Fifth Grade

Science Curriculum

Francis Howell School District

HOME SCHOOL COMMUNITY

LEARNING TOGETHER

Board Approved:

July 18, 2019

Francis Howell School District

Mission Statement

The mission of the Francis Howell School District is to prepare students today for success tomorrow.

Vision Statement

Every student will graduate with college and career readiness skills.

Values

Francis Howell School District is committed to:

- Providing a consistent and comprehensive education that fosters high levels of academic achievement
- Operating safe and well-maintained facilities
- Providing a safe learning environment for all students
- Promoting parent, community, student, and business involvement in support of the school district
- Ensuring fiscal responsibility
- Developing responsible citizens
- Operating as a professional learning community
- Making appropriate use of technology

Francis Howell School District Graduate Goals

Upon completion of their academic study in the Francis Howell School District, students will be able to:

1. Gather, analyze and apply information and ideas.
2. Communicate effectively within and beyond the classroom.
3. Recognize and solve problems.
4. Make decisions and act as responsible members of society.

Science Graduate Goals

Upon completion of their Science study in the Francis Howell School District, students will be able to:

- Use Scientific and Engineering Practices to understand how scientific knowledge develops and the work of engineers, as well as the links between engineering and science. These practices include:
    - Asking questions (for science) and defining problems (for engineering)
    - Developing and using models
    - Planning and carrying out investigations
    - Analyzing and interpreting data
    - Using mathematics and computational thinking
    - Constructing explanations (for science) and designing solutions (for engineering)
    - Engaging in argument from evidence
    - Obtaining, evaluating, and communicating information
- Develop an understanding of, and be able to explain, concepts that bridge disciplinary boundaries, including:
    - Patterns
    - Cause and effect: Mechanism and explanation
    - Scale, proportion, and quantity
    - Systems and system models
    - Energy and matter: Flows, cycles, and conservation
    - Structure and function
    - Stability and change
- Use scientific knowledge to understand the world in four major domains:
    - Physical sciences (Matter and its interactions, Motion and Stability, Energy, Waves and Their Applications)
    - Life sciences (From Molecules to Organisms, Ecosystems, Heredity, Biological Evolution)
    - Earth and space sciences (Earth's Place in the Universe, Earth's Systems, Earth and Human Activity)
    - Engineering, technology, and the applications of science (Engineering Design, Links among Engineering, Technology, Science, and Society)

Rationale for Elementary Science

Science, engineering, and technology permeate nearly every facet of modern life, and they also hold the key to meeting many of humanity's most pressing current and future challenges. The overarching goal of science education is to ensure that all students have some appreciation of the beauty and wonder of science; possess sufficient knowledge of science and engineering to engage in public discussions on related issues; are careful consumers of scientific and technological information related to their everyday lives; are able to continue to learn about science outside of school; and have the skills to enter careers of their choice, including (but not limited to) careers in science, engineering, and technology. Elementary science in Francis Howell School District will develop student understandings and skills which are necessary for them to function productively as problem-solvers in a scientific and technological world, cultivate students' scientific and engineering habits of mind, develop their capability to engage in scientific and engineering practices, and teach them how to reason in the contexts of science, engineering, and technology.

Fifth Grade Science Course Description

Fifth Grade Science is designed to explore Structures and Properties of Matter, Matter and Energy in Organisms and Ecosystems, Earth's Systems, and Stars and the Solar System. Students are able to describe that matter is made of particles too small to be seen through the development of a model. Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. Through the development of a model using an example, students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. They describe and graph data to provide evidence about the distribution of water on Earth. Students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment and that energy in animals' food was once energy from the sun. Students will develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. The crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; energy and matter; and systems and systems models are called out as organizing concepts for these disciplinary core ideas. In fifth grade, students are expected to demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, engaging in argument from evidence, and obtaining, evaluating, and communicating information; and to use these practices to demonstrate understanding of the core ideas.

4-5 Science Curriculum Team and Contributors

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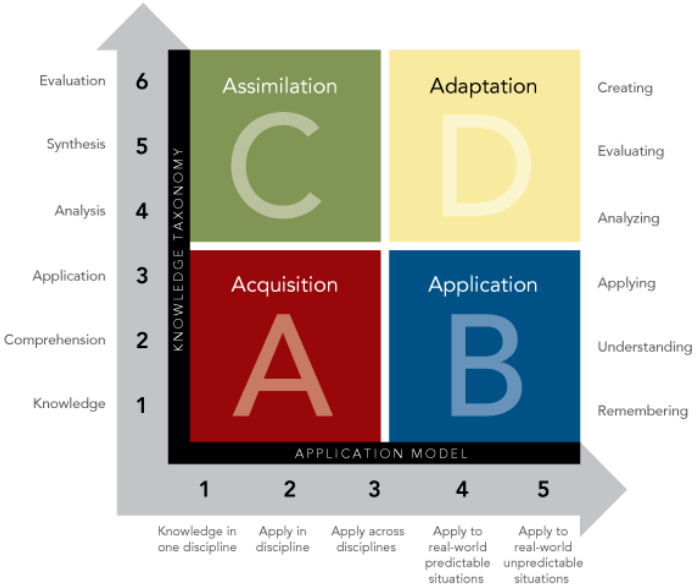
Curriculum Notes

All FHSD performance tasks and sample learning activities are aligned not only to understandings and standards, but also the Rigor and Relevance Framework and 21st Century Skills. Information on these two things is provided below or by clicking on the hyperlinks.

Rigor and Relevance Framework

The Rigor/Relevance Framework is a tool developed by the International Center to examine curriculum, instruction, and assessment along the two dimensions of higher standards and student achievement.



The Rigor/Relevance Framework has four quadrants.
Quadrant A represents simple recall and basic understanding of knowledge for its own sake. Examples of Quadrant A knowledge are knowing that the world is round and that Shakespeare wrote Hamlet.

Quadrant C represents more complex thinking but still knowledge for its own sake. Quadrant C embraces higher levels of knowledge, such as knowing how the U.S. political system works and analyzing the benefits and challenges of the cultural diversity of this nation versus other nations.

Quadrants B and D represent action or high degrees of application. Quadrant B would include knowing how to use math skills to make purchases and count change. The ability to access information in wide-area network systems and the ability to gather knowledge from a variety of sources to solve a complex problem in the workplace are types of Quadrant D knowledge.

A	B	C	D
Students gather and store bits of knowledge and information. Students are primarily expected to remember or understand this knowledge.	Students use acquired knowledge to solve problems, design solutions, and complete work. The highest level of application is to apply knowledge to new and unpredictable situations.	Students extend and refine their acquired knowledge to be able to use that knowledge automatically and routinely to analyze and solve problems and create solutions.	Students have the competence to think in complex ways.

21st Century Skills

These skills have been pared down from 18 skills to what are now called the 4Cs. The components include critical thinking, communication, collaboration, and creativity. Critical thinking is focused, careful analysis of something to better understand and includes skills such as arguing, classifying, comparing, and problem solving. Communication is the process of transferring a thought from one mind to others and receiving thoughts back and includes skills such as choosing a medium (and/or technology tool), speaking, listening, reading, writing, evaluating messages. Collaboration is working together with others to achieve a common goal and includes skills such as delegating, goal setting, resolving conflicts, team building, decision-making, and managing time. Creativity is expansive, open-ended invention and discovery of possibilities and includes skills such as brainstorming, creating, designing, imagining, improvising, and problem-solving.

Standards

Standards aligned to this course can be found:

Science Standards

http://www.nextgenscience.org/overview-topics

https://dese.mo.gov/sites/default/files/curr-mls-standards-sci-k-5-sboe-2016.pdf

National Educational Technology Standards

http://www.iste.org/standards/standards/for-students-2016

Units & Standards Overview

Quarter 1 **Quarter 2** **Quarter 3** **Quarter 4**

Unit 1: What's the Matter?	**Unit 2: All About the Energy**	**Unit 3: The World as We Know It**	**Unit 4: Out of this World**
Fifth grade students will be able to describe that matter is made of particles too small to be seen through the development of a model. Students will develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students will determine whether the mixing of two or more substances results in new substances.	Fifth graders will understand and support the idea that plants get the materials they need for growth from air and water. As the unit progresses, students will understand that energy is provided from the sun and then model how that energy can be transferred in various ways. Students will be able to classify major organ systems with different vertebrate classes.	In this unit students will learn about the interaction between the four spheres on our planet. Students will also explore freshwater availability on the planet and how science can help us manage this very limited resource. They will describe and graph data to provide evidence about the distribution of water on the Earth.	Students are expected to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.The students will understand the direction of gravitational force on objects. Throughout this unit, the students will be expected to support arguments, represent data, compare/contrast, and analyze patterns.
Unit Standards:	**Unit Standards:**	**Unit Standards:**	**Unit Standards:**
5-PS1-1/MO 5.PS1.A.1 5-PS1-2/MO 5.PS1.A.2 5-PS1-3 MO 5-PS.1.B.1 5-PS1-4/MO 5.PS1.B.2 **CCC2; CCC3** **SEP1; SEP2**; SEP3; SEP4 SEP5; **SEP7**	5-LS1-1/MO 5.PS3.D.1 **5-LS2-1/MO 5.LS2.B.1** 5-PS3-1/MO 5.PS3.D.1 **CCC4**; CCC5 **SEP1; SEP2**; SEP6; **SEP8**	5-ESS2-1/MO 5-ESS2.A.1 5-ESS2-2/MO 5-ESS2.C.1 **5-ESS3-1/MO 5-ESS3.C.1** **CCC3**; **CCC4** **SEP1; SEP2**; SEP5; **SEP8**	5-ESS1-1/MO 5.ESS1.A.1 MO 5.ESS1.B.1 5-ESS1-2/MO 5.ESS1.B.2 **5-PS2-1/MO 5.PS2.B.1** CCC1; **CCC2**; **CCC3**; CCC7 **SEP1**; **SEP2**; SEP4 SEP5; **SEP7**
PE Assessment:	**PE Assessment:**	**PE Assessment:**	**PE Assessment:**
Solar Distiller Assessment	Ecosystem Assessment	Air Pollution Assessment	Gravitational Force Assessment
PE Standards:	**PE Standards:**	**PE Standards:**	**PE Standards:**

