Curriculum Map: Science 6 2019

Course: SCIENCE 6 Sub-topic: General

Grade(s): 6

Course Description: Earth and Space Science

Course Textbooks, Workbooks, Materials Citations: Earth and Space Science

Publisher: McGraw-Hill 2017

Unit: Methods of Science

Month: September

Essential Questions: Why is the scientific inquiry model essential in science?

STANDARDS:

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A7 (Advanced) Science as Inquiry

• Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.

(* standards consolidated from Topic level)

Topic: Scientific Inquiry Model

Core Lesson Description: Scientific inquiry is a process that uses a set of skills to answer questions or to test ideas about the natural world.

Core Lesson Student Learning Objectives:

1) Students will be able to list the steps of the scientific inquiry model (E)

2) Students will be able to understand the differences between hypotheses, theories, and laws (I)

3) Students will be able to differentiate between facts and opinions. (C)

Core Lesson

1) What is the scientific inquiry model?

Essential Questions:	2) What are the differences between hypothesis, theories, and laws? 3) What are facts and opinions?
Core Lesson Big Ideas:	Science is a process founded in tested, observable, and accepted facts.
Core Lesson Materials:	textbook worksheets labs
Core Lesson Key Terminology & Definitions:	See textbook for definition of terms: 1) science (E) 2) observations (E) 3) inference (I) 4) hypothesis (E) 5) predictions (I) 6) critical thinking (E) 7) skepticism (E) 8) theory (E) 9) scientific law (I) 10) accepted (E) 11) facts (C) 12) opinions (C) 13) beliefs (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A7 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.

Unit: Exploring Earth

Month: September/October

STANDARDS:

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.2.6.A1 (Advanced)	Distinguish the differences in properties of solids, liquids, and gases. Differentiate between volume and mass. Investigate that equal volumes of different substances usually have different masses.
3.2.6.A5 (Advanced)	CONSTANCY AND CHANGE - Identify characteristic properties of matter that can be used to separate one substance from the other.
3.2.6.B6 (Advanced)	ENERGY - Demonstrate that heat moves in predictable ways from warmer objects to cooler ones. SCALE - Investigate that materials may be composed of parts too small to be seen without magnification.
3.3.6.A2 (Advanced)	Examine how soil fertility, composition, resistance to erosion, and texture are affected by many factors.
3.3.6.A5 (Advanced)	Describe the composition and layers of the atmosphere. Explain the effects of oceans on climate. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.
3.3.7.A1 (Advanced)	Define basic features of the rock cycle. Describe the layers of the earth. Differentiate among the mechanisms by which heat is transferred through the Earth's system.
3.3.7.A2 (Advanced)	Explain land use in relation to soil type and topography.
3.3.8.A1 (Advanced)	Distinguish between physical and chemical weathering. Compare and contrast the types of energy that drive Earth's systems.
3.3.8.A3 (Advanced)	Explain how matter on earth is conserved throughout the geological processes over time.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.
3.3.7.B1 (Advanced)	Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars, and the solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
MS-ESS2-4 (Advanced)	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

(* standards consolidated from Topic level)

Topic: Spherical Earth

Core Lesson Earth's major systems include the atmosphere, hydrosphere, cryosphere, biosphere, and geosphere.

Description:

All four major Earth systems interact by exchanging matter and energy. A change in one Earth system affects all other Earth systems.

Gravity caused particles to come together to form a spherical Earth.

Core Lesson Student Learning Objectives:

Students will be able to comprehend the different systems of Earth and have a basic understanding of how they interact. (E)

Students will be able to explain why Earth has a spherical shape. (E)

Core Lesson Essential Questions:

Why does Earth have a spherical shape?

Core Lesson Big Ideas:

Scientists use systems to help understand relationships.

Core Lesson Materials:

textbook

worksheets

labs

class notes

Core Lesson Key Terminology & Definitions:

sphere (C)

geosphere (E)

hydrosphere (E)

atmosphere (E)

biosphere (E)

density (E)

gravity (E)

mass (C)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A5 (Advanced)	Describe the composition and layers of the atmosphere. Explain the effects of oceans on climate. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.
3.3.7.B1 (Advanced)	Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars, and the solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-4 (Advanced)	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Topic: Earth's Interior

Core Lesson Description:

Earth's interior layers include the crust, mantle, and core.

The outer core is liquid and the inner core is solid.

Core Lesson Student Learning Objectives:

Students will be able to label and define the layers of the Earth including the continental and oceanic crusts, the upper and lower mantle, and the outer and inner core. (E,C)

Students will be able to define the major mineral compositions of each layer. (I)

Students will be able to list each layer by density. (E,C)

Core Lesson Essential Questions:

What are the interior layers of the Earth?

What evidence indicates that Earth has a solid inner core and a liquid outer core?

How is density related to the formation of the Earth's layers.

