer and greenhouse gasses. ● explain the process of conduction, convection, and radiation. ● demonstrate how the sun's heat transfers differently through land, air, and water. <p>Anchoring Phenomenon</p> <ul style="list-style-type: none"> ● Permafrost explosion <p>Topics</p> <ul style="list-style-type: none"> ● Layers of the atmosphere ● ozone, greenhouse gasses composition ● Air pressure/density ● Types of heat transfer ● How heat is distributed on Earth 	<ul style="list-style-type: none"> ● Weather maps ● Global Warming <p><i>(LABS:., Hurricanes vs. Tornadoes Debate, STEM Hurricane Proof Tower)</i> **Unit Test (Illuminate)</p> <p>Unit 3 - 3 weeks Energy Resources</p> <ul style="list-style-type: none"> ● discuss the differences between renewable and nonrenewable energy resources. ● determine how renewable and nonrenewable energy resources are used in our everyday lives. ● design and build a prototype which would represent a sustainable solution for conservation of natural resources. ● evaluate how the rise of global temperature changes have affected the Earth over the past century. <p>Anchoring Phenomenon</p> <ul style="list-style-type: none"> ● Salt Flat with Lithium <p>Topics</p> <ul style="list-style-type: none"> ● Renewable/Nonrenewable 	<ul style="list-style-type: none"> ● identify how plate tectonics occur ● compare and contrast convergent, divergent, and transform boundaries. ● explain how plate tectonics can cause major geological events such as earthquakes and volcanic eruptions. ● explain how fossils provide evidence of our surface and climate changing over time. ● deconstruct the layers of the soil. <p>Anchoring Phenomenon Plate Interaction</p> <ul style="list-style-type: none"> ● Tectonic Plates ● Hair Glass from Volcanoes ● Eye of the Sahara ● california earthquakes <p>Topics</p> <ul style="list-style-type: none"> ● Plate Tectonics ● Plate Boundaries: convergent, divergent, transform ● Continental Drift ● Seafloor Spreading ● Earth's Interior ● Earthquakes/Volcanoes ● Fossils <p><i>(LABS: Edible Plate Lab, Pie Chart Lab, Pangea Puzzle, STEM Lava Flow Activity)</i></p>	<ul style="list-style-type: none"> ● discuss changes and models of the Earth's position in the solar system. ● discuss how scientific theories have changed over time. ● create a model of the Milky Way in terms of where it lies in the universe. ● use data to compare and contrast the planets in terms of size relative to Earth, surface and atmospheric features, distance from the sun, and the ability to support life. ● create a model of how gravity and inertia governs the motion of objects in the solar system. ● differentiate comets, meteors, and asteroids by their characteristics, composition, and location. <p>Anchoring Phenomenon</p> <ul style="list-style-type: none"> ● A Large Asteroid Hit the Sun ● Blood Moon ● Big Bang Theory <p>Topics</p> <ul style="list-style-type: none"> ● Phases of the Moon ● Eclipses: Solar & Lunar ● Seasons based on tilt of the Earth
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<ul style="list-style-type: none"> Land vs. Water <p>**Unit Test (Illuminate)</p>	<ul style="list-style-type: none"> Advantages/Disadvantages of energy sources Human Impact on Earth's resources Global Warming <p><i>(LABS:)</i> **Mid Term (Illuminate)</p>	<p>**Unit Test - Illuminate</p>	<ul style="list-style-type: none"> Models of Earth's position : Geocentric, Heliocentric, Big Bang Compare and contrast planet characteristics and positions Inner/Outer Planets Earth's location in Milky Way Galaxy Gravity & Inertia Comets, Meteors, Asteroids <p><i>(LABS: Create An Alien, Moon Phases Lab, Eclipse Model, Solar System Distance Activity, Space Suits Taternauts)</i></p> <p>**Unit Test - Illuminate</p>
<p>Formal Assessments</p> <ul style="list-style-type: none"> Unit Test Midterm Final Exam (x2) Projects STEM Labs Labs 		<p>Informal Assessments</p> <ul style="list-style-type: none"> Quizzes Daily Grades Homework 	
<p>Standards</p> <p>S6E1. Obtain, evaluate, and communicate information about current scientific views of the universe and how those views evolved.</p> <p>a. Ask questions to determine changes in models of Earth's position in the solar system, and origins of the universe as evidence that scientific theories change with the addition of new information. (Clarification statement: Students should consider Earth's position in geocentric and heliocentric models and the Big Bang as it describes the formation of the universe.)</p> <p>b. Develop a model to represent the position of the solar system in the Milky Way galaxy and in the known universe.</p>		<p>Standards</p> <p>S6E3. Obtain, evaluate, and communicate information to recognize the significant role of water in Earth processes.</p> <p>a. Ask questions to determine where water is located on Earth's surface (oceans, rivers, lakes, swamps, groundwater, aquifers, and ice) and communicate the relative proportion of water at each location.</p> <p>b. Plan and carry out an investigation to illustrate the role of the sun's energy in atmospheric conditions that lead to the cycling of water. (Clarification statement: The water cycle should include evaporation, condensation, precipitation, transpiration, infiltration, groundwater, and runoff.)</p>	