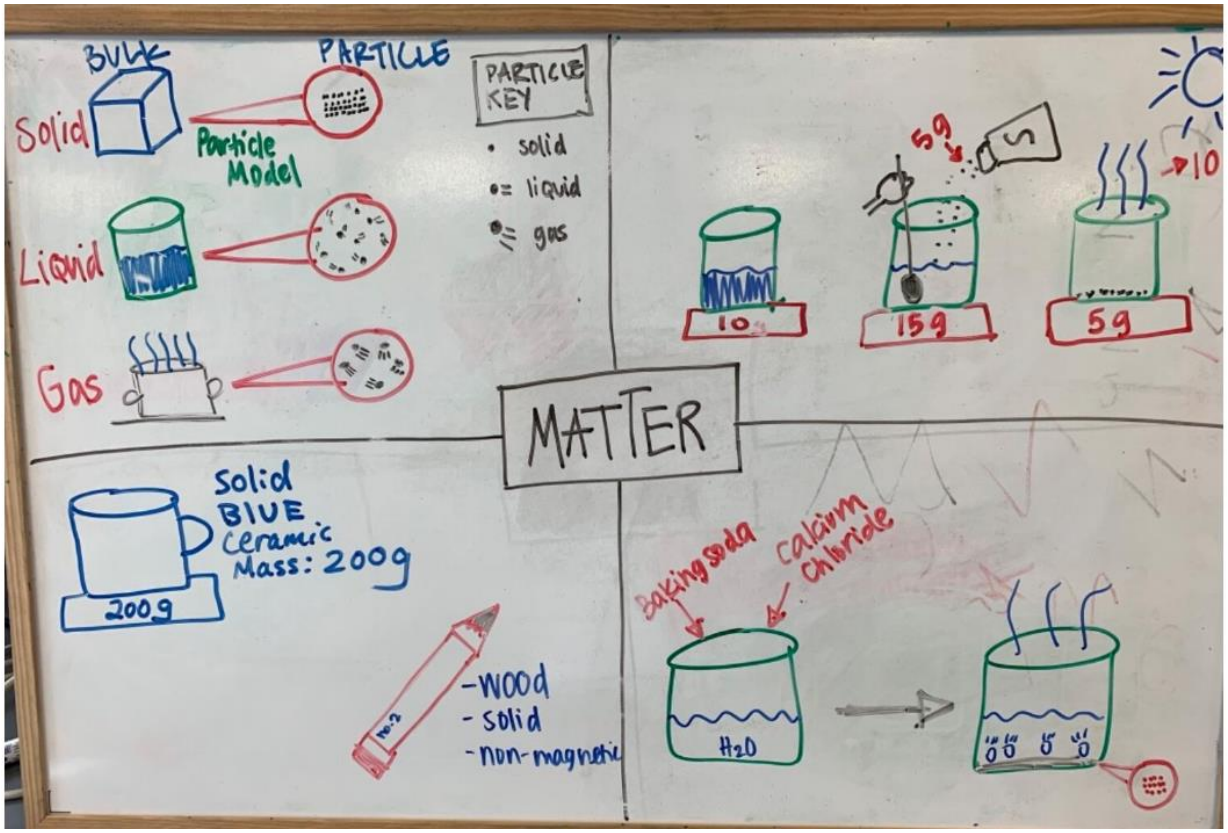
5-PS1-1 PS1.A CCC 3 SEP1 SEP 2 SEP 7	5-LS2-1/MO 5.LS2.B.1 CCC 4 CCC 5 SEP 1 SEP 2	5-ESS3-1 CCC 4 SEP 1 SEP 8	5-PS2-1 CCC 2 SEP 7

Unit 1: What's the Matter?

Content Area: Science	Course: Fifth Grade	UNIT: What's the Matter? (Structure and Properties of Matter)

Unit Description:
Students will be able to describe that matter is made of particles too small to be seen through the development of a model. Students will develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students will determine whether the mixing of two or more substances results in new substances.

Link to anchor chart



Unit Timeline:
4 Weeks

DESIRED Results

Transfer Goal - ***Students will be able to independently use their learning to……***

1. **Asking Questions and Defining Problems:** Ask questions about what would happen if a variable is changed. Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
2. **Developing and Using Models:** Develop a model to describe phenomena.
3. **Planning and Carrying Out Investigations:** Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
4. **Analyzing and Interpreting Data:** Represent data in tables and various graphical displays (e.g., bar graphs, pictographs) to reveal patterns that indicate relationships. Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.
5. **Using Mathematics and Computational Thinking:** Measure and graph quantities such as weight to address scientific and engineering questions and problems.
7. **Constructing Explanations and Designing Solutions:** Apply scientific ideas to solve design problems.

Understandings – *Students will understand that… (Big Ideas)*

2. (Cause and Effect) Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts. Cause and effect relationships are routinely identified and used to explain change.
3. (Scale, Proportion, and Quantity) Natural objects exist from the very small to the immensely large. Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Essential Questions: *Students will keep considering…*

- How does the mixing of two or more substances result in new substances?
- What is matter made of?
- How do you measure changes of matter?
- How do you investigate components of physical properties?

STANDARDS ADDRESSED		
Students who demonstrate understanding can: **5-PS1-1/MO 5.PS1.A.1 Develop a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.][Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.] 5-PS1-2/MO 5.PS1.A.2 Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.] 5-PS1-3/foundational to MO standard 5.PS1.B.1 Make observations and measurements to identify materials based on their properties. [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.] MO 5-PS.1.B.1 (not in NGSS) Plan and conduct investigations to separate the components of a mixture/solution by their physical properties (i.e., sorting, filtration, magnets, screening). [Assessment Boundary: Tasks should avoid specific events or steps in a procedure.] 5-PS1-4/MO 5.PS1.B.2 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.		
Disciplinary Core Ideas **Students will know...**	**Cross Cutting Concepts** **Students will understand…**	**Science and Engineering Practice** **Students will be able to...**
PS1.A: Structure and Properties of Matter Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1)	**CCC 3: Scale, Proportion, and Quantity** ● Natural objects exist from the very small to the immensely large. (5-PS1-1)	**SEP 2: Developing and Using Models** **Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.** ● Develop a model to describe phenomena. (5-PS1-1)

PS1.A: Structure and Properties of Matter The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2) PS1.B: Chemical Reactions No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)	**CCC 3: Scale, Proportion, and Quantity** ● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2)	SEP 1: Asking Questions and Solving Problems Asking questions and defining problems in grades 3–5 builds from grades K–2 experiences and progresses to specifying qualitative relationships. ● Ask questions about what would happen if a variable is changed. ● Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. SEP 5: Using Mathematics and Computational Thinking Mathematical and computational thinking at the 3–5 level builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. ● Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)
PS1.A: Structure and Properties of Matter Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3)	**CCC 3: Scale, Proportion, and Quantity** ● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-3)	SEP 4: Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. ● Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3)

PS1.B.1 Mixtures and Solutions Matter exists as different substances that have observable different properties. Components of mixtures and solutions can be separated using a variety of methods, depending on the properties of the individual components. (MO 5-PS.1.B.1)	**CCC 2: Cause and Effect** ● Cause and effect relationships are routinely identified and used to explain change. (MO 5-PS.1.B.1)	SEP 3: Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. ● Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using a fair test in which variables are controlled and the number of trials are considered. (MO 5-PS.1.B.1) **SEP 7: Constructing Explanations and Designing Solutions** **Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.** ● Apply scientific ideas to solve design problems. (MO 5-PS.1.B.1)

PS1.B: Chemical Reactions When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4)	**CCC 2: Cause and Effect** ● Cause and effect relationships are routinely identified and used to explain change. (5-PS1-4)	**SEP 2: Developing and Using Models** **Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.** ● Develop a model to describe phenomena. SEP 3: Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. ● Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5-PS1-4)

