This scope and sequence document was developed to assist teachers with the implementation of the Louisiana Student Standards for Science. This tool is not full curriculum and will need to be further built out by science educators. It has been designed to help in the initial transition to the new standards.

This document is considered a "living" document, as we believe that teachers and other educators will find ways to improve it as they use it. Please send feedback to classroomsupporttoolbox@la.gov so that we may use your input when updating this tool.

About the Sample Scope and Sequence Tools

The Louisiana Student Standards for Science represent the knowledge and skills needed for students to successfully transition to postsecondary education and the workplace. The standards call for students to:

- Apply content knowledge
- Investigate, evaluate, and reason scientifically
- Connect ideas across disciplines

This scope and sequence document is designed to assist teachers, schools, and districts with the development of instructional resources that align with the Louisiana Student Standards for Science. This scope and sequence is only a sample; it does not illustrate the only appropriate sequence to teach the standards or the only possible ways to bundle the standards. The bundles can be reorganized around different phenomenon, including phenomenon specific to Louisiana or to a region in Louisiana.

Based on the instructional shifts, this tool uses phenomena to drive 3-dimensional science instruction. The incorporated phenomena are observable events that occur in the universe and can be explained by science. They establish the purpose for learning and help students to connect their learning to real-world events.

- The standards are bundled into units.
- The units are built around an anchor phenomenon.
- One unit has been built out further to contain a series of investigative phenomena, which have been sequentially organized to reinforce one another and build toward the performance expectations.

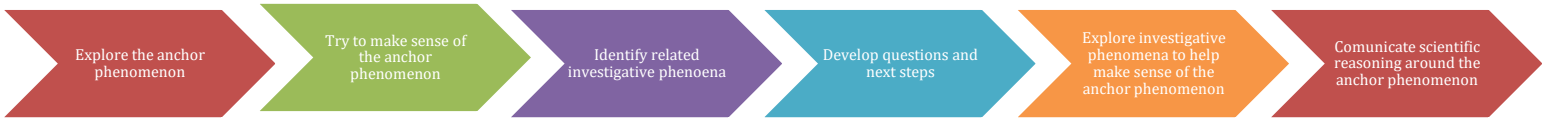
Throughout each unit, students should have multiple opportunities to apply the science and engineering practices, make sense of the crosscutting concepts, and develop a deep understanding of disciplinary core ideas.

Building out the Science Scope and Sequences for Classroom Instruction

How to Use the Anchor and Investigative Phenomena[1]

1. Explore the anchor phenomenon
2. Attempt to make sense of the phenomenon
3. Identify related phenomena
4. Develop questions and next steps
5. Explore investigative phenomena to help make sense of the anchor phenomenon
6. Communicate scientific reasoning around the anchor phenomenon

Instructional Process



Choosing an Anchor Phenomenon

Students should be able to make sense of anchoring phenomenon, but not immediately, and not without investigating it using sequences of the science and engineering practices. With instruction and guidance, students should be able to figure out, step by step, how and why the phenomenon works. [2]

A good anchor phenomenon[3]:

☐ is too complex for students to explain or design a solution for after a single lesson.

- The explanation is just beyond the reach of what students can figure out without instruction.
- Searching online will not yield a quick answer for students to copy.

☐ can be a case (pine beetle infestation, building a solution to a problem), something that is puzzling (why isn't rainwater salty?), or a wonderment (how did the solar system form?).

☐ has relevant data, images, and text to engage students in the range of ideas students need to understand. It should allow them to use a broad sequence of science and engineering practices to learn science through first-hand or second-hand investigations.

☐ will require students to develop an understanding of and apply multiple performance expectations while also engaging in related acts of mathematics, reading, writing, and

[1] adapted from How do we bring 3-dimensional learning into our classroom?

[2] Using Phenomena

[3] Qualities of a Good Anchor Phenomenon

communication.

- ☐ is observable to students. "Observable" can be with the aid of scientific procedures (e.g., in the lab) or technological devices to see things at very large and very small scales (telescopes, microscopes), video presentations, demonstrations, or surface patterns in data.

Choosing Investigative Phenomena

Students should be able to make sense of investigative phenomenon, but not immediately, and not without investigating it using sequences of the science and engineering practices. With instruction and guidance, students should be able to figure out, step-by-step, how and why the phenomenon works.[4]

A good investigative phenomenon:

- ☐ helps students make sense of one or two parts of the anchor phenomenon.
- ☐ has relevant data, images, and text to engage students in the range of ideas students need to understand.
- ☐ can be understood or explained by students using the science and engineering practices.