c. Analyze and interpret data to compare and contrast the planets in our solar system in terms of: size relative to Earth, surface and atmospheric features, relative distance from the sun, and ability to support life.

d. Develop and use a model to explain the interaction of gravity and inertia that governs the motion of objects in the solar system.

e. Ask questions to compare and contrast the characteristics, composition, and location of comets, asteroids, and meteoroids.

S6E2. Obtain, evaluate, and communicate information about the effects of the relative positions of the sun, Earth, and moon.

a. Develop and use a model to demonstrate the phases of the moon by showing the relative positions of the sun, Earth, and moon.

b. Construct an explanation of the cause of solar and lunar eclipses.

c. Analyze and interpret data to relate the tilt of the Earth to the distribution of sunlight throughout the year and its effect on seasons.

S6E5. Obtain, evaluate, and communicate information to show how Earth's surface is formed.

a. Ask questions to compare and contrast the Earth's crust, mantle, inner and outer core, including temperature, density, thickness, and composition.

b. Plan and carry out an investigation of the characteristics of minerals and how minerals contribute to rock composition.

c. Construct an explanation of how to classify rocks by their formation and how rocks change through geologic processes in the rock cycle.

d. Ask questions to identify types of weathering, agents of erosion and transportation, and environments of deposition. (Clarification statement: Environments of deposition include deltas, barrier islands, beaches, marshes, and rivers.)

e. Develop a model to demonstrate how natural processes (weathering, erosion, and deposition) and human activity change rocks and the surface of the Earth.

f. Construct an explanation of how the movement of lithospheric plates, called plate tectonics, can cause major geologic events such as earthquakes and volcanic eruptions. (Clarification statement: Include convergent, divergent, and transform boundaries.)

c. Ask questions to identify and communicate, using graphs and maps, the composition, location, and subsurface topography of the world's oceans. **d. Analyze and interpret data** to create graphic representations of the causes and effects of waves, currents, and tides in Earth's systems.

S6E4. Obtain, evaluate, and communicate information about how the sun, land, and water affect climate and weather.

a. Analyze and interpret data to compare and contrast the composition of Earth's atmospheric layers (including the ozone layer) and greenhouse gases. (Clarification statement: Earth's atmospheric layers include the troposphere, stratosphere, mesosphere, and thermosphere.)

b. Plan and carry out an investigation to demonstrate how energy from the sun transfers heat to air, land and water at different rates. (Clarification statement: Heat transfer should include the processes of conduction, convection, and radiation.)

c. Develop a model demonstrating the interaction between unequal heating and the rotation of the Earth that causes local and global wind systems.

d. Construct an explanation of the relationship between air pressure, weather fronts, and air masses and meteorological events such as tornadoes and thunderstorms.

e. Analyze and interpret weather data to explain the effects of moisture evaporating from the ocean on weather patterns and weather events such as hurricanes.