Unit 1: Assessment

EVIDENCE of LEARNING			
Understanding 2, 3	Standards **5-PS1-1/MO** **5.PS1.A.1** **PS1.A** **CCC 3** **SEP1** **SEP 2** **SEP 7**	**Unit Performance Assessment**: Particle Model of Matter Performance Assessment **Teacher will assess:** *What criteria will be used in each assessment to evaluate attainment of the desired results?* 1. Analyze the information presented in the video and draw conclusions based on knowledge of matter. 2. Make observations and provide an explanation supporting a model. 3. Develop a model to support an improved design. **Scoring Guide:**	**R/R Quadrant 21 Century** D Critical Thinking Creativity Communication

Unit 1: Sample Activities

SAMPLE LEARNING PLAN
Pre-assessment: *What pre-assessments will you use to check students' prior knowledge, skill levels, and potential misconceptions?*
Anchoring Phenomena for this Unit: Supercooled Water

Understanding	Standards	Major Learning Activities:	Instructional Strategy:	R/R Quadrant: 21C:
2, 3	**5-PS1-1/MO** **5.PS1.A.1** **PS1.A** **CCC 3** **SEP 1**	**Sample Lesson #1- Asking Questions and Defining Problem (Supercooled Water - first activity)** **Objective:** Students will ask and answer questions about the cause and effect of structure and properties of matter. **Description:** 1. Show the Anchoring Phenomenon Supercooled Water video to the whole class. 2. Ask students to write down questions they have about what they observed. (5 minutes) Rules for Producing Questions: a. Ask as many questions as you can. b. Do not stop to discuss, judge or answer the questions.	Setting Objectives Cues and Questions Identifying Similarities and Differences Cooperative	D Collaboration Communication Critical thinking

		c. Write down every question exactly as it is stated. d. Change any statement into a question. 3. Have students share their questions in a small group. Within the small group, students will create a list with a minimum of 5 questions about the phenomenon. 4. Categorize Your Questions (5 minutes) In your list, you might have the two types of questions previously mentioned: closed-ended and open-ended. Here are working definitions for closed and open-ended questions: Closed-ended questions can be answered with "yes" or "no" or with one word. Open-ended questions require an explanation and cannot be answered with "yes" or "no" or with one word. Review your list of questions and identify closed and open-ended questions. Mark the open-ended questions with an O and the closed-ended questions with a C. THEN, change questions from one type to another. Go back to your list of questions and change one closed-ended question into an open-ended, and change one open-ended question into a closed-ended one. Make the changes right on the list. 5. Choose the three most important questions from your list. Mark them with an "X" and discuss your reasons for selecting those three. **You are not answering any questions. Students should be encouraged to focus on questioning today.** Appendix Documents: Supercooled Water, Burning Wool Phenomenon	Learning Generating and Testing Hypotheses	
2, 3	**5-PS1-1/MO 5.PS1.A.1 PS1.A CCC 3 SEP 2**	**Sample Lesson #2- Develop & Use Models (Supercooled Water - second activity)** **Objective**: Students will create a model to make predictions of how the Phenomena works. **Description:** 1. Class discussion - review questions from day 1 2. With no talking, each student sketches a model of how they think the water bottle froze. 3. Teacher highlights important aspects of creating a model. E.g.: a. Title b. Diagram with labels c. Explanation d. Color/color-coding e. Other good features i. Zoom-in bubbles ii. Measurement/Time	Setting Objectives Cues and Questions Non-Linguistic Representation Summarizing and Notetaking Identifying Similarities and Differences	D Creativity Collaboration Communication Critical Thinking

		iii. Questions 4. Students revise their model to include some of the elements described. 5. Share models with table/group explaining their thinking. 6. Students revise their own models.	Generating and Testing Hypotheses	
2, 3	**5-PS1-1/MO** **5.PS1.A.1** 5-PS1-2 5-PS1-3 **PS1.A** **SEP 3** **SEP 4** **CCC 2** **CCC 3**	**Sample Lesson #3- Investigation and Instruction** *Before the start of the lesson, refer to the student resource list to gather materials for investigation.* **Objective:** Students will develop an investigation to understand the cause and effect relationships between properties of matter. **Description:** 1. As we conduct our experiment today, students will wonder about the following questions. How do you measure changes of matter? How do you investigate components of physical properties? Freezing Water- Bottle Slam Lab Sheet 2. Each group will get the necessary supplies to conduct the experiment. Students will create the experiment on their own. Remind students that the water bottle should not be opened throughout the entire experiment. Allow students time to draw a model of their experiment to label after the instruction. *Experiment should be available for students to reference and make observations throughout the lesson.* 3. Teacher will: a. Ask students to record the temperature at the beginning of the experiment. b. Explain the properties of matter: solid, liquid, and gas c. Model how all particles of each state of matter look up close. d. Ask students to use their experiment and label what part of their experiment is represented by each state of matter. e. Halfway through the lesson, have students record the temperature and notice changes made during the experiment f. Instruct students on how matter changes properties by adding or taking away temperatures. g. After 30 minutes, have students pull water bottle from ice and draw a model of the water bottle with applying their understanding of particles up close. h. Have students “slam” their bottle on a hard surface and note the changes that are occurring.	Setting Objectives Cues and Questions Non-Linguistic Representation Cooperative Learning Generating and Testing Hypotheses	D Creativity Collaboration Communication Critical Thinking

		4. Within their group, students should discuss what they observed and the changes that occurred. Students should discuss why states of matter did or didn't change. *Note: there is a possibility that not all water bottles will change states, be prepared to talk about what could be done next time to see a successful change*. 5. Each group shares their findings (cause and effect) with the whole class. 6. As a whole class, come to a consensus of how temperature affects states of matter.		
2, 3	**5-PS1-1/MO** **5.PS1.A.1** 5-PS1-4 **PS1.A** **SEP 1** **SEP 2** **CCC 3**	**Sample Lesson #4- Teacher Demonstrated Phenomena** *Today's investigation will require observations to be made over a span of 1-3 days (depending on crystal growth)* **Objective:** Students will create a model to show what happens to the particles of matter when heating and cooling a mixture of water and salt. **Link for demonstration:** Salt Crystals Experiment **Description:** 1. Before the day of the lesson, teachers will need to gather materials to use for classroom demonstration. 2. Teacher will: a. Ask the students to generate a list of products they use every day that are made up of more than one substance. b. Introduce the students to the words- mixture and solution. c. Explain today's demonstration will allow them to observe mixture and solutions at work. 3. Walk students through the Salt Crystal experiment and talk with students about mixture and solution as the experiment is taking place. 4. Ask students to write down questions they have about what they observed. Rules for Producing Questions: a. Ask as many questions as you can. b. Do not stop to discuss, judge or answer the questions. c. Write down every question exactly as it is stated. d. Change any statement into a question. 5. Students will then create a model of what they think is happening in the experiment. The teacher should highlight important aspects of creating a model. E.g.: a. Title b. Diagram with labels	Setting Objectives Cues and Questions Non-Linguistic Representation Summarizing and Notetaking Identifying Similarities and Differences	D Collaboration Communication Critical Thinking

		c. Explanation d. Color/color-coding e. Other good features i. Zoom-in bubbles ii. Measurement/Time iii. Questions 6. Have students share drawings and questions with their science group. Students should discuss with predictions of what will happen to the solution. 7. Over the next few days, have students make observations about the variety of salt crystals. Students should use their notebooks to draw observations and be given an opportunity to discuss with the group their findings. 8. At the end of the final day of observations, have a group discussion about the predictions that were made and how they think the crystals were formed.		
2,3	5-PS1-2 5-PS1-4 MO 5-PS.1.B.1 PS1.B **SEP 2** **SEP 3** **CCC 2**	**Sample Lesson #5- Planning & Carrying out Investigations** *Before the start of the lesson the teacher will need to gather a variety of substances for students to use in the creation of their mixture or solution. Materials to use during the separation of their mixture and solution will also need to be gathered. This lesson could take multiple days depending on how much choice is given to students in the selection of substances and ways to separate their newly created mixture or solution.* **Objective:** Students will develop an investigation to determine the cause and effect relationship of mixing and separating two or more substances. **Description:** 1. Working with a partner or small group, students will create a mixture or solution. Students will also measure the weight of their substances prior to mixing and after mixing to determine if matter was conserved. 2. Students will draw a diagram of their new mixture or solution. 3. Students will then plan and investigate how to separate the mixture or solution they created. **Appendix Documents:** Mixtures and Solution Investigation	Setting Objectives Cues and Questions Non-Linguistic Representation Identifying Similarities and Differences Providing Feedback	D Creativity, Collaboration, Communication, Critical Thinking

Unit 1: Resources

UNIT RESOURCES

Teacher Resources:

- Instant Freeze Water - Bottle Slam experiment set video (teacher resource)
- Instant Freeze Water - Bottle Slam (video for students) - no volume needed
- Raising a Flag Image
- Question Formulation Technique from rightquestion.org

Student Resources:

- Water Bottles
- Container
- Ice
- Thermometer
- Rock salt
- Scale
- Variety of substances (soil, sand, baking soda, vinegar, oil, iron filings, etc.) to create mixtures and solutions, along with materials or items to separate their mixture or solution (magnets, screens, heat source, filters, etc.)