Core Lesson Materials:

textbook

class notes

labs

worksheets

Core Lesson Key Terminology & Definitions:

crust (C) (continental (E), oceanic (E)

mantle (C) (upper (E) and lower (E))

core (C) (inner (E) and outer (E))

lithosphere (E)

aesthenosphere (E)

magnetosphere (I)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.2.6.A1 (Advanced)	Distinguish the differences in properties of solids, liquids, and gases. Differentiate between volume and mass. Investigate that equal volumes of different substances usually have different masses.
3.2.6.A5 (Advanced)	CONSTANCY AND CHANGE - Identify characteristic properties of matter that can be used to separate one substance from the other.
3.2.6.B6 (Advanced)	ENERGY - Demonstrate that heat moves in predictable ways from warmer objects to cooler ones. SCALE - Investigate that materials may be composed of parts too small to be seen without magnification.

3.3.7.A1 (Advanced)	Define basic features of the rock cycle. Describe the layers of the earth. Differentiate among the mechanisms by which heat is transferred through the Earth's system.
3.3.7.B1 (Advanced)	Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars, and the solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Topic: Rocks and the Rock Cycle

Core Lesson Description:

Rocks can melt or recrystallize. Rocks exposed on Earth's surface can break down in the presence of water, ice, wind, and gravity. New rocks form under changing temperature and pressure conditions or the addition of chemical fluids.

There are three major rock types: igneous, metamorphic, and sedimentary. Geologists study rock texture and mineral composition to identify rocks of each type.

Core Lesson Student Learning Objectives:

Students will know how to classify rocks. (C), (E)

Students will be able to draw, label, and explain the major processes of the rock cycle. (E), (I)

Core Lesson Essential Questions:

How are rocks classified?

What is the rock cycle?

Core Lesson Materials:

textbook

class notes

labs

rock samples

worksheets

Core Lesson Key Terminology & Definitions:

rock (C)

grain (I)

texture (I)

magma (E)

lava (E)

sediment (E)

rock cycle (C), (E)

cementation (E)

erosion (E), (I)

deposition (E)

melting (E)

cooling (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.7.A1 (Advanced)	Define basic features of the rock cycle. Describe the layers of the earth. Differentiate among the mechanisms by which heat is transferred through the Earth's system.
3.3.8.A3 (Advanced)	Explain how matter on earth is conserved throughout the geological processes over time.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.
3.3.7.B1 (Advanced)	Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars, and the solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Topic: Weathering and Soil

Core Lesson Description:

Weathering acts mechanically and chemically, and breaks down rocks.

Through the action of Earth processes such as freezing and thawing mechanical weathering breaks rocks into smaller pieces.

Chemical weathering by water and acids change the materials in rocks into new materials.

Pants depend on certain characteristics of soil, such as the amount of organic matter and amount of weathering.

Five factors - parent material, climate, topography, biota, and time - affect the formation of soil.

Soil can be characterized by properties such as the amount of organic matter and inorganic matter.

Horizons are soil layers formed from the movement of the various products of weathering.

Core Lesson Student Learning Objectives:

Students will be able to describe how weathering chemically and/or mechanically breaks down or changes rocks. (I)

Students will be able to explain how soil is created. (I)

Students will be able to describe how soils and soil conditions are related to life. (E)

Core Lesson Essential Questions:

How does weathering break down or change rocks?

How is soil created?

How can soil properties be observed and measured?

Core Lesson Materials:

textbook

class notes

labs

worksheets

Core Lesson Key Terminology & Definitions:

weathering (E)

mechanical weathering (I)

chemical weathering (I)

oxidation (I)

soil (E)

organic matter (I)

pore (I)

decomposition (E)

parent material (I)

climate (E)

topography (I)

biota (I)

horizon (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A2 (Advanced)	Examine how soil fertility, composition, resistance to erosion, and texture are affected by many factors.
3.3.7.A2 (Advanced)	Explain land use in relation to soil type and topography.
3.3.8.A1 (Advanced)	Distinguish between physical and chemical weathering. Compare and contrast the types of energy that drive Earth's systems.
3.3.8.A3 (Advanced)	Explain how matter on earth is conserved throughout the geological processes over time.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Unit: Geologic Changes

Month: October/November/December

STANDARDS:

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A1 (Advanced)	Recognize and interpret various mapping representations of Earth's common features.
3.3.6.A2 (Advanced)	Examine how soil fertility, composition, resistance to erosion, and texture are affected by many factors.