Investigating the Phenomena

When a phenomenon is introduced, whether anchor or investigative, students should have the opportunity to make observations, discuss current understandings, and pose questions about the phenomenon. Once questions are compiled, it may be helpful to categorize questions as follows:

- Questions that can be investigated by our class
- Questions that can be investigated but not with our current resources and equipment
- Questions that can be researched
- Questions that cannot be answered (due to current technologies or scientific limitations)

Other Useful Questions When Designing a Sequence of Learning[5]

- How do we kick off investigations in a unit?
- How do we work with students to motivate the next step in an investigation?
- How do we help students use practices to figure out the pieces of the science ideas?
- How do we push students to go deeper and revise the science ideas we have built together so far?
- How do we help students put together pieces of the disciplinary core ideas and crosscutting concepts?

[4] Using Phenomena

[5] Questions to Guide the Development of a Classroom Culture That Supports "Figuring Out"

Seventh Grade Science Standards Overview

The Seventh Grade Science course focuses on the study of Matter and Its Interactions, Energy, Earth's Systems, Earth and Human Activity, From Molecules to Organisms: Structures and Processes, Ecosystems: Interactions, Energy, and Dynamics, Heredity: Inheritance and Variation of Traits, and Biological Evolution: Unity and Diversity.

	Science and Engineering Practices									
Crosscutting Concepts		Asking Questions and Defining Problems	Developing and Using Models	Planning and Carrying Out Investigations	Analyzing and Interpreting Data	Using Mathematics and Computational Thinking	Constructing Explanations and Designing Solutions	Engaging in Argument from Evidence	Obtaining, Evaluating, and Communicating Information	**All Domains**
	Patterns				7-MS-PS1-2					
	Cause and Effect		7-MS-LS3-2 7-MS-PS1-4	7-MS-ESS2-5			7-MS-LS4-4		7-MS-LS4-5	
	Scale, Proportion and Quantity			7-MS-PS3-4						
	Systems and System Models		7-MS-ESS2-6					7-MS-LS1-3		
	Energy and Matter		7-MS-ESS2-4 7-MS-LS1-7 7-MS-PS-1-5				7-MS-LS1-6			
	Structure and Function							7-MS-LS2-4		
	Stability and Change	7-MS-ESS3-5					7-MS-LS2-5			

Overview of Sample Units

	Unit 1 Structure and Properties of Matter	Unit 2 Chemical Reactions	Unit 3 The Human Body	Unit 4 Genetics and Inheritance of Traits	Unit 5 Biodiversity and Changes	Unit 6 Weather Patterns
Anchor Phenomenon	Brinicles encase aquatic organisms with a tube of ice.	Corpse flowers are the world's largest flowers and can reach approximately 10 to 15 feet in height. When the flowers bloom, they emit an odor that is similar to rooting meat or a decaying corpse.	Endurance Olympic athletes like Michael Phelps practice carbohydrate loading when training for the Olympic games.	Four out of seven children in the Fugate family have blue skin and fingernails.	Forty-three percent of Atlantic forest birds are close to extinction.	Seventy-five percent of all tornadoes on Earth occur in North America. Some states are much more prone to tornadoes than others.
Standards	7-MS-PS1-2* 7-MS-PS1-4 7-MS-PS3-4	7-MS-PS1-2* 7-MS-PS1-4* 7-MS-PS1-5 7-MS-LS1-6	7- MS-LS1-3 7-MS-LS1-7	7-MS-LS3-2 7-MS-LS4-4 7-MS-LS4-5	7-MS-LS2-4 7-MS-LS2-5 7-MS-ESS3-5	7-MS-ESS2-4 7-MS-ESS2-5 7-MS-ESS2-6

* The performance expectation is only partially addressed using the identified phenomenon. The performance expectation is addressed in other unit(s).

Unit 1: Structure and Properties of Matter

About the Standards

Performance Expectations

- 7-MS-PS1-2* Matter and Its Interactions: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- 7-MS-PS1-4 Matter and Its Interactions: Develop and use a model that predicts and describes changes in particle motion, temperature, and the state of a pure substance when thermal energy is added or removed.
- 7-MS-PS3-4 Energy: Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

*The performance expectation is only partially addressed using the identified phenomenon. The performance expectation is addressed in other unit(s).