Vocabulary:

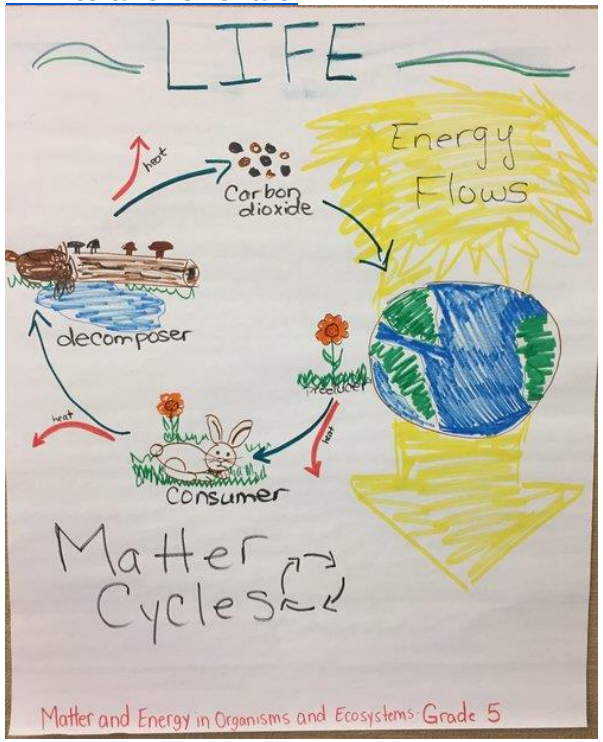
Amount: a quantity of something, especially the total of a thing or things in number, size, value, or extent (mass or weight)
Cause and effect: a relationship between actions or events such that one or more are the result of the other or others
Change: to transform or convert (e.g. heating, cooling, phase change, dissolving, mixing)
Conservation of matter: matter takes up space and has weight. It cannot be created, and it cannot be destroyed. You may change the shape or form of matter, but it will always exist
Matter: anything that has mass and takes up space
Mixing: combine or put together to form one substance or mass
Particle of matter (Microscopic): All matter is made of up particles that are too small to be seen, these particles behave in different ways whether they are solid, liquid or gas.
Properties: are what a material or substance is like and how it behaves. It can describe any piece of the material- Quantitative- (e.g. weight or mass) or Qualitative (e.g. state of matter, color, texture, odor)
States of matter: The main difference in the structures of each state is in the densities of the particles and how they behave (e.g. solid, liquid, gas)
Substance: a particular kind of matter with uniform properties

Unit 2: All About the Energy

Content Area: Science	Course: Fifth Grade	UNIT: All About the Energy (Matter and Energy in Organisms and Ecosystems)

Unit Description:
Fifth graders will understand and support the idea that plants get the materials they need for growth from air and water. As the unit progresses, students will understand that energy is provided from the sun and then model how that energy can be transferred in various ways. Students will be able to classify major organ systems with different vertebrate classes.

Link to anchor chart:



Unit Timeline:
4 weeks

DESIRED Results

Transfer Goal - ***Students will be able to independently use their learning to……***

1. **Asking Questions and Defining Problems:** Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
2. **Developing and Using Models:** Develop a model to describe phenomena. Use models to describe phenomena.
6. **Constructing Explanations and Designing Solutions:** Identify the evidence that supports particular points and in explanation.
8. **Engaging in Argument from Evidence:** Construct and/or support an argument with evidence, data, and/or a model.

Understandings – *Students will understand that… (Big Ideas)*

4. (Systems and System Models) A system can be described in terms of its components and their interactions. A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
5. (Energy and Matter) Energy can be transferred in various ways and between objects. Matter is transported into, out of, and within systems.

Essential Questions: *Students will keep considering…*

- How do we classify animals?
- How do organisms obtain and use the matter and energy they need to live and grow?
- How are matter and energy moved/transferred through an ecosystem?
- How do organisms interact with their environment?

STANDARDS ADDRESSED		
Students who demonstrate understanding can: MO 5th LS.1.A.1 Compare and contrast the major organs/organ systems (e.g., support, digestive, transport/circulatory, excretory, response) that perform similar functions for animals belonging to different vertebrate classes. 5-PS3-1/MO 5.PS3.D.1 Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.] **5-LS2-1/MO 5.LS2.B.1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.** 5-PS3-1/MO 5.PS3.D.1 Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.		
Disciplinary Core Ideas **Students will know...**	**Cross Cutting Concepts** **Students will understand…**	**Science and Engineering Practice** **Students will be able to...**
LS1.A: Structure and Function Organisms have both internal and external macroscopic structures that allow for growth, survival, behavior, and reproduction with organs that are specialized for particular body functions. (MO 5-LS1.A.1)	**CCC 4: Systems and System Models** ● Students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. Students can also describe a system in terms of its components and their interactions. (MO 5-LS1.A.1) CCC 5: Energy and Matter ● Energy can be transferred in various ways and between objects. (MO 5-LS1.A.1)	SEP 6: Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. ● Identify the evidence that supports particular points and in explanation. (MO 5-LS1.A.1) **SEP 8: Engaging in Argument from Evidence** **Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).** ● Construct and/or support an argument with evidence, data, and/or a model. (MO 5-LS1.A.1)
LS1.C: Organization for Matter and Energy Flow in Organisms	CCC 5: Energy and Matter ● Matter is transported into,	**SEP 8: Engaging in Argument from Evidence** **Engaging in argument from evidence in 3–5 builds**

Plants acquire their material for growth chiefly from air and water. (5-LS1-1)	out of, and within systems. (5-LS1-1)	**on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).** ● Support an argument with evidence, data, or a model. (5-LS1-1)
LS2.A: Interdependent Relationships in Ecosystems The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1) **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)	**CCC 4: Systems and System Models** ● A system can be described in terms of its components and their interactions. (5-LS2-1)	**SEP 1: Asking Questions and Defining Problems** **Asking questions and defining problems in grades 3–5 builds from grades K–2 experiences and progresses to specifying qualitative relationships.** ● Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. **SEP 2: Developing and Using Models** **Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.** ● Develop a model to describe phenomena. (5-LS2-1)
PS3.D: Energy in Chemical Processes and Everyday Life The energy released [from] food was once	CCC 5: Energy and Matter ● Energy can be transferred in various ways and	**SEP 1: Asking Questions and Defining Problems** **Asking questions and defining problems in grades 3–5 builds from grades K–2 experiences and**

energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1) <u>LS1.C: Organization for Matter and Energy Flow in Organisms</u> Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1)	between objects. (5-PS3-1)	**progresses to specifying qualitative relationships.** ● Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. **<u>SEP 2: Developing and Using Models</u>** **Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.** ● Use models to describe phenomena. (5-PS3-1)

Unit 2: Assessment

EVIDENCE of LEARNING

<u>Understanding</u>	<u>Standards</u>	**<u>Unit Performance Assessment</u>**:	**<u>R/R Quadrant</u>**
4, 5	**5-LS2-1/MO** **5.LS2.B.1** **CCC 4** CCC 5 **SEP 1** **SEP 2**	Unit 2: 5-LS2-1 Movement of Matter Assessment **Teacher will assess:** *What criteria will be used in each assessment to evaluate attainment of the desired results?* 1. Develop and use a model to describe how matter moves from the environment to animals through plants. 2. Explains how an increase in one part of an ecosystem can affect the whole system, using knowledge to support their reasoning. 3. Develops and uses a model to describe how the cycling of matter by decomposers supports the ecosystem. 1. **Scoring Guide:** Unit 2: 5-LS2-1 Rubric Movement of Matter	**<u>21 Century</u>** D Critical Thinking Creativity Communication

Unit 2: Sample Activities

SAMPLE LEARNING PLAN
Pre-assessment: Question: A giraffe eats leaves from a tree. What is it gaining in terms of energy by doing this? Where does the tree get the energy to grow and produce leaves and fruit? Where does the energy go after the giraffe eats it?
Anchoring Phenomena for this Unit: Silent Invaders Video.

Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant: 21C:**
4, 5	**5-LS2-1/MO 5.LS2.B.1 CCC 4 SEP 1**	**Sample Lesson #1- Asking Questions** **Objective:** Students will ask questions about the movement of matter for the components within an ecosystem. **Description:** 1. Show the Anchoring Phenomena to the whole class on Silent Invaders Video. 2. In small groups, with one person as recorder, ask students to write down questions they have about what they observed. (5 minutes) Rules for Producing Questions: a. Ask as many questions as you can. b. Do not stop to discuss, judge or answer the questions. c. Write down every question exactly as it is stated. d. Change any statement into a question. 3. Categorize Your Questions (5 minutes) In your list, you might have the two types of questions previously mentioned: closed-ended and open-ended. Here are working definitions for closed and open-ended questions: Closed-ended questions can be answered with “yes” or “no” or with one word. Open-ended questions require an explanation and cannot be answered with “yes” or “no” or with one word. Review your list of questions and identify closed and open-ended questions. Mark the open-ended questions with an O and the closed-ended questions with a C. THEN, change questions from one type to another. Go back to your list of questions	Setting Objectives Cues, Questions, and Advanced Organizers Cooperative Learning Generating and Testing Hypothesis	A Critical Thinking Collaboration Communication

		and change one closed-ended question into an open-ended, and change one open-ended question into a closed-ended one. Make the changes right on the list. 4. Choose the three most important questions from your list. Mark them with an "X" and discuss your reasons for selecting those three. **You are not answering any questions. Students should be encouraged to focus on questioning today.** **Appendix Documents:** Silent Invaders Video		
4, 5	**5-LS2-1/MO** **5.LS2.B.1** **CCC 4** **SEP 2**	**Sample Lesson #2- Developing and Using Models** **Objective:** Students will develop and use models to show their understanding of the components and system as a whole when an invasive species disrupts an ecosystem. **Description:** 1. Ask students to review the questions they developed in activity 1. 2. Ask students to share their questions with a partner or small group. 3. Next, students will develop a model to explain how the ecosystem might change based on this invasive species. These might include components and interactions in this environment. Remind students that models should include a. Title b. Diagram with labels c. Explanation d. Color/color-coding e. Other good features i. Zoom-in bubbles ii. Measurement/Time iii. Questions 4. Students will post their models for others to review. Without talking, students will review other models, using post-it notes to ask questions to help their classmates clarify or make adjustments. 5. Students will return to their desks with their model and feedback and adjust their model (based on feedback and some other things they may have seen). *Teachers might also consider allowing students to create their models on Chromebooks, laptops, or other devices uses an application such as Google Drawings.*	Setting Objectives Cues and Questions Non-Linguistic Representation Cooperative Learning Generating and Testing Hypothesis	C Critical Thinking Communication Creativity
4, 5	**5-LS2-1/MO**	**Sample Lesson #3- Ask and Answer Questions** (new ecosystem)	Setting	B

	5.LS2.B.1 **CCC 4** **SEP 1**	**Objective:** Students will ask and answer questions to begin to understand how matter moves through the system as a whole within an ecosystem. **Description:** Discuss with the students that they will be exploring another food web with predator and prey relationships in other areas. 1. Access "Why Would a Hawk Move to New York City" Mystery Science video. 2. If you would like to use Google Classroom to answer the video's questions, use the Web of Life Google Slides 3. As a class, complete Exploration 1, 2 and 3. **Appendix Documents:** "Why Would a Hawk Move to New York City" and Web of Life Google Slides	Objectives Cues and Questions Graphic Organizers Identifying Similarities and Differences	Critical Thinking Communication Creativity
4, 5	**5-LS2-1/MO** **5.LS2.B.1** **CCC 4** **SEP 2**	**Sample Lesson #4- Develop a Model** **Objective:** Students will develop a model to describe the components and movement of matter among plants, animals, and decomposers in an ecosystem. **Description:**In this activity, students will be playing "Eat or Be Eaten," a card game in which they make food chains. The game is designed for 2 to 4 players. 1. Prep for "Why Would a Hawk Move to New York City?" a. Print materials. You will need these materials for today's lesson. Each group of players will need: a. A set of these 5 sheets to be cut into playing cards. (Use card stock if possible.) b. A printout of the rules of the game c. Scissors for each player (so everyone can help cut up the cards) d. An Eat or Be Eaten Score Card 2. Access "Why Would a Hawk Move to New York City" Mystery Science video and prep for the activity, "Eat or Be Eaten!" a. You will be following the first nine directions given for the activity. The students will be building food chains with the provided cards. *If you want to modify this game, you can have the students make the cards with the descriptors.* b. For steps 10 and 11, you may have the students record their answers in Web of Life Google Slides.	Setting Objectives Cues and Questions Non-Linguistic Representation Identifying Similarities and Differences Cooperative Learning	C Critical Thinking Collaboration Communication

		c. Have the students discuss and answer the following questions. They are also located in Web of Life Google Slides. i. How do organisms obtain and use the matter and energy they need to live and grow? ii. How are matter and energy moved/transferred through an ecosystem? **Appendix Documents**: "Why Would a Hawk Move to New York City" , Web of Life Google Slides		
4, 5	**5-LS2-1/MO 5.LS2.B.1 CCC 4** SEP 6	**Sample Lesson #5- Construct an Explanation** **Objective**: Students will construct an explanation about the movement within the system among plants, animals, and decomposers in an ecosystem. **Description:** The students will explain how an increase in one part of an ecosystem can affect the whole system, using knowledge to support their reasoning. 1. Students will revisit the model from Lesson 2 and revise based on new learning. 2. Access the video "Sea Otters: A Keystone Species." Play video until **1:19**. Discuss how the sea otters affect this ecosystem. Pose questions based on how energy is passed in the ecosystem. a. You may put the students in partnerships or have them work independently. 3. Have the students develop a model to represent the Sea Otter's ecosystem and construct an explanation based on protecting the keystone species. The students need to decide what would be the best way to protect the species. Use the Constructing Explanations graphic organizer to help guide their thinking. 4. For a modified version of this activity, use Ecosystem Picture and Scenario Cards. **Appendix Documents:** "Sea Otters: A Keystone Species." **,** Ecosystem Picture , Scenario Cards. Constructing Explanations graphic organizer	Setting Objectives Cues and Questions Non-Linguistic Representation Graphic Organizer Identifying Similarities and Differences Generating and Testing Hypothesis	D Critical Thinking Collaboration Communication Creativity

Unit 2: Resources

UNIT RESOURCES

Teacher Resources:

- Silent Invaders Video
- "Why Would a Hawk Move to New York City"
- Web of Life Google Slides
- "Why Would a Hawk Move to New York City" Mystery Science video and prep for the activity, "Eat or Be Eaten!"
- "Sea Otters: A Keystone Species."
- Constructing Explanations graphic organizer
- Ecosystem Picture
- Scenario Cards.
- Unit 2: 5-LS2-1 Movement of Matter Assessment
- Unit 2: 5-LS2-1 Rubric Movement of Matter
- *Horseshoe Crabs and Shorebirds:the story of a food web* (Crenson, Victoria)
- *Living Sunlight:how plants bring the earth to life* (Bang, Molly)
- *Pass the Energy Please* (McKinney, Barbara Shaw)
- *Secrets of the garden: food chains and the food web in our backyard* (Zoehfeld, Kathleen Weidner)
- *Seed, soil, sun: Earth's recipe for food* (Peterson, Cris)

Student Resources:

- Paper
- Scissors
- Chromebook or electronic device
- Student link for Mystery Science video

Vocabulary:

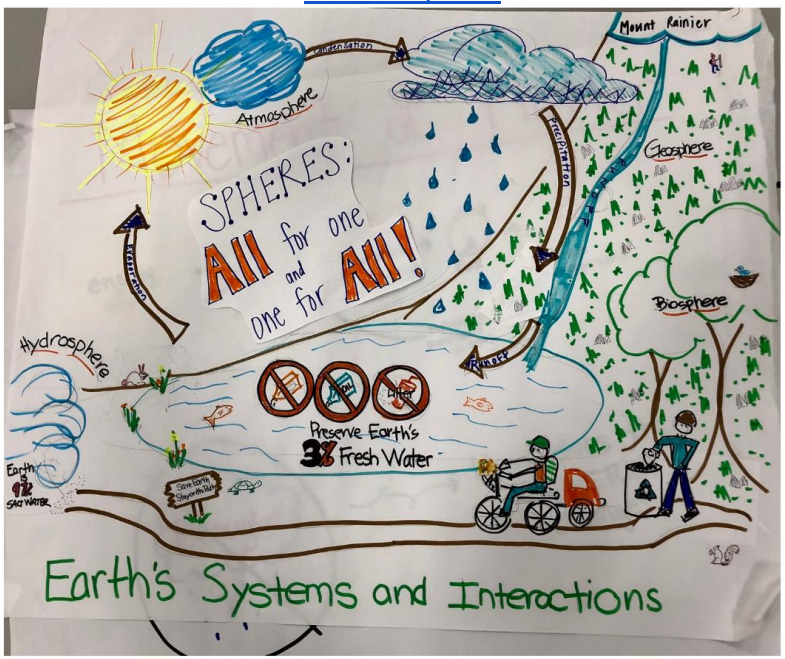
Decomposers: an organism that breaks down the cells of dead plants and animals into simpler substances. (eg. fungi and bacteria)
Ecosystem: a system, or a group of interconnected elements, formed by the interaction of a community of organisms with their environment
Energy: process of transfer from one body to another (eg. sunlight)
Environment: the surroundings or conditions in which a person, animal, or plant lives or operates
Function: the reason some object or process occurred in a system (eg. body repair, growth, motion, body warmth)
Matter: anything that has mass and takes up space (eg. air, soil, water)

Unit 3: The World as We Know It

Content Area: Science	Course: Fifth Grade	UNIT: The World as We Know It (Earth's Systems)

Unit Description:
In this unit students will learn about the interaction between the four spheres on our planet. Students will also explore freshwater availability on the planet and how science can help us manage this very limited resource. They will describe and graph data to provide evidence about the distribution of water on the Earth.