S6E5. Obtain, evaluate, and communicate information to show how Earth's surface is formed.

a. Ask questions to compare and contrast the Earth's crust, mantle, inner and outer core, including temperature, density, thickness, and composition.

b. Plan and carry out an investigation of the characteristics of minerals and how minerals contribute to rock composition.

c. Construct an explanation of how to classify rocks by their formation and how rocks change through geologic processes in the rock cycle.

d. Ask questions to identify types of weathering, agents of erosion and transportation, and environments of deposition. (Clarification statement: Environments of deposition include deltas, barrier islands, beaches, marshes, and rivers.)

e. Develop a model to demonstrate how natural processes (weathering, erosion, and deposition) and human activity change rocks and the surface of the Earth.

f. Construct an explanation of how the movement of lithospheric plates, called plate tectonics, can cause major geologic events such as earthquakes and volcanic eruptions. (Clarification statement: Include convergent, divergent, and transform boundaries.)

S6E6. Obtain, evaluate, and communicate information about the uses and conservation of various natural resources and how they impact the Earth.

a. Ask questions to determine the differences between renewable/sustainable energy resources (examples: hydro, solar, wind, geothermal, tidal, biomass) and nonrenewable energy resources (examples: nuclear: uranium, fossil fuels: oil, coal, and natural gas), and how they are used in our everyday lives.

b. Design and evaluate solutions for sustaining the quality and supply of natural resources such as water, soil, and air.

c. Construct an argument evaluating contributions to the rise in global temperatures over the past century. (Clarification statement: Tables, graphs, and maps of global and regional temperatures, and atmospheric levels of greenhouse gases such as carbon dioxide and methane,

<p>Resource Links: GYSTC Resource Guide Units 1,2,3,6, and 7 GYSTC.org Username: Colquitt2021 Password: ColquittCounty42</p> <p>State Standards https://www.georgiastandards.org/Georgia-Standards/Documents/Science-Sixth-Grade-Georgia-Standards.pdf</p> <p>State Curriculum Map https://www.georgiastandards.org/Georgia-Standards/Documents/6th-Grade-Science-Curriculum-Map.pdf</p> <p>SLDS-TRL Tab</p> <p>State Units, Lessons, and Resources https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Pacing-Guide-Solar-System-and-Beyond.pdf</p> <p>https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Modeling-the-Solar-System-and-Beyond-Instructional-Segment-1.pdf</p> <p>https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-A-Retelling-of-The-Story-of-Andromeda.pptx</p> <p>https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Phenomenon-Celestial-Objects-with-Teacher-Notes.pptx</p> <p>https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Pacing-Guide-Earth-Moon-Sun.pdf</p>	<p>should be used as sources of evidence.)</p> <p>Resource Links: GYSTC Resource Guide Units 4,5 and 8 GYSTC.org Username: Colquitt2021 Password: ColquittCounty42</p> <p>State Standards https://www.georgiastandards.org/Georgia-Standards/Documents/Science-Sixth-Grade-Georgia-Standards.pdf</p> <p>State Curriculum Map https://www.georgiastandards.org/Georgia-Standards/Documents/6th-Grade-Science-Curriculum-Map.pdf</p> <p>SLDS-TRL Tab</p> <p>State Units, Lessons, and Resources https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Segment-Five-Climate-and-Weather-Pacing-Guide.pdf</p> <p>https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Segment-Five-Climate-and-Weather-Part-1-of-2-Water-Water-Everywhere.pdf</p> <p>https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Segment-Five-Climate-and-Weather-Part-2-of-2-Sun-and-Water-How-do-they-affect-Earth.pdf</p> <p>https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Segment-Six-Pacing-Guide-Natural-Resources.pdf</p> <p>https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Segment-Six-Human-Energy-Needs.pdf</p>
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<https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Motions-of-the-Earth-Moon-Sun.pdf>