Science and Engineering Practices

- Develop and/or use a model to predict and/or describe phenomena.
- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.
- Analyze and interpret data to determine similarities and differences in findings.

Crosscutting Concepts

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.
- Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.
- Macroscopic patterns are related to the nature of microscopic and atomic-level structure.

Putting the Standards into Practice

Sample Anchor Phenomenon: Brinicles encase aquatic organisms in a tube of ice.

Explore the anchor phenomenon

Resources: A number of resources for the anchor phenomenon are included below. Teachers should screen the resources and pull photos, quotes, and data that are appropriate to share with seventh grade students. These resources may not be appropriate to be given to students as they are due to the length, content, or accessibility of the content.

BBC: Brinicle, Underwater Icicle "Finger of Death"
NOAA: Arctic Sea Ice: Channels of Life
NSIDC: All About Sea Ice, Salinity and Brine
BBC: Brine Pool of Death
The Bottomless Jacuzzi of Despair: Massive Brine Pool Off the Coast of New Orleans
ACS Chemistry of Life: Middle School Chemistry
Exploring Our Fluid Earth: Density, Temperature, and Salinity

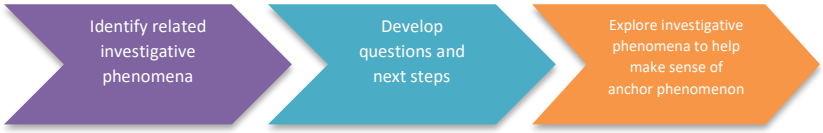
Questions students may pose that could be used for future learning or investigations:

Try to make sense of the anchor phenomenon

- What are brinicles?
- What are brines?
- What role do brines play in the formation of brinicles?
- How do brinicles form in aquatic ecosystems?
- If the salinity of oceanic waters were lower, would brinicles still form?
- How do the properties of salt contribute to the formation of brines and brinicles?
- What types of aquatic organisms are encased by brinicles?
- Do any organisms have adaptations that will allow them to survive in brine pools or brinicles?
- How do oceanic temperatures contribute to the formation of brinicles?
- Does thermal energy impact the motion of liquid particles

Teachers should provide Investigative Phenomena based on student observations, questions, and the Characteristics of Quality Investigative Phenomenon.

Sample Investigative Phenomena



Sample 1: In the winter of 2014, 88% of the Great Lakes or 82,940 square miles froze over, which was the largest ice cover the lakes had experienced since 1994.

Great Lakes Become Nearly Covered with Ice
Time: Watch the Great Lakes Freeze Over
NOAA: Animation of Historical Great Lakes Ice Cover
NOAA: Great Lakes Environmental Research Laboratory: Historical Ice Cover

Sample questions for students to investigate:

- Develop a model of the molecules in the Great Lakes when the lakes are completely frozen. Use evidence from your model to describe how molecules in the Great Lakes move relative to one another in the winter when the lakes are solids.
- Develop a model to predict and describe how thermal energy from the sun is transferred to the Great Lakes. Use your model to answer the following prompts:
    - Describe how an increase in thermal energy impact how molecules in a solid move relative to one another.
    - How is energy transferred from one object to another object?
    - Describe how thermal energy from the sun is transferred to the lakes when they are solidified.
- Develop a model of liquid molecules in the Great Lakes when the lakes are completely liquid. Use evidence from your model to describe how molecules in the Great Lakes move relative to one another in the summer when the lakes are liquids.
- Develop a model to predict and describe how gas molecules move relative to one in the summer and winter. Use evidence from your model to explain how molecules of gases, liquids, and solids move relative to one another when temperatures increase and decrease.
- How do increases and decreases in thermal energy in the Great Lakes impact how molecules move relative to one another when the lakes are solidified and liquefied?
- Describe how the molecules in brinicles move relative to one another.
- What patterns exist between the microscopic molecules in solids and liquids and the Great Lakes ability to freeze?

3-D learning opportunities:

SEP: Develop and use a model

DCI: MS.PS1A.c; MS.PS1A.d; MS.PS1A.f; MS.PS3A.e

CCC: Cause and effect; Patterns

Sample 2: Although 88% of the Great Lakes froze in the winter of 2014, only a small portion of Lake Ontario froze.