Link to anchor chart: Earth's System



Unit Timeline:
4 weeks

DESIRED Results

Transfer Goal - ***Students will be able to independently use their learning to……***

1. **Asking Questions and Defining Problems:** Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. Use prior knowledge to describe problems that can be solved.
2. **Developing and Using Models:** Develop a model using an example to describe a scientific principle.
5. **Using Mathematics and Computational Thinking:** Describe and graph quantities such as area and volume to address scientific questions.
8. **Obtaining Evaluating, and Communicating Information:** Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

Understandings – *Students will understand that… (Big Ideas)*

3. (Scale, Proportion, and Quantity) Standard units are used to measure and describe physical quantities such as weight and volume.
4. (Systems and System Models) A system can be described in terms of its components and their interactions.

Essential Questions: *Students will keep considering…*

- How do earth's systems affect one another?
- Why should we care about all of the earth's water?
- How can we determine the distribution of water on Earth?
- How can I use science ideas to protect the earth?

STANDARDS ADDRESSED		
Students who demonstrate understanding can: 5-ESS2-1/MO 5-ESS2.A.1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.] 5-ESS2-2/MO 5-ESS2.C.1 Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.] **5-ESS3-1/MO 5-ESS3.C.1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.**		
Disciplinary Core Ideas **Students will know...**	**Cross Cutting Concepts** **Students will understand…**	**Science and Engineering Practice** **Students will be able to...**
ESS2.A: Earth Materials and Systems Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1)	**CCC 4: Systems and System Models** ● A system can be described in terms of its components and their interactions. (5-ESS2-1)	**SEP 1: Asking Questions and Defining Problems** **Asking questions and defining problems in grades 3–5 builds from grades K–2 experiences and progresses to specifying qualitative relationships.** ● Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. **SEP 2: Developing and Using Models** **Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.** ● Develop a model using an example to describe a scientific principle. (5-ESS2-1)
ESS2.C: The Roles of Water in Earth's Surface Processes Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams,	**CCC 3: Scale, Proportion, and Quantity** ● Standard units are used to measure and describe physical quantities such	SEP 5: Using Mathematics and Computational Thinking Mathematical and computational thinking at the 3–5 level builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to

lakes, wetlands, and the atmosphere. (5-ESS2-2)	as weight and volume. (5-ESS2-2)	analyze data and compare alternative design solutions. ● Describe and graph quantities such as area and volume to address scientific questions. (5-ESS2-2)
ESS3.C: Human Impacts on Earth Systems Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)	**CCC 4: Systems and System Models** ● A system can be described in terms of its components and their interactions. (5-ESS3-1)	**SEP 1: Asking Questions and Defining Problems** **Asking questions and defining problems in grades 3–5 builds from grades K–2 experiences and progresses to specifying qualitative relationships.** ● Use prior knowledge to describe problems that can be solved. **SEP 8: Obtaining, Evaluating, and Communicating Information** **Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.** ● Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5-ESS3-1)

Unit 3: Assessment

EVIDENCE of LEARNING

Understanding	Standards	Unit Performance Assessment:	R/R Quadrant 21 Century
3, 4	**5-ESS3-1/MO** **5-ESS3.C.1** **CCC 4** **SEP 1** **SEP 8**	Unit 3: ESS3-1 Warning Air Pollution SPA **Teacher will assess:** *What criteria will be used in each assessment to evaluate attainment of the desired results?* 1. Explains how human activities affect the environment and supports the explanation with evidence from resources and reasoning using knowledge about variations in air pollution.	D Critical Thinking

		2. Obtains information and uses knowledge to explain how humans impact an environmental system. 3. Synthesizes information from reliable media to support an explanation of how human activities have affected the environment and ways communities are protecting the environment. **<u>Performance:</u>** **Scoring Guide: Unit 3: ESS3-1 Rubric Warning Air Pollution**	Creativity Communication

Unit 3: Sample Activities

SAMPLE LEARNING PLAN
Pre-assessment: *What do you know about earth's systems and their interactions?*
Anchoring Phenomena for this Unit: United Arab Emirates Iceberg

Understanding	Standards	Major Learning Activities:	Instructional Strategy:	R/R Quadrant: 21C:
3, 4	5-ESS2-1/MO 5-ESS2.A.1 **5-ESS3-1/MO 5-ESS3.C.1 CCC4 SEP1**	**Sample Activity #1- Asking Questions and Defining Problems Objective:** Students will ask and answer questions about the cause and effect of the interactions of Earth's spheres. **Description:** a) Show the Anchoring Phenomenon Iceberg in the United Arab Emirates video to the whole class. Students may need more information about this project. Iceberg Article b) Ask students to write down questions they have about what they observed. (5 minutes) Rules for Producing Questions: i) Ask as many questions as you can. ii) Do not stop to discuss, judge or answer the questions. iii) Write down every question exactly as it is stated. iv) Change any statement into a question. c) Have students share their questions in a small group. Within the small group, students will create a list with a minimum of 5 questions about the phenomenon. d) Categorize Your Questions (5 minutes) In your list, you might have the two types of questions previously mentioned: closed-ended and open-ended. e) Choose the three most important questions from your list. Mark them with an "X" and discuss your reasons for selecting those three. **You are not answering any questions. Students should be encouraged to focus on questioning today.** Appendix Documents: Iceberg Project, Iceberg Article	Setting Objectives Cues, Questions, and Advanced Organizers Cooperative Learning Generating and Testing Hypothesis	Critical Thinking Collaboration Communication Creativity

3, 4	5-ESS2-1/MO 5.ESS2.A.1 **CCC4** **SEP2**	**Sample Lesson #2- Develop & Use Models** **Objective**: Students will create a draft model of how earth systems work, including the components and interactions within the system **Description:** 1. Students will need to develop a draft model, using as an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. Model Earth Systems and Interactions 2. This can be completed individually or with a group of students. An example may look like a class poster.	Setting Objectives Generating and Testing Hypothesis Non-Linguistic Representation	Critical Thinking Collaboration Communication Creativity
3, 4	5-ESS2-1/MO 5.ESS2.A.1 **CCC4** **SEP8**	**Sample Lesson #3- Obtaining, Evaluating, and Communicating Information (Research)** **Objective:** Students will research one of the Earth's systems to understand the how components work separately and together as a full system. **Description:** 1. Number students off 1-4. Each student will be researching a different earth system. (Atmosphere, Biosphere, Geosphere, Hydrosphere.) 2. Students will research their assigned earth system and become an expert on their topic. Students will evaluate the interactions between the different earth systems. 3. Students will jigsaw teach the four earth systems within their assigned group. Jigsaw Teaching Article **Appendix Documents:** Jigsaw Teaching Article, Model Earth Systems and Interactions	Setting Objectives Cues, Questions, and Advanced Organizers Cooperative Learning Non-Linguistic Representation Summarizing and Notetaking	Critical Thinking Communication
3, 4	5-ESS2-1/MO 5.ESS2.A.1 **CCC4** **SEP2**	**Sample Lesson #2- Develop & Use Models** **Objective**: Based on the previous lesson learning and sharing, students will create or revise their model of how earth systems work, including details of the components and interactions within the system **Description:** 1. Students will need to develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. Model Earth Systems and Interactions 2. This can be completed individually or in pairs.	Setting Objectives Non-Linguistic Representation	Critical Thinking Collaboration Communication Creativity
3, 4	5-ESS2-2/MO 5.ESS2.C.1	**Sample Lesson #4- Asking Questions and Defining Problem** **Objective:** Students will ask and answer questions about the surprising difference in the amounts of fresh and saltwater on Earth.	Setting Objectives	Critical Thinking

	CCC3 **SEP1**	**Description:** 1. Prep for "Map the World's Water" activity. a. Gather materials: pencils and paper for students to do their calculations, markers or colored pencils to help students keep track as they count the squares on their maps, scissors and tape to cut out and post classroom materials, small, removable sticky-glue dots or Post-its in 3 colors to represent fresh, frozen, and salt water, enough space on a wall or door to accommodate a graph that's 76 stickers high and 3 bars wide b. Print out materials:one copy of the 2-page "Where in the world is my map?" to post for students to see, one copy of the Bar Graph Labels, one copy of the "Map Checklist & Answer Key" for you to use, at least one Maps Worksheet (they're numbered 1–18) for each student…plus extras. c. Find a good spot for your graph and put the Bar Graph Labels in place, Post the "Where in the world is my map?" sheets so students can see the map sections they'll be working with, Have extra maps available, if possible, for students whose first tries don't work out, Have stickers or Post-its for the graph ready to distribute during class 2. Access How much water is in the world? Mystery Science video. 3. If you would like to use Google Classroom to answer the video's questions, use the"Water on Earth's Surface" slides. You must make a copy of the slides before editing it. You can push the slides out in Google Classroom and have each student answer questions individually. 4. As a class, complete Exploration 1-9. 5. For the activity, follow steps 1-18 in the How much water is in the world? Mystery Science video. 6. Watch the final video in the Mystery Science video. 7. If you chose to demonstrate this learning, use the following link to extend this learning. "Can You Spare a Drop?" **Appendix Documents:** "Map the World's Water", "Where in the world is my map?", Bar Graph Labels, "Map Checklist & Answer Key",Maps Worksheet, How much water is in the world? Mystery Science video, "Water on Earth's Surface" slides, "Can You Spare a Drop?"	Cues, Questions, and Advanced Organizers Generating and Testing Hypothesis Non-Linguistic Representation Summarizing and Notetaking	Collaboration Communication Creativity