<https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Phases-of-the-moon-Engaging.pptx>

<https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Segment-3-Pacing-Guide-Earths-Changing-Landscape.pdf>

<https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Segment-3-Inside-and-Out.pdf>

<https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Segment-3-Land-Surface-Features.pptx>

<https://lor2.gadoe.org/gadoe/file/10acee3b-7425-4c8a-83d4-9f38faf3a10/1/Science-6th-Instructional-Segment-4-Weathering-and-Erosion-with-supports.pdf>

GPB

<https://www.gpb.org/education/learn>

<https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-What-is-the-climate-like.pptx>

<https://www.georgiastandards.org/Georgia-Standards/Documents/Science-6th-Grade-Segment-Four-Pacing-Guide-Water-in-Earths-Processes.pdf>

GPB

<https://www.gpb.org/education/learn>

EOG Resources

Achievement Level Descriptors

https://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/ALD/ALDS_for_Grade_6_Milestones_EOG_Science.pdf

Content Weights for EOG

https://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Content%20Weights/ContentWeights_EOGCharts_August_2019.pdf

What is STEM

STEM education is an interdisciplinary approach to learning which removes the traditional instructional setting of teaching isolated subjects and integrates science, technology, engineering and math into real world learning experiences for students.

5 E Instructional Model

5E Instructional Model



The 5E instructional model is built on the idea that learners build on and construct new ideas on top of their old ones. Advantages of the 5E model include: Enhancing mastery of subject matter, Developing scientific reasoning, Understanding the complexity and ambiguity of empirical work, Developing practical skills, Understanding the nature of science, Cultivating interest in science and interest in learning science, Developing teamwork abilities.

Engagement	Exploration	Explanation	Extend/Elaboration	Evaluation
Teacher generates interest, assess prior knowledge,	Students experience key concepts, learn new skills,	Connecting prior knowledge to new content/discoveries, use of	Apply learning to similar situations, explain new situation	Should be ongoing throughout the learning phase, shows

connects prior knowledge, sets instructional focus on the concept,	asking question,reflect on their thinking and develop relationships and understanding of concepts	academic language, teacher and students work together	with formal academic language,	evidence of accomplishment,Teacher, peer and self assessments
Teacher actions: Motivates, creates interest, raises questions, taps into prior knowledge	Teacher actions: Moves into a facilitator role, observes students, asks guiding questions, encourages teamwork, provides materials and resources, provide adequate time for students to engage with the materials	Teacher actions: Encourages students to explain understandings in their own words, provides explanations of definitions, laws, theories, ask clarifying questions, builds onto students understanding, provide a variety of instructional strategies, develop academic language, formative assessments to gauge understanding	Teacher actions: Provide an opportunity for students to apply their new gained information to enhance additional learning, remind students to look for alternative ways to solve the problem,providing guidance on perseverance	Teacher actions: Observes students, asks open-ended questions,assess students, encourages students to self assess
Student actions: Ask questions, attentive to teacher/classmates, makes connections to prior learning, self reflects on what they already know, what do they want to know	Student actions: Conducts experiments, activities, work with groups to make meaning of the problem, record observations, use journals, listen to others ideas,	Student actions: Explain solutions, critiques or ask further questions of others solutions,refers back to notes and journals to communicate findings and understanding, self assesses their own learning	Student actions: Generates interest in new learning, explore related content, records observations and interacts with peers to broaden one's o	Student actions: Self evaluates, uses academic language, demonstrates understanding of concept, solves problems
Example: Topic : Observe and describe the process of erosion, transportation, and deposition of the earth's land surface using natural phenomena and models Materials : paint tray (the kind used for a paint roller), pieces of sod (enough for each group), potting soil, heavy clay like soil, Rainmaker (paper cup with about ten tiny holes poked in the bottom) , Water. Activity	Example: Construct a model to investigate how these changes may have occurred. Provide materials so the students can construct their own model of a landscape. It should include a piece of sod, fine potting soil, and a heavy clay like soil. Have them use a paint roller tray as the base of the landscape. Do not put any landscape materials in the bottom well; it should remain empty. Once students have constructed their models, have them diagram and label their models and make a prediction	Example: Tell me what some of your predictions were before it rained on your landscape. (Record on board.) What actually happened to your landscape when it rained on it? (record so you can make comparisons.) How is your landscape different after the rain than before it rained on it? What happened to the soil? Where did it go? Why did this happen? As students share their ideas	Example: Using the same paint roller tray as the base for their landscape, have the groups of students plan a method to decrease or eliminate erosion. Students should draw a diagram of the model planned and label the materials used in their landscape. They should write a short explanation explaining why they think this will work to curb erosion. (Tell students that you will provide the same materials that they used today and they are responsible for supplying the rest of the	Example: Have photographs representing each process and have students identify and explain why they identified it as such. Have students take a walk in their own neighborhood tonight to find examples of each process. They should draw and write one sentence telling what they observed. Have students write their own definition and list an example for each process in their science