NASA: Earth Observatory: Great Freeze Over the Great Lakes
NOAA: Great Lakes Environmental Research Laboratory: Historical Ice Cover
Lake Ontario Facts
Why Won't Lake Ontario Freeze Over
Great Lake Nearly Freeze Completely

Sample questions for students to investigate:

- Analyze and interpret data from the NASA and NOAA websites to determine the similarities and differences between the Great Lakes that experienced and didn't experience freezing in 2014. Use evidence from the data to support your answers to the following questions:
  - Which lakes experience continuous freezing from year to year?
  - Which lakes do not continuously freeze from year to year?
  - How have the maximum ice coverages of the Great Lakes changed over time?
  - Based on your readings and analysis, what factors contribute to the amount of ice coverage that Lake Ontario experiences in winter months?
  - What patterns did you identify in the data that you analyzed?
- Plan and carry out an investigation to determine the relationship among the transfer of thermal energy, the type of matter, the mass of the matter involved in the thermal energy transfer, and the change in the average kinetic energy of the particles.
  - How will you measure the mass of the materials used in your experiment? What units will you use when measuring the mass of the materials?
  - How and when will you measure the temperature of the materials in your experiment?
  - What are your independent and dependent variables? How do you anticipate they will change throughout the experiment?
  - Describe the relationship among the transfer of thermal energy, the type of matter, the mass of matter, and the change in the average kinetic energy of the particles in your experiment.
- How do the amount of thermal energy and the change in the average kinetic energy of the particles in Lake Ontario impact the lake's ability to freeze in the winter?

3-D learning opportunities:

SEP: Plan and carry out an investigation; Develop and use a model; Analyze and interpret data

DCI: MS.PS3A.c; MS.PS3A.d; MS.PS3B.b; MS.PS3B.c; MS.PS3B.d; MS.PS3A.e

CCC: Scale, proportion, and quantity; Patterns

- Develop and use a model to describe how energy is spontaneously transferred out of hotter regions or objects into colder ones. Use evidence from your model to explain why Lake Ontario didn't freeze in the winter of 2014.
- How does the amount of matter in Lake Ontario impact the total thermal energy of the lake's system?
- Do the depth of oceanic waters impact the formation of brinicles? Make a prediction supported by evidence to support your response to the question.

Sample 3: During winter in the northern hemisphere, freshwater lakes often freeze. Whereas, only 15 percent of the ocean is covered with sea ice during the year.

NOAA: Can the Ocean Freeze?
Freezing Point of Water Compared to a Salt Solution
NASA Aquarius Project: Can Sea Water Freeze?
National Snow and Ice Data Center: Ice Formation
National Snow and Ice Data Center: Salinity and Brine

Sample questions for students to investigate:

- Plan and carry out an investigation to determine the differences between the freezing points and masses of fresh water and salt water.
    - How will you measure the mass and temperature of the materials used in your experiment? What units will you use when measuring the mass and temperature of the materials?
    - How and when will you measure the temperature and mass of the materials in your experiment?
    - What are your independent and dependent variables? How do you anticipate they will change throughout the experiment?
    - Describe the differences between oceanic waters and freshwater lakes.
- How does the concentration of salt in an ocean impact its ability to freeze?
- Describe the relationship between salt brines in oceans and the formation of brinicles. How do brinicles form?

3-D learning opportunities:

SEP: Analyze and interpret data; Plan and carry out an investigation

DCI: MS.PS3B.b; MS.PS3B.c; MS.PS1A.b

CCC: Cause and effect

Sample Anchor Phenomenon Reflections

Communicate scientific reasoning around the anchor phenomenon

- Develop a model that describe changes in particle motion, temperature, and the state of pure substances when brinicles form and thermal energy is added and removed.
- Develop a model that describe the relationship among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of particles in an ecosystem that has a brinicle.

Unit 2: Chemical Reactions

About the Standards

Performance Expectations

- 7-MS-PS1-2* Matter and Its Interactions: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- 7-MS-PS1-4* Matter and Its Interactions: Develop and use a model that predicts and describes changes in particle motion, temperature, and the state of a pure substance when thermal energy is added or removed.
- 7-MS-PS1-5 Matter and Its Interactions: Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
- 7-MS-LS1-6 From Molecules to Organisms: Structures and Processes: Construct a scientific explanation based on evidence for the role of photosynthesis and cellular respiration in the cycling of matter and flow of energy into and out of organisms.