3.3.6.A6 (Advanced)	MODELS/SCALES - Describe the scales involved in characterizing Earth and its atmosphere. MODELS/SCALES - Create models of Earth's common physical features.
3.3.6.A7 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
3.3.7.A1 (Advanced)	Define basic features of the rock cycle. Describe the layers of the earth. Differentiate among the mechanisms by which heat is transferred through the Earth's system.
3.3.7.A3 (Advanced)	Explain and give examples of how physical evidence, such as fossils and surface features of glaciation support theories that the Earth has evolved over geologic time. Compare geologic processes over time.
3.3.7.A6 (Advanced)	MODELS/SCALES - Locate significant geologic structures using various mapping representations. CONSTANCY/CHANGE - Describe changes in atmospheric conditions associated with various weather patterns. CONSTANCY/CHANGE SCALE - Describe geologic time as it relates to earth processes.
3.3.8.A3 (Advanced)	Explain how matter on earth is conserved throughout the geological processes over time.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.
3.4.6.D3 (Advanced)	Design and use instruments to evaluate data.
NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)	
MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
MS-ESS2-3 (Advanced)	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

(* standards consolidated from Topic level)

Topic: The Continental Drift Hypothesis

Core Lesson Description: The puzzle piece fit of continents, fossil evidence rocks, and matching mountain ranges across oceans support the hypothesis of continental drift.

Core Lesson Student Learning Students will be able to explain the details that led Alfred Wegener to propose his continental drift hypothesis. (C), (E)

Objectives: Students will be able to describe the contrasting arguments of Wegener's peers. (E), (I)

Core Lesson Essential Questions: What evidence supports continental drift?

Why did scientists question the continental drift hypothesis?

Core Lesson Materials: textbook

class notes

worksheets

Core Lesson Key Terminology & Definitions: Pangaea (E)

continental drift (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A1 (Advanced)	Recognize and interpret various mapping representations of Earth's common features.
3.3.6.A7 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
3.3.7.A3 (Advanced)	Explain and give examples of how physical evidence, such as fossils and surface features of glaciation support theories that the Earth has evolved over geologic time. Compare geologic processes over time.
3.3.7.A6 (Advanced)	MODELS/SCALES - Locate significant geologic structures using various mapping representations. CONSTANCY/CHANGE - Describe changes in atmospheric conditions associated with various weather patterns. CONSTANCY/CHANGE SCALE - Describe geologic time as it relates to earth processes.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Topic: Theory of Plate Tectonics

Core Lesson Description: The three types of plate boundaries, the theory of plate tectonics, that ridge push, slab pull, and mantle convection are the forces that cause plate motion.

Core Lesson Student Learning Objectives:	1) Students will be able to identify the three types of plate boundaries (E), (I) 2) Students will be able to understand the theory of plate tectonics and the forces that cause plate motion. (C), (E)
Core Lesson Essential Questions:	What is the theory of plate tectonics? What are the three types of plate boundaries? Why do tectonic plates move?
Core Lesson Big Ideas:	There are three types of plate boundaries: convergent, divergent, and transverse. The theory of plate tectonics states that Earth's surface is made of rigid slabs of rock. or plates, that move with respect to each other. Mantle convection, ridge push, and slab pull are the forces that cause plate motion. Radioactivity in the mantle and thermal energy from the core produce the energy for convection.
Core Lesson Materials:	class notes worksheets labs videos textbook
Core Lesson Key Terminology & Definitions:	plate tectonics (C), (E) lithosphere (E) divergent plate boundaries (E), (I) transform plate boundaries (E), (I) convergent plate boundaries (E), (I) subduction (E) convection (E) ridge push (E) slab pull (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A6 (Advanced)	MODELS/SCALES - Describe the scales involved in characterizing Earth and its atmosphere. MODELS/SCALES - Create models of Earth's common physical features.
3.3.7.A3 (Advanced)	Explain and give examples of how physical evidence, such as fossils and surface features of glaciation support theories that the Earth has evolved over geologic time. Compare geologic processes over time.
3.3.8.A3 (Advanced)	Explain how matter on earth is conserved throughout the geological processes over time.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to

	identify Earth's resources.
3.4.6.D3 (Advanced)	Design and use instruments to evaluate data.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
MS-ESS2-3 (Advanced)	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Topic: Earthquakes

Core Lesson Description:	Earthquakes are the vibrations in the ground that result from movement along breaks in Earth's lithosphere.
Core Lesson Student Learning Objectives:	Students will be able to understand what an earthquake is (C, E) where earthquakes occur (E), and how scientists monitor earthquake activity (E,I).
Core Lesson Essential Questions:	1) What is an Earthquake? 2) Where do Earthquakes occur? 3) How do scientists monitor earthquake activity?
Core Lesson Big Ideas:	1) Earthquakes are the vibrations in the groundthat result from the movement breaks in Earth's lithosphere 2) Earthquakes mostly occur along tectonic plate boundaries 3) Earthquakes are monitored using seismometers and described using the Richter magnitude scale and Modified Mercalli scale.
Core Lesson Materials:	class notes textbook labs worksheets
Core Lesson Key Terminology & Definitions:	earthquake (C) (E) fault (E) seismic waves (E) (I) focus (E) epicenter (E) primary waves (E) (I) secondary waves (E) (I)