<p>1.bottom of slide under swing</p> <p>2.end of splash guard by rain spout at entrance to door</p> <p>3. path leading to the playground at the bottom of hill/slope</p> <p>Do you notice anything different about these areas? (They are just dirt; no grass is growing here.)</p> <p>What do you think caused these changes? (Students walking over them; water running through it)</p>	<p>as to what will happen if it "rains" on their landscape.</p> <p>One student pours a cup of water all at once into the rainmaker. Hold the rainmaker about 4 inches above the upper end of the landscape and slowly move it back and forth so the water "rains" down on the model landscape. Observe what happens to the landscape. When it is finished raining the students observe the final effects of the rain on their landscape. Have students go back to their predictions and record what actually happened.</p>	<p>and understandings, record key phrases on the board. Some phases that may be valuable to your later discussion may include:dirt and soil washed away,the soil collected at the bottom of the slope,the water hollowed out the soil, the rain carried the soil down the hill,when the water washed away the soil it formed a hole</p> <p>Relate their observations to the processes scientists observe over an extended period of time. Use student models to identify and label erosion and deposition. Have students work to create definitions for these terms. When you are sure students have a real understanding of the terms, formulate a final definition and post on board or chart in the classroom for future reference. Demonstrate the process of transportation and lead students to understand that it is the movement of soil particles from one place to another. Refer to the list generated during the engagement and have students make connections; they should use the new terms to discuss and explain what they saw. Help them to understand that they just used water to simulate erosion, transportation, and deposition, but it can also be caused by wind, people, animals, etc.</p>	<p>materials to build their new landscape tomorrow.)</p> <p>Have students use a variety of resources and references to research various landmarks that are the result of these processes.</p>	<p>journals.</p>
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Science and Engineering Practices

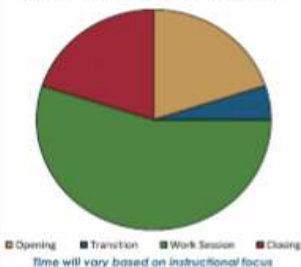
Asking questions and defining problems	Developing and using models
A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world(s) works and which can be empirically tested. Engineering questions clarify problems to determine criteria for successful solutions and identify constraints to solve problems about the designed world. Both scientists and engineers also ask questions to clarify ideas.	A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs.
Planning and carrying out investigations	Using mathematics and computational thinking
Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters. Engineering investigations identify the effectiveness, efficiency, and durability of designs under different conditions	In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; solving equations exactly or approximately; and recognizing, expressing, and applying quantitative relationships. Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of such predictions.
Analyzing and interpreting data	Constructing explanations and designing solutions
Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis. Engineering investigations	The end-products of science are explanations and the end-products of engineering are solutions. The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories. The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Each proposed solution results from a process of balancing competing criteria of