*The performance expectation is only partially addressed using the identified phenomenon. The performance expectation is addressed in other unit(s).

Science and Engineering Practices

- Develop and/or use a model to predict and/or describe phenomena.
- Analyze and interpret data to determine similarities and differences in findings.
- Develop a model to describe unobservable mechanisms.
- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Crosscutting Concepts

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.
- Macroscopic patterns are related to the nature of microscopic and atomic-level structure.
- Matter is conserved because atoms are conserved in physical and chemical processes.
- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

Putting the Standards into Practice

Sample Anchor Phenomenon: Corpse flowers are the world's largest flowers and can reach approximately 10 to 15 feet in height. When the flowers bloom, they emit an odor that is similar to rooting meat or a decaying corpse.

Explore the anchor phenomenon

Resources: A number of resources for the anchor phenomenon are included below. Teachers should screen the resources and pull photos, quotes, and data that are appropriate to share with seventh grade students. These resources may not be appropriate to be given to students as they are due to the length, content, or accessibility of the content.

New York Botanical Garden: Corpse Flower Bloom-Time Lapse
National Geographic: The Corpse Flower: Behind the Stink
Live Science: Corpse Flower: Facts About the Smelly Plant
NPR's Skunk Bear: The Stink of the Corpse Flower, Explained
Britannica: Corm Plant Anatomy
Journal of Botanic Garden Horticulture: The Cultivation of Titan Arum

Questions students may pose that could be used for future learning or investigations:

Try to make sense of the anchor phenomenon

- Why do corpse flowers emit an odor when they are blooming?
- How long does it take a corpse flower to bloom?
- Do corpse flowers only bloom at night?
- How do corpse flowers and other plants take in energy from the sun and transform it into food?
- How do corpse flowers store energy? How is this different from other plants?
- How do plants release oxygen into the atmosphere?
- How do plants and animals transform particles during the process of photosynthesis and cellular respiration?
- Why do the center of corpse flowers increase in temperature?
- How does the temperature of corpse flowers impact the number of pollinators attracted to the plant?
- What types of organisms pollinate the plant?
- If the center of the plant did not increase in temperature, would fewer pollinators be drawn to the plants?

Teachers should provide Investigative Phenomena based on student observations, questions, and the Characteristics of Quality Investigative Phenomenon.

Sample Anchor Phenomenon Reflections

Communicate scientific reasoning around the anchor phenomenon

- Construct a scientific explanation based on evidence for the role of photosynthesis and cellular respiration in the cycling of matter and flow of energy into and out of organisms.
- Describe how substances change before and after
- Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- Develop a model that describes changes in particle motion, temperature, and the state of a pure substance when thermal energy is produced by a corpse plant. How do this impact pollinators ability
- Develop a model to describe how the total number of atoms are conserved during the processes of photosynthesis and cellular respiration.

Unit 3: The Human Body

About the Standards

Performance Expectations

- 7-MS-LS1-3 From Molecules to Organisms: Structures and Processes
  Use an argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- 7-MS-LS1-7 From Molecules to Organisms: Structures and Processes Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

Science and Engineering Practices

- Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Crosscutting Concepts

- Systems may interact with other systems; they may have subsystems and be a part of larger complex systems.
- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

Putting the Standards into Practice

Sample Anchor Phenomenon: Endurance Olympic athletes like Michael Phelps practice carbohydrate loading when training for Olympic games.

Explore the anchor phenomenon

Resources: A number of resources for the anchor phenomenon are included below. Teachers should screen the resources and pull photos, quotes, and data that are appropriate to share with seventh grade students. These resources may not be appropriate to be given to students as they are due to the length, content, or accessibility of the content.