surface waves (E) (I)

seismologist (E)

seismometer (E)

seismogram (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A1 (Advanced)	Recognize and interpret various mapping representations of Earth's common features.
3.3.7.A1 (Advanced)	Define basic features of the rock cycle. Describe the layers of the earth. Differentiate among the mechanisms by which heat is transferred through the Earth's system.
3.3.7.A3 (Advanced)	Explain and give examples of how physical evidence, such as fossils and surface features of glaciation support theories that the Earth has evolved over geologic time. Compare geologic processes over time.
3.3.8.A3 (Advanced)	Explain how matter on earth is conserved throughout the geological processes over time.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
MS-ESS2-3 (Advanced)	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Topic: Volcanoes

Core Lesson Description: Volcanoes form when molten rock flows through cracks or vents in Earth's crust.

Core Lesson Student Learning Objectives:

Students will understand how volcanoes form. (C) (E)

Students will understand the factors that contribute to the eruption style of a volcano. (E) (I)

Students will be able to classify volcanoes. (C) (E)

Core Lesson Essential Questions:

How do volcanoes form?

What factors contribute to the eruption style of a volcano?

How are volcanoes classified?

Core Lesson Big Ideas:

1) Volcanoes form when molten rock flows through cracks or vents in Earth's crust.

2) The eruption style, size, and shape of a volcano depend on the composition of the magma. including the amount of dissolved gas.

3) Volcanoes are classified as cinder cone, composite cones, or shield volcanoes depending upon their shape.

Core Lesson textbook

Materials:

class notes

labs

worksheets

Core Lesson Key Terminology & Definitions:

volcano (C), (E)

magma (E)

lava (E)

hot spot (E) (I)

shield volcano (E)

composite volcano (E)

cinder cone (E)

volcanic ash (I)

viscosity (E) (I)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.7.A1 (Advanced)	Define basic features of the rock cycle. Describe the layers of the earth. Differentiate among the mechanisms by which heat is transferred through the Earth's system.
3.3.7.A6 (Advanced)	MODELS/SCALES - Locate significant geologic structures using various mapping representations. CONSTANCY/CHANGE - Describe changes in atmospheric conditions associated with various weather patterns. CONSTANCY/CHANGE SCALE - Describe geologic time as it relates to earth processes.
3.3.8.A3 (Advanced)	Explain how matter on earth is conserved throughout the geological processes over time.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
MS-ESS2-3 (Advanced)	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Topic: Fossils

Core Lesson Description:

Some kinds of organisms that once lived on Earth have completely disappeared, although they were something like others that are alive today. Fossils can be compared to one another and to living organisms according to their similarities and differences. Some organisms that lived long ago are similar to existing organisms, but some are quite different.

Core Lesson Student Learning Objectives:

Students will understand what fossils are and how they formed. (E) (I)

Students will understand that scientists use fossils to reveal clues about Earth's past. (C) (E)

Core Lesson Essential Questions:

What are fossils and how do they form?

What can fossils reveal about Earth's past?

Core Lesson Big Ideas:

Fossils include carbon films, molds, casts, and trace fossils.

Dead organisms are more likely to become fossils if they have hard parts and are buried quickly after they die.

Paleontologists use clues from fossils to learn about ancient life and the environments ancient organisms lived in.

Core Lesson Materials:

fossils

textbook

worksheets

labs

class notes

Core Lesson Key Terminology & Definitions:

fossil (C) (E)

catastrophism (E) (I)

uniformitarianism (E) (I)

carbon film (E) (I)

mold (E)

cast (E)

trace fossil (I)

paleontologist (C) (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A2 (Advanced)	Examine how soil fertility, composition, resistance to erosion, and texture are affected by many factors.
3.3.7.A3 (Advanced)	Explain and give examples of how physical evidence, such as fossils and surface features of glaciation support theories that the Earth has evolved over geologic time. Compare geologic processes over time.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2 (Advanced)	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
MS-ESS2-3 (Advanced)	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Unit: Weather and Climate

Month: January/February/March

STANDARDS:

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.1.6.B6 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
3.3.6.A1 (Advanced)	Recognize and interpret various mapping representations of Earth's common features.
3.3.6.A4 (Advanced)	Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere.
3.3.6.A5 (Advanced)	Describe the composition and layers of the atmosphere. Explain the effects of oceans on climate. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.
3.3.6.A6 (Advanced)	MODELS/SCALES - Describe the scales involved in characterizing Earth and its atmosphere. MODELS/SCALES - Create models of Earth's common physical features.
3.3.7.A4 (Advanced)	Differentiate among Earth's water systems. Describe the motions of tides and identify their causes.
3.3.7.A5 (Advanced)	Describe basic elements of meteorology. Explain the relationship between the energy provided by the sun and the temperature differences among water, land and atmosphere.
3.3.7.A6 (Advanced)	MODELS/SCALES - Locate significant geologic structures using various mapping representations. CONSTANCY/CHANGE - Describe changes in atmospheric conditions associated with various weather patterns. CONSTANCY/CHANGE SCALE - Describe geologic time as it relates to earth processes.
3.3.8.A4 (Advanced)	Explain how the oceans form one interconnected circulation system powered by wind, tides, the Earth's rotation, and water density differences.
3.3.8.A5 (Advanced)	Explain how the curvature of the earth contributes to climate. Compare and contrast water vapor, clouds, and humidity.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.
3.3.8.A7 (Advanced)	Science as Inquiry • Compare and contrast scientific theories. • Know that both direct and indirect observations are used by scientists to study the natural world and universe. • Identify questions and concepts that guide scientific investigations. • Formulate and revise explanations and models using logic and evidence. • Recognize and analyze alternative explanations and models. • Explain the importance of accuracy and precision in making valid measurements.
3.3.6.B2 (Advanced)	MODELS - Use models to demonstrate that earth has

	different seasons and weather patterns. MODELS - Use models to demonstrate that the phases of the moon are a result of its orbit around Earth.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-4 (Advanced)	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
MS-ESS2-5 (Advanced)	Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
MS-ESS2-6 (Advanced)	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

(* standards consolidated from Topic level)

Topic: Describing Weather

Core Lesson Description: Weather is the atmospheric conditions, along with the short term changes, of a certain place at a certain time.

Core Lesson Student Learning Objectives:

Students will understand what weather is. (C) (E)

Students will be able to explain the variables used to describe the weather. (E)

Students will understand how weather is related to the water cycle. (E) (I)

Core Lesson Essential Questions:

What is weather?

What variables are used to describe weather?

How is weather related to the water cycle?

Core Lesson Big Ideas:

Weather is the atmospheric conditions along with short term changes, of a certain place at a certain time.

Variables used to describe weather are air temperature, air pressure, wind, humidity, and relative humidity.

The processes in the water cycle - evaporation, condensation, and precipitation - are all involved in the formation of different types of weather.

Core Lesson Materials:

class notes

textbook

labs

worksheets

Core Lesson Key Terminology & Definitions:

weather (C) (E)

air pressure (E)

humidity (E)

relative humidity (E) (I)

dew point (E) (I)

precipitation (C) (E)

water cycle (C) (E) (I)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A4 (Advanced)	Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere.
3.3.6.A5 (Advanced)	Describe the composition and layers of the atmosphere. Explain the effects of oceans on climate. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.
3.3.6.A6 (Advanced)	MODELS/SCALES - Describe the scales involved in characterizing Earth and its atmosphere. MODELS/SCALES - Create models of Earth's common physical features.
3.3.8.A5 (Advanced)	Explain how the curvature of the earth contributes to climate. Compare and contrast water vapor, clouds, and humidity.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.
3.3.6.B2 (Advanced)	MODELS - Use models to demonstrate that earth has different seasons and weather patterns. MODELS - Use models to demonstrate that the phases of the moon are a result of its orbit around Earth.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-4 (Advanced)	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
MS-ESS2-5 (Advanced)	Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
MS-ESS2-6 (Advanced)	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Topic: Weather Patterns

Core Lesson Description:	Weather patterns describe the way weather moves around the planet including fronts, air masses, and pressure systems.
Core Lesson Student Learning Objectives:	Students will understand basic patterns in weather including fronts (E) (I), air masses (E) (I), pressure systems (C) (E).
Core Lesson Essential Questions:	What are the scientifically observable patterns associated with weather?
Core Lesson Big Ideas:	Weather is an Earth system that can be observed through a variety naturally occurring patterns.
Core Lesson Materials:	class notes textbook labs worksheets

Core Lesson Key Terminology & Definitions:	air pressure (E)
	dew point (E)
	humidity (E)
	kinetic energy (E) (I)
	precipitation (C) (E)
	relative humidity (E)
	water cycle (C) (E) (I)
	air mass (I)
	blizzard (I)
	high-pressure system (E)
	hurricane (I)
	tornado (I)
	computer model (E) (I)
	Doppler radar (E) (I)
	surface report (E) (I)
	upper-air report (E) (I)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A1 (Advanced)	Recognize and interpret various mapping representations of Earth's common features.
3.3.6.A4 (Advanced)	Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere.
3.3.6.A5 (Advanced)	Describe the composition and layers of the atmosphere. Explain the effects of oceans on climate. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.
3.3.6.A6 (Advanced)	MODELS/SCALES - Describe the scales involved in characterizing Earth and its atmosphere. MODELS/SCALES - Create models of Earth's common physical features.
3.3.7.A4 (Advanced)	Differentiate among Earth's water systems. Describe the motions of tides and identify their causes.
3.3.7.A5 (Advanced)	Describe basic elements of meteorology. Explain the relationship between the energy provided by the sun and the temperature differences among water, land and atmosphere.
3.3.7.A6 (Advanced)	MODELS/SCALES - Locate significant geologic structures using various mapping representations. CONSTANCY/CHANGE - Describe changes in atmospheric conditions associated with various weather patterns. CONSTANCY/CHANGE SCALE - Describe geologic time as it relates to earth processes.
3.3.8.A4 (Advanced)	Explain how the oceans form one interconnected circulation system powered by wind, tides, the Earth's rotation, and water density differences.
3.3.8.A5 (Advanced)	Explain how the curvature of the earth contributes to climate. Compare and contrast water vapor, clouds, and humidity.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-4 (Advanced)	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-ESS2-5 (Advanced)	Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
MS-ESS2-6 (Advanced)	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Topic: Climate Cycles