3, 4	5-ESS2-1/MO 5.ESS2.A.1 **5-ESS3-1/MO 5.ESS3.C.1 CCC3 SEP2**	**5. Title: Develop & Use Models** **Objective**: Students will create a model to explain of how water cycles from the Earth's surface to the atmosphere and back again. **Description:** 1. Access Can we make it rain? Mystery Science video. 2. If you would like to use Google Classroom to answer the video's questions, use the Can we make it rain? (Notes) slides. You can push the slides out in Google Classroom and have each student answer questions individually. 3. As a class, complete Exploration 1-11. 4. After the exploration, students will be ready for the activity! There is some preparation that is needed before beginning the activity part of this mystery. Please Rain Activity Supplies, if you would like your students to participate in this activity. 5. Activity "Make it Rain" 1-14 6. Watch the final video for this mystery science exercise. If you have more time, view the assessment, reading, and extension activities in the optional extras. This will all be found at the conclusion of this mystery. **Appendix Documents: Rainmaker Experiments Part 1 & 2**	Setting Objectives Cues, Questions, and Advanced Organizers Generating and Testing Hypothesis Non-Linguistic Representation Summarizing and Notetaking	Critical Thinking Collaboration Communication Creativity

Unit 3: Resources

UNIT RESOURCES
Teacher Resources: ● Anchoring Phenomenon Iceberg in the United Arab Emirates video ● Iceberg Project ● Iceberg Article ● Jigsaw Teaching Article, ● Model Earth Systems and Interactions ● "Map the World's Water" ● "Where in the world is my map?" ● Bar Graph Labels ● "Map Checklist & Answer Key" ● Maps Worksheet ● How much water is in the world? Mystery Science video ● "Water on Earth's Surface" slides

- small, removable sticky-glue dots or Post-its in 3 colors
- enough space on a wall or door to accommodate a graph that's 76 stickers high
- "Can You Spare a Drop?"
- 5 gallon bucket
- 2-cup transparent measuring cup
- 1-cup transparent measuring cup
- 1 eyedropper
- Water body worksheet
- Rain Activity Supplies
- Can we make it rain?

Student Resources:

- Iceberg Article
- paper
- Model Earth Systems and Interactions
- pencils and paper
- markers or colored pencils
- scissors
- tape
- Can we make it rain? (Notes)
- Rainmaker Experiments Part 1 & 2

Vocabulary:

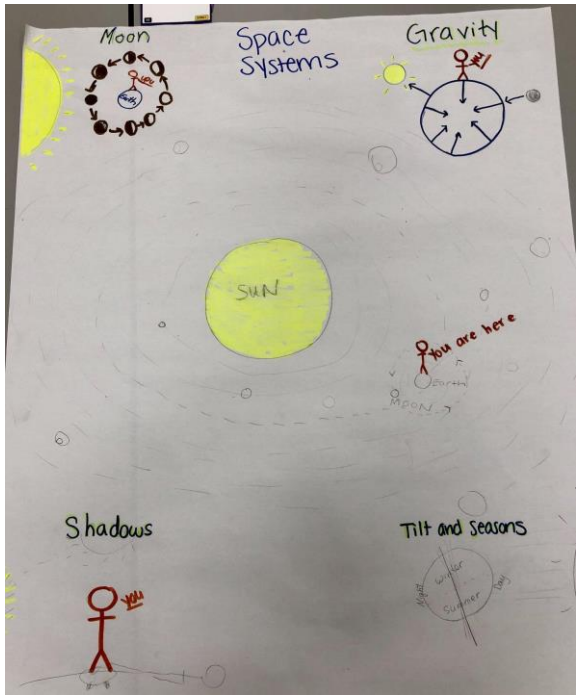
Atmosphere: the envelope of gases surrounding the earth or another planet (i.e., wind, oxygen)
Biosphere: the part of earth that is able to support life (i.e., plants, animals [including humans]).
Communities: all of the populations sharing a specific area or region; for example, all the organisms in a lake
Ecosystem: all the living populations in an area along with the nonliving parts of that environment
Fresh water: fresh water (or freshwater) is any naturally occurring water except seawater and brackish water. Fresh water includes water in ice sheets, ice caps, glaciers, icebergs, bogs, ponds, lakes, rivers, streams, and even underground water called groundwater.
Geosphere: (i.e., solid and molten rock, soil, sediment, continents, mountains)
Human activities: (e.g. agriculture, industry, everyday life)
Hydrosphere: (i.e., water and ice in the form of rivers, lakes, glaciers)
Interaction: a particular way in which particles affect one another
Protect: keep safe from harm or injury. (resources, environment)
Salt water: water that naturally contains a significant amount of salt (oceans)
Systems: a set of things working together as parts of a mechanism or an interconnecting network

Unit 4: Out of this World

Content Area: Science	Course: Fifth Grade	UNIT: Out of this World (Space Systems)

Unit Description:
Fifth grade students are expected to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.The students will understand the direction of gravitational force on objects. Throughout this unit, the students will be expected to support arguments, represent data, compare/contrast, and analyze patterns.

Link to anchor chart: **Out of this World Anchor Chart**



Unit Timeline:
4 weeks

DESIRED Results

Transfer Goal - ***Students will be able to independently use their learning to……***

1. **Asking Questions and Defining Problems:** Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
2. **Developing and Using Models:** Develop and/or use models to describe and/or predict phenomena.
4. **Analyzing and Interpreting Data:** Represent data in tables and/or various graphical displays, bar graphs, pictographs, and/or pie charts to reveal patterns that indicate relationships.
5. **Using Mathematics and Computational Thinking:** Organize simple data sets to reveal patterns that suggest relationships.
6. **Engaging in Argument from Evidence:** Support an argument with evidence, data, or a model.

Understandings – *Students will understand that… (Big Ideas)*

1. (Patterns) Patterns of change can be used to make predictions. Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.
2. (Cause and Effect) Cause and effect relationships are routinely identified and used to explain change.
3. (Scale, Proportion, and Quantity) Natural objects exist from the very small to the immensely large.
4. (Stability and Change) Change is measured in terms of differences over time and may occur at different rates.

Essential Questions: *Students will keep considering…*

- How does gravity affect the Earth?
- How can we explain the patterns that we see in the sky?
- Why is the Sun the brightest object we see in the sky?
- What are the predictable patterns caused by Earth's movement in the solar system?

STANDARDS ADDRESSED		
Students who demonstrate understanding can: 5-ESS1-1/MO 5.ESS1.A.1 Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth. [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.] MO 5-ESS1.B.1 (not in NGSS) Make observations during different seasons to relate the amount of daylight to the time of the year. [Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.] [Assessment Boundaries: Tasks should only reflect the seasonal patterns of Missouri. Students' descriptions should be limited to a written response. Pictorial descriptions would be possible as part of a technology enhanced item.] 5-ESS1-2/MO 5.ESS1.B.2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.] **5-PS2-1/MO 5.PS2.B.1 Support an argument that the gravitational force exerted by Earth on objects is directed down.** [Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).]		
Disciplinary Core Ideas **Students will know...**	**Cross Cutting Concepts** **Students will understand…**	**Science and Engineering Practice** **Students will be able to...**
ESS1.A: The Universe and Its Stars The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. (5-ESS1-1)	**CCC 3: Scale, Proportion, and Quantity** ● Natural objects exist from the very small to the immensely large. (5-ESS1-1)	**SEP 2: Developing and Using Models** **Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions**. ● Develop and/or use models to describe and/or predict phenomena. **SEP 7: Engaging in Argument from Evidence** **Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).** ● Support an argument with evidence, data, or a model. (5-ESS1-1)

ESS1.B: Seasons Patterns of seasons can be observed, described, and predicted. (MO 5-ESS1.B.1)	CCC 1: Patterns ● Patterns of change can be used to make predictions. (MO 5-ESS1.B.1) CCC 7: Stability and Change ● Change is measured in terms of differences over time and may occur at different rates. (MO 5-ESS1.B.1)	**SEP 1: Asking Questions and Solving Problems** **Asking questions and defining problems in grades 3–5 builds from grades K–2 experiences and progresses to specifying qualitative relationships.** ● Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (MO 5-ESS1.B.1) SEP 4: Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. ● Represent data in tables and/or various graphical displays, bar graphs, pictographs, and/or pie charts to reveal patterns that indicate relationships. (MO 5-ESS1.B.1) SEP 5: Using Mathematics and Computational Thinking Mathematical and computational thinking at the 3–5 level builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. ● Organize simple data sets to reveal patterns that suggest relationships. (MO 5-ESS1.B.1)
ESS1.B: Earth and the Solar System The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year. (5-ESS1-2)	CCC 1: Patterns ● Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5-ESS1-2)	SEP 4: Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. ● Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5-ESS1-2)
PS2.B: Types of Interactions	**CCC 2: Cause and Effect**	**SEP 7: Engaging in Argument from Evidence**