Michael Phelps Under Armour
Carbohydrate Loading Helps Athletes Improve Performance
Effects of Carbohydrate Loading on High Performance Athletics
Phet: Membrane Channels
Heart Rate Lab
Human Body Systems
Phet: Eating and Exercise
What Happens When You Breathe?
Going the Distance with Sports Drinks
Sports Drinks
Read Works: Learning About Our Bodies

Questions students may pose that could be used for future learning or investigations:

Try to make sense of the anchor phenomenon

- Why do athletes practice carbohydrate loading when training for Olympic Games?
- How are carbohydrates, in energy drinks, and other carbon-containing food molecules used by the body?
- How do carbohydrates, in energy drinks, and other carbon-containing foods help cells and therefore athletes function more efficiently?
- How are cells, tissues, organs, organ systems, and organisms interconnected?
- How do human body systems work together to carry out complex bodily functions in athletes?
- How do organs and organ systems work together to carry out all the necessary functions for survival and growth?
- How is energy produced by organisms?
- How are food particles broken down by the human body?

Teachers should provide Investigative Phenomena based on student observations, questions, and the Characteristics of Quality Investigative Phenomenon.

Sample Anchor Phenomenon Reflections

Communicate scientific reasoning around the anchor phenomenon

- Make a claim supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- Develop a model to describe how carbohydrates are rearranged through chemical reactions forming new molecules that release energy as this matter moves through an organism.

Unit 4: Genetics and the Inheritance of Traits

About the Standards

Performance Expectations

- 7-MS-LS3-2 Heredity: Inheritance and Variation of Traits: Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- 7-MS-LS4-4 Biological Evolution: Unity and Diversity: Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
- 7-MS-LS4-5 Biological Evolution: Unity and Diversity: Gather, read, and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.
- 7-MS-LS1-6* From Molecules to Organisms: Structure and Processes: Construct a scientific explanation based on evidence for the role of photosynthesis and cellular respiration in the cycling of matter and flow of energy into and out of organisms.

* The performance expectation is only partially addressed using the identified phenomenon. The performance expectation is addressed in other unit(s).

Science and Engineering Practices

- Develop and/or use a model to predict and/or describe phenomena.
- Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence

Crosscutting Concepts

- Cause and effect relationships may be used to predict phenomena in natural or designed systems
- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

Putting the Standards into Practice

Sample Anchor Phenomenon: Four out of seven children in the Fugate family have blue skin and fingernails.

Explore the anchor phenomenon

Resources: A number of resources for the anchor phenomenon are included below. Teachers should screen the resources and pull photos, quotes, and data that are appropriate to share with seventh grade students. These resources may not be appropriate to be given to students as they are due to the length, content, or accessibility of the content.

Basic Genetics
What are Traits?
Fugates of Kentucky: Skin Bluer than Lake Louise
The Blue People of Troublesome Creek
Blue People in Kentucky
Read Works: Inheritance of Traits

Questions students may pose that could be used for future learning or investigations:

Try to make sense of the anchor phenomenon

- What causes the family's skin to have a blue color?
- Why do only four out of seven people in the family have blue skin?
- How are the genotypes of offspring predicted?
- Did the parents of the every offspring with blue skin have blue skin?
- What are genes, DNA, and chromosomes?
- How might genetics play a role in the Fugate family's traits?
- Do the unique characteristics of the Fugate family provide benefits?
- How have genetically based technological developments changed the way humans influence the inheritance of desired traits in organisms?

Teachers should provide Investigative Phenomena based on student observations, questions, and the Characteristics of Quality Investigative Phenomenon.

Sample Anchor Phenomenon Reflections

Communicate scientific reasoning around the anchor phenomenon

- Create a model to describe the differences between the genetic variations that occur during asexual and sexual reproduction.
- Create a model that explains why 4 out of 7 children in the Fugate family have blue skin and fingernails.
- Construct an explanation supported by evidence that describes how genetic variations of traits in a population help some organisms survive and reproduce in their environment.

- Describe how technologies have changed the way humans influence the inheritance of desired traits in organisms.

Unit 5: Biodiversity and Changes

About the Standards

Performance Expectations

- 7-MS-ESS3-5 Earth and Human Activity: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
- 7-MS-LS2-4 Ecosystems: Interactions, Energy, and Dynamics: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- 7-MS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics: Undertake a design project that assists in maintaining diversity and ecosystem services.

Science and Engineering Practices

- Ask questions to identify and/or clarify evidence and/ or the premise(s) of an argument.
- Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.

Crosscutting Concepts

- Stability might be disturbed either by sudden events or gradual changes that accumulate over time.
- Small changes in one part of a system might cause large changes in another part.

Putting the Standards into Practice

Explore the anchor phenomenon

Sample Anchor Phenomenon: Forty-three percent of Atlantic forest birds are close to extinction.