Core Lesson Description:

Over the past 4.6 billion years, climate on Earth has varies between ice ages and warm periods. Interglacials mark warm periods or Earth during Ice Ages.

Earth's axis is tilted. This causes seasons as Earth revolves around the sun

The El Nino/Southern Oscillation and monsoons are two climate patterns that result from interactions between oceans and the atmosphere.

Core Lesson Student Learning Objectives:

Students will be able to describe how climate has varied over time. (E) (I)

Students will understand what causes seasons. (C) (E)

Students will be able to describe the affect the oceans have on climate. (E) (I)

Core Lesson Essential Questions:

How has climate varied over time?

What causes seasons?

How does the ocean affect climate?

Core Lesson Big Ideas:

Ice ages are geologic spans of time when glaciers cover much of Earth's surface.

Changes in Earth's orbit and the tilt of Earth's axis affect long term climate cycles.

El Nino/Souther Oscillation, or ENSO, is the combined ocean and atmospheric cycle that results in weakened trade winds across the Pacific Ocean.

Monsoons are wind circulation patterns that change direction with the seasons.

Core Lesson Materials:

classnotes

labs

worksheets

Core Lesson Key Terminology & Definitions:

ice age (C) (E)

interglacial (C) (I)

El Nino/Southern Oscillation (C) (I)

monsoon (E)

drought (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.1.6.B6 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
3.3.6.A5 (Advanced)	Describe the composition and layers of the atmosphere. Explain the effects of oceans on climate. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.
3.3.6.A6 (Advanced)	MODELS/SCALES - Describe the scales involved in characterizing Earth and its atmosphere. MODELS/SCALES - Create models of Earth's common physical features.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-4 (Advanced)	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
MS-ESS2-5 (Advanced)	Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
MS-ESS2-6 (Advanced)	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Topic: Recent Climate Change

Core Lesson Description:	Releasing carbon dioxide and aerosols into the the atmosphere through burning fossil fuels and deforestation are two ways humans can affect climate change. Predictions about future climate change are made using computers and general circulation models.
Core Lesson Student Learning Objectives:	Students will understand how human activities can affect climate. (C) (E) Students will gain a general understanding about how predictions and models are developed for future climate change. (C) (I)
Core Lesson Essential Questions:	How can human activities affect climate? How are predictions for future climate change made?
Core Lesson Big Ideas:	Average temperatures on Earth have been increasing for the past 100 years. Most scientists hve concluded that human activities are the main cause of global climate change. Rapid changes in climate can change condition on Earth. Scientists use global climate models to predict climate change.

Core Lesson Materials:	class notes labs worksheets
Core Lesson Key Terminology & Definitions:	global climate change (C) (E) (I) global warming (C) greenhouse gas (E) (I) deforestation (E) (I) global climate model (C) (I)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A5 (Advanced)	Describe the composition and layers of the atmosphere. Explain the effects of oceans on climate. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.
3.3.6.A6 (Advanced)	MODELS/SCALES - Describe the scales involved in characterizing Earth and its atmosphere. MODELS/SCALES - Create models of Earth's common physical features.
3.3.7.A6 (Advanced)	MODELS/SCALES - Locate significant geologic structures using various mapping representations. CONSTANCY/CHANGE - Describe changes in atmospheric conditions associated with various weather patterns. CONSTANCY/CHANGE SCALE - Describe geologic time as it relates to earth processes.
3.3.8.A5 (Advanced)	Explain how the curvature of the earth contributes to climate. Compare and contrast water vapor, clouds, and humidity.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.
3.3.8.A7 (Advanced)	Science as Inquiry • Compare and contrast scientific theories. • Know that both direct and indirect observations are used by scientists to study the natural world and universe. • Identify questions and concepts that guide scientific investigations. • Formulate and revise explanations and models using logic and evidence. • Recognize and analyze alternative explanations and models. • Explain the importance of accuracy and precision in making valid measurements.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-1 (Advanced)	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-5 (Advanced)	Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
MS-ESS2-6 (Advanced)	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Unit: Water