<p>include analysis of data collected in the tests of designs. This allows comparison of different solutions and determines how well each meets specific design criteria— that is, which design best solves the problem within given constraints. Like scientists, engineers require a range of tools to identify patterns within data and interpret the results. Advances in science make analysis of proposed solutions more efficient and effective.</p>	<p>desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints.</p>
<p>Engaging in argument from evidence</p>	<p>Obtaining, evaluating, and communicating information</p>
<p>Argumentation is the process by which evidence-based conclusions and solutions are reached. In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods based on merits. Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims</p>	<p>Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs</p>

The Science Standards-Based Classroom Instructional Framework provides a common language of instruction in order to successfully implement high quality practices. The tool can be used to develop lesson plans as well as a guide for teachers to reference during instruction. It is imperative that an opening, transition, work and closing is addressed with each lesson.

SCIENCE STANDARDS-BASED CLASSROOM INSTRUCTIONAL FRAMEWORK

Instructional Framework



PERVASIVE LESSON PRACTICES

Teacher will embed pervasive practices throughout lesson based on instructional focus

Literacy Across the Content:

- Disciplinary literacy
- Content literacy
- Close reading
- Disciplinary research/reading to learn

Writing Across the Content

- Content writing
- Writing process
- Writing to learn

Vocabulary Development:

- Academic vocabulary
- Content vocabulary
- Discipline vocabulary
- Engages in three-dimensional learning

Formative Assessment:

- Formal assessments
- Informal assessments
- Standards-based feedback

Classroom Culture:

- Models practices and procedures
- Encourages risk-taking and collaboration
- Demonstrates high expectations in classroom discourse
- Emphasizes safety practices

OPENING

Teacher:

- Introduces phenomena to engage students in investigations
- Engages students/accesses prior knowledge and makes connections by encouraging them to ask questions
- Provides explicit instruction aligned to standard(s), including skill development and conceptual understanding
- Models science and engineering practices and questioning based on crosscutting concepts

Student:

- Accesses prior knowledge
- Asks thought-provoking and clarifying questions.
- Participates in classroom discussions; engages in investigations and analyzes thinking

TRANSITION TO WORK SESSION

Teacher:

- Provides guidance to engage in exploration of phenomena
- Helps students in identifying routines to engage in collaboration
- Introduces organizing tools
- Reviews success criteria and expectations for work

Student:

- Engages in exploration of phenomena
- Participates in discussion
- Prepares organizing tools
- Asks questions or define problems

WORK SESSION

Teacher:

- Facilitates independent and small group work; scaffolds learning tasks
- Engages students in the 3-dimensions of science instruction
- Monitors, assesses and documents student progress and provides standards-based feedback
- Provides small group instruction
- Allows students to engage in productive struggle, make mistakes, and engage in error analysis
- Conferences formally and informally with students

Student:

- Engages in independent or collaborative learning
- Demonstrates proficiency of science and engineering practices, crosscutting concepts and core disciplinary ideas
- Completes conceptually rich performance tasks, research or guided practice
- Conferences with teacher and receives standards-based feedback

CLOSING

Teacher:

- Formally or informally assesses student understanding
- Asks questions targeting students' explanations and claims to provide feedback
- Provides phenomena that challenges students' explanations
- Engages students in summarizing learning and celebrates progress toward mastery of standard(s)
- Identifies next steps for instruction based on data analysis

Student:

- Shares, assesses, and justifies work using language of the standards
- Provides peer feedback and asks clarifying questions using language of the standards
- Reflects and summarizes progress toward mastery of learning target/standard based on success criteria