The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1)	● Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)	**Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).** ● Support an argument with evidence, data, or a model. (5-PS2-1)

Unit 4: Assessment

EVIDENCE of LEARNING			
Understanding 1, 2	Standards **5-PS2-1/MO** **5-PS2.B.1** **CCC 2** **SEP 7**	**Unit Performance Assessment**: Unit 4- 5-PS2-1 Out of this World Assessment **Teacher will assess:** *What criteria will be used in each assessment to evaluate attainment of the desired results?* 1. Support an argument that the gravitational force exerted by the Earth is downward. 2. Describe the cause and effect of gravitational force. **Scoring Guide: Unit 4- PS2-1 Out of this World Answer Key**	**R/R Quadrant 21 Century** C Critical Thinking Communication

Unit 4: Sample Activities

SAMPLE LEARNING PLAN
Pre-assessment: A man standing on the South Pole of the Earth drops a ball. Mike thinks that the ball will move away from the Earth and Maria thinks that the ball will move toward the Earth. Who do you agree with? Who do you disagree with? What could you say to that person to convince them that their idea is not correct? Be sure to use evidence to support your idea.
Anchoring Phenomena for this Unit: Star Trails

Understanding	Standards	Major Learning Activities:	Instructional Strategy:	R/R Quadrant: 21C:
2, 3	5-ESS1-2 5.ESS1.B.2 CCC1 **CCC3** **SEP 1**	**Sample Lesson #1-Asking Questions and Defining Problem (Star Trails-first activity)** **Objective:** Students will ask and answer questions about the similarities and differences of patterns in the sky. **Description:** a. Show the Anchoring Phenomenon Star Trails video. b. Ask students to write down questions they have about what they observed. (5 minutes) Rules for Producing Questions: i. Ask as many questions as you can.	Setting Objectives Cooperative Learning Generating and Testing	D Collaboration Communication Critical Thinking

		ii. Do not stop to discuss, judge or answer the questions. iii. Write down every question exactly as it is stated. iv. Change any statement into a question. c. Have students share their questions in a small group. Within the small group, students will create a list with a minimum of 5 questions about the phenomenon. d. Categorize Your Questions (5 minutes) In your list, you might have the two types of questions previously mentioned: closed-ended and open-ended. Go back to your list of questions and change one closed-ended question into an open-ended, and change one open-ended question into a closed-ended one. Make the changes right on the list. e. Choose the three most important questions from your list. Mark them with an "X" and discuss your reasons for selecting those three. **You are not answering any questions. Students should be encouraged to focus on questioning today.** Appendix Documents Appendix Documents: Star Trails Phenomenon	Hypothesis Non-Linguistic Representation Cues, Questions, and Advanced Organizers	
2, 3	5-ESS1-2 5.ESS1.B.2 CCC 1 **CCC 3** **SEP 2**	**Sample Lesson #2- Develop & Use Models (Star Trails phenomena)** **Objective**: Students will create a model to show the pattern occurring in the night sky over time. **Description:** 1. Class discussion - review questions from day 1 2. With no talking, each student sketches a model of how they think the star trails occur. 3. Teacher highlights important aspects of creating a model. E.g.: a. Title b. Diagram with labels c. Explanation d. Color/color-coding e. Other good features i. Zoom-in bubbles ii. Measurement/Time iii. Questions 4. Students revise their model to include some of the elements described. 5. Share models with table/group explaining their thinking. 6. Students revise their own models.	Setting Objectives Generating and Testing Hypothesis Non-Linguistic Representation Cues, Questions, and Advanced Organizers	D Collaboration Communication Critical Thinking
1,4	5-ESS1-2	**Sample Lesson #3- Investigation and Instruction**	Setting	D

	5.ESS1.B.2 CCC 1 CCC 7 **SEP 1** SEP 4 SEP 5	*Before the start of the lesson, refer to the student resource list to gather materials for investigation. Teachers may also want to review with class how to use a protractor.* **Objective:** Students will investigate to understand the patterns of shadows. **Description:** 1. As we conduct our experiment today, students will wonder about the following question: How does the position of the sun affect the length and direction of shadows throughout the day? 2. Teacher will: a. Introduce the vocabulary independent and dependent variable. The position of the sun would be labeled “independent variable” because that is what the scientist will be changing. “Lengths and direction of shadow” would be labeled as the “dependent variable” because that is what the scientist will be measuring as a result of the independent variable. b. Read the background knowledge paragraph with the students. Use this time to discuss rotation and Earth’s axis. c. Have students label the sunrise and sunset in the model. 3. Students will: a. Generate a hypothesis to predict the shadows with their group using scientific vocabulary they have learned. b. Gather materials for investigation. c. Students will work with their group or partners on gathering data and creating a graph with the information they collect. d. Analyze data and answer questions based on what they observed. 4. After investigation is complete, discuss with the class how this investigation is similar to the Earth’s rotation. You may also discuss how this experiment had limitations or things they would do to extend their learning. 5. Teachers may choose to extend the learning by having students observe shadows throughout the day. Teachers can also extend this activity to the pattern and relationship between day and night, and the seasonal appearance of stars in the night sky. Appendix: Investigating Shadows	Objectives Generating and Testing Hypothesis Non-Linguistic Representation Cues, Questions, and Advanced Organizers	Collaboration Communication Critical Thinking

1, 3	5-ESS1-1 ESS1.A **CCC 3** **SEP 2**	**Sample Lesson #4- Develop & Use Models** **Objective**: Students will develop a model to show the scale of the distance between Earth and stars. **Description:** 1. Preparation: Prior to the lesson the teacher will need to prepare a string that is 65 feet long or mark with tape 65 feet in a large room or hallway. Print the image of the Sun and Earth to scale. 2. Show students the image of the Sun. You may choose to discuss what the surface of the Sun actually looks like compared to what the Sun looks like to our eyes. Have students predict how big the Earth would be if the Sun is the size of the image. 3. Reveal the answer by showing the image of Earth. At this point you may choose to hand each student a copy of the Sun and Earth to scale to use in the next step. 4. Have students predict how far the model Earth should be from the model Sun. At this point you may allow students to walk to where they think the distance should be. 5. Once students have made their predictions use the string to measure 65 feet from the model Sun to where the model Earth should be. 6. At 65 feet away, look back toward the model Sun. Notice how big it looks at this distance. At this scale, the model Sun should be about the same size as the actual Sun appears to us here on Earth. 7. At this point teachers may choose to have students predict and discuss how far other stars must be from Earth. Appendix: Sun and Earth to scale	Setting Objectives Generating and Testing Hypothesis Non-Linguistic Representation Cues, Questions, and Advanced Organizers	C Collaboration Communication Critical Thinking
1, 3	5-ESS1-1 **CCC 3** **SEP 7**	**Sample Lesson #5- How Big?, How Far?, How Hot?** **Objective**: Students will support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth **Description:** 1. Students will first individually sort the nine How Big? images of objects associated with the Earth and Sun. Students will arrange the images in order of actually size from smallest to largest. 2. Students will then discuss with a partner or cooperative group to compare how they individually ordered the nine objects associated with the Earth and Sun. Encouraging students to write down and keep track of questions they may have during discussion. 3. Have each group come to a consensus on the order of size from	Setting Objectives Cooperative Learning Generating and Testing Hypothesis Non-Linguistic	C Collaboration Communication Critical Thinking

		smallest to largest. 4. Present the correct order and lead a discussion about the actual sizes. Answer and discuss questions students had during discussions with their individual group. You could use a parking lot structure for students to post their questions or have each individual group share out questions they came up with. 5. Repeat the steps about with the How Far?, and How Hot? images. Appendix: How Big?, How Far?, How Hot?	Representation Cues, Questions, and Advanced Organizers	

Unit 4: Resources

UNIT RESOURCES
Teacher Resources: ● The Sun and Earth to Scale ● www.nasa.gov ● String or tape ● Measuring Tape ● How Big?, How Far?, How Hot? Images and discussion notes ● Solar Center
Student Resources: ● Flashlight ● Figurine or small binder clip ● Protractor ● Shadow tracking paper ● Tape ● Ruler ● Cut out of the Sun and Earth to Scale ● How Big? How Far? How Hot? images
Vocabulary: **Axis:** imaginary line passing through the center of a planet (such as Earth), that the plant spins around

Daily changes: (e.g. length and direction of shadow, day and night)
Gravitational force: the force of attraction between all masses in the universe; especially the attraction of the earth's mass for bodies near its surface
Orbit: path an object in space follows as it revolves around another object, such as Earth around the sun or a satellite around Earth
Rotation: spinning of a planet, moon, sun, or other object, around its axis
Seasonal changes: (e.g. stars in the night sky)
Stars: huge object in space made up of gas and giving off light and heat from nuclear reactions; the sun is a star
Stellar: relating to a star or stars
Sun: the heart of our solar system, is a yellow dwarf star, a hot ball of glowing gases. Its gravity holds the solar system together, keeping everything from the biggest planets to the smallest particles of debris in its orbit