Month: March/April

STANDARDS: **STANDARDS**

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.5.A2 (Advanced)	Describe the usefulness of Earth's physical resources as raw materials for the human made world.
3.3.6.A1 (Advanced)	Recognize and interpret various mapping representations of Earth's common features.
3.3.6.A2 (Advanced)	Examine how soil fertility, composition, resistance to erosion, and texture are affected by many factors.
3.3.6.A4 (Advanced)	Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere.
3.3.6.A7 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
3.3.7.A4 (Advanced)	Differentiate among Earth's water systems. Describe the motions of tides and identify their causes.
3.3.7.A5 (Advanced)	Describe basic elements of meteorology. Explain the relationship between the energy provided by the sun and the temperature differences among water, land and atmosphere.
3.3.7.A6 (Advanced)	MODELS/SCALES - Locate significant geologic structures using various mapping representations. CONSTANCY/CHANGE - Describe changes in atmospheric conditions associated with various weather patterns. CONSTANCY/CHANGE SCALE - Describe geologic time as it relates to earth processes.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.
3.3.8.A7 (Advanced)	Science as Inquiry • Compare and contrast scientific theories. • Know that both direct and indirect observations are used by scientists to study the natural world and universe. • Identify questions and concepts that guide scientific investigations. • Formulate and revise explanations and models using logic and evidence. • Recognize and analyze alternative explanations and models. • Explain the importance of accuracy and precision in making valid measurements.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-4 (Advanced)	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

(* standards consolidated from Topic level)

Topic: The Water Planet

Core Lesson Description:	This lesson covers a basic introduction to water on Earth including basic properties of water, the water cycle, and why water is essential to life.
Core Lesson Student Learning Objectives:	Students will understand water's role in life on Earth and how Earth's water moves through the water cycle. (E)
Core Lesson Essential Questions:	Why is water important to life on Earth? How is water stored; where is water located on Earth? What are the forces that drive water to change states of matter? What is the water cycle and how does water move through it?
Core Lesson Big Ideas:	Water is the dominant molecule on Earth's surface, interacting with a variety of Earth systems.
Core Lesson Materials:	class notes textbook labs worksheets
Core Lesson Key Terminology & Definitions:	condensation (E) hydrosphere (I) specific heat (I) transpiration (I) water cycle (C) (E) evaporation (E) precipitation (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.A1 (Advanced)	Recognize and interpret various mapping representations of Earth's common features.
3.3.6.A2 (Advanced)	Examine how soil fertility, composition, resistance to erosion, and texture are affected by many factors.
3.3.6.A4 (Advanced)	Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere.
3.3.7.A4 (Advanced)	Differentiate among Earth's water systems. Describe the motions of tides and identify their causes.
3.3.7.A5 (Advanced)	Describe basic elements of meteorology. Explain the relationship between the energy provided by the sun and the temperature differences among water, land and atmosphere.
3.3.7.A6 (Advanced)	MODELS/SCALES - Locate significant geologic structures using various mapping representations. CONSTANCY/CHANGE - Describe changes in atmospheric conditions associated with various weather patterns. CONSTANCY/CHANGE SCALE - Describe geologic time as it relates to earth processes.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and

	transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.
3.3.8.A7 (Advanced)	Science as Inquiry • Compare and contrast scientific theories. • Know that both direct and indirect observations are used by scientists to study the natural world and universe. • Identify questions and concepts that guide scientific investigations. • Formulate and revise explanations and models using logic and evidence. • Recognize and analyze alternative explanations and models. • Explain the importance of accuracy and precision in making valid measurements.
NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)	
MS-ESS2-4 (Advanced)	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Topic: Water Quality

Core Lesson Description:	This lesson covers the physical, biological, and chemical status of bodies of water; how they are determined and humanity's impact on water quality.
Core Lesson Student Learning Objectives:	Students will understand human impacts on water quality. (C) (E) Students will be able to differentiate between point and non-point pollution. (E) Students will gain a basic understanding of the various methods scientists use to measure water quality. (I)
Core Lesson Essential Questions:	What is water quality? How does humanity impact water quality? What are the various indicators of water quality?
Core Lesson Big Ideas:	Water quality is essential to life on Earth. Humanity plays a large role in water quality.
Core Lesson Materials:	Class notes Textbook Labs Worksheets
Core Lesson Key Terminology & Definitions:	bioindicator (E) nitrate (E) nonpoint-source (E) point-source (E) turbidity (E) water quality (C) (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.5.A2 (Advanced)	Describe the usefulness of Earth's physical resources as raw materials for the human made world.
3.3.6.A2 (Advanced)	Examine how soil fertility, composition, resistance to erosion, and texture are affected by many factors.
3.3.6.A7 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
3.3.8.A6 (Advanced)	CHANGES - Explain changes in earth systems in terms of energy transformation and transport. MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS2-4 (Advanced)	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Unit: Exploring the Universe