Resources: A number of resources for the anchor phenomenon are included below. Teachers should screen the resources and pull photos, quotes, and data that are appropriate to share with seventh grade students. These resources may not be appropriate to be given to students as they are due to the length, content, or accessibility of the content.

The Deforestation of the Amazon
Google Earth Amazon Deforestation
Climate 101: Deforestation
Amazon Rainforest Losses Impact on Climate
National Geographic: Deforestation
Global Deforestation Rates
History of Deforestation in the Highlands

Questions students may pose that could be used for future learning or investigations:

Try to make sense of the anchor phenomenon

- Why are so many of Atlantic forest birds close to extinction?
- How have the rates of deforestation in the Amazon Rainforest changed over time?
- How are organisms, such as Atlantic forest birds, impacted by the reduction of the Amazon Rainforest?
- How can we maintain biodiversity and ecosystem services in the Amazon Rainforest?
- What design solutions have engineers developed to enhance biodiversity and ecosystem services in the Amazon Rainforest?
- What type of design solution can I create to help maintain biodiversity and ecosystem services?
- How do governmental agencies regulate the amount of timber cut and removed by companies?
- Does deforestation impact the cycling of matter in Earth's atmosphere?

Teachers should provide Investigative Phenomena based on student observations, questions, and the Characteristics of Quality Investigative Phenomenon.

Sample Anchor Phenomenon Reflections

Communicate scientific reasoning around the anchor phenomenon

- Construct an argument supported by empirical evidence that changes to physical or biological components of the Amazon Rainforest affect Atlantic Bird populations.

- Describe factors that have contributed to the rise in global temperatures over the past century.
- Design a solution to assist in maintaining the diversity and ecosystem services of the Amazon Rainforest.

Unit 6: Weather Patterns

About the Standards

Performance Expectations

- 7-MS-ESS2-4 Earth's Systems: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- 7-MS-ESS2-5 Earth's Systems: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
- 7-MS-ESS2-6 Earth's Systems: Develop and use a model to describe how unequal heating and rotation of the Earth causes patterns of atmospheric and oceanic circulation that determine regional climates.

Science and Engineering Practices

- Develop a model to describe unobservable mechanisms
- Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions
- Develop and use a model to describe phenomena

Crosscutting Concepts

- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter
- Cause and effect relationships may be used to predict phenomena in natural or designed systems
- Models can be used to represent systems and their interactions—such as inputs, processes and outputs— and energy, matter, and information flows within systems.

Putting the Standards into Practice

Explore the anchor phenomenon

Sample Anchor Phenomenon: Seventy-five percent of all tornadoes on Earth occur in North America. Some states are much more prone to tornadoes than others.

Resources: A number of resources for the anchor phenomenon are included below. Teachers should screen the resources and pull photos, quotes, and data that are appropriate to share with eighth grade students. These resources may not be appropriate to be given to students as they are due to the length, content, or accessibility of the content.

Tornado Before and After
Tornadoes in America: the Oklahoma Disaster in Context
Tornado Alley: The Most Tornado Prone Region in the World
Why Tornado Alley is Prone to Disaster
Why do so Many Tornadoes Hit the Midwest?
National Geographic Tornadoes
Map of Tornado Alley
NOAA: Tornado Alley

Questions students may pose that could be used for future learning or investigations:

Try to make sense of the anchor phenomenon

- How do tornadoes form?
- Why do tornadoes tend to occur in certain areas?
- What are the relationships between the movement of air masses, ocean temperatures, and currents?
- How do meteorologist use patterns in weather conditions- temperature, air pressure, humidity and wind speed- to predict the formation of tornadoes?
- How do landforms such as mountains impact weather?

Teachers should provide Investigative Phenomena based on student observations, questions, and the Characteristics of Quality Investigative Phenomenon.

Sample Anchor Phenomenon Reflections

Communicate scientific reasoning around the anchor phenomenon

- Create a model to show how water continually cycles through Earth's system.
- Describe the cause and effect relationship between the transfer of energy from the sun and the rate of evaporation.
- Create a model to show how the unequal heating and rotation of the Earth causes changes in

atmospheric and oceanic patterns. Explain how these patterns create weather conditions such as tornados.

- Explain how gravity interacts with water in different phases to drive water cycling through Earth's atmosphere?