Month: April/May/June

STANDARDS:

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.B1 (Advanced)	Compare and contrast the size, composition, and surface features of the planets that comprise the solar system as well as the objects orbiting them. Recognize the role of gravity as a force that pulls all things on or near the earth toward the center of the earth and in the formation of the solar system and the motions of objects in the solar system. Explain why the planets orbit the sun in nearly circular paths. Describe how the planets change their position relative to the background of the stars. Explain how the tilt of the earth and its revolution around the sun cause an uneven heating of the earth which in turn causes the seasons and weather patterns.
3.3.6.B2 (Advanced)	MODELS - Use models to demonstrate that earth has different seasons and weather patterns. MODELS - Use models to demonstrate that the phases of the moon are a result of its orbit around Earth.
3.3.6.B3 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and

	understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
3.3.7.B1 (Advanced)	Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars, and the solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth.
3.3.7.B2 (Advanced)	SCALE AND MEASUREMENT - Identify a variety of instruments used to gather evidence about the universe. PATTERNS - Describe repeating patterns in the Sun-Earth-Moon system and the positions of stars. SCALE - Relate planetary size and distance in our solar system using an appropriate scale model.
3.3.7.B3 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
3.3.8.B1 (Advanced)	Explain how light, measured remotely, can be used to classify objects in the universe.
3.3.8.B2 (Advanced)	SCALE AND MEASUREMENT - Explain measurements and evidence indicating the age of the universe.
NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)	
MS-ESS1-1 (Advanced)	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
MS-ESS1-2 (Advanced)	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
MS-ESS1-3 (Advanced)	Analyze and interpret data to determine scale properties of objects in the solar system.

(* standards consolidated from Topic level)

Topic: The Solar System

Core Lesson Description:	This lesson introduces students to the solar system including what the solar system is, various objects in the solar system, and the motion of the planets.

Core Lesson Student Learning Objectives:	Students will understand what the solar system is. (C) Students will be able to define the various objects in the solar system. (E) Students will have a basic understanding of the motion of various solar system bodies. (E) (I)
Core Lesson Essential Questions:	What is the structure of the solar system?
Core Lesson Big Ideas:	The Sun and the objects that orbit it are the solar system.
Core Lesson Materials:	class notes textbook labs worksheets
Core Lesson Key Terminology & Definitions:	asteroid (E) astronomical unit (E) comet (E) orbit (C) period of rotation (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.B1 (Advanced)	Compare and contrast the size, composition, and surface features of the planets that comprise the solar system as well as the objects orbiting them. Recognize the role of gravity as a force that pulls all things on or near the earth toward the center of the earth and in the formation of the solar system and the motions of objects in the solar system. Explain why the planets orbit the sun in nearly circular paths. Describe how the planets change their position relative to the background of the stars. Explain how the tilt of the earth and its revolution around the sun cause an uneven heating of the earth which in turn causes the seasons and weather patterns.
3.3.6.B3 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.

3.3.7.B1 (Advanced)	Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars, and the solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth.
3.3.7.B2 (Advanced)	SCALE AND MEASUREMENT - Identify a variety of instruments used to gather evidence about the universe. PATTERNS - Describe repeating patterns in the Sun-Earth-Moon system and the positions of stars. SCALE - Relate planetary size and distance in our solar system using an appropriate scale model.
3.3.7.B3 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)	
MS-ESS1-2 (Advanced)	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
MS-ESS1-3 (Advanced)	Analyze and interpret data to determine scale properties of objects in the solar system.

Topic: Stars and Galaxies

Core Lesson Description:	This lesson covers general information about stars including their composition, structure, and how they are classified. This lesson also covers what a galaxy is, how galaxies are classified, and how galaxies formed.
Core Lesson Student Learning Objectives:	Students will understand what a star is (C), how stars are classified (I), and the basic structure and function of stars (E). Students will understand what a galaxy (C) is and how galaxies are classified (I).
Core Lesson Essential Questions:	What is a star? What is the composition and structure of stars? How are stars classified? What is a galaxy? How do/did galaxies form? What is the Milky Way galaxy?
Core Lesson Big Ideas:	Stars are large balls of gas held together by gravity. Stars have a composition and structure. Stars are classified by their size, luminosity, and life stage.

Galaxies are a huge collection of stars held together by gravity.

Galaxies are classified by their shape.

Core Lesson Materials:

class notes

textbook

labs

worksheets

Core Lesson Key Terminology & Definitions:

apparent (E)

apparent magnitude (E)

astronomical unit (E)

luminosity (E)

parallax (I)

spectroscope (I)

chromosphere (I)

convection zone (I)

corona (E)

Hertzsprung-Russell diagram (I)

nuclear fusion (C) (E)

photosphere (E)

radiative zone (E)

star (C)

stellar (C)

black hole (E)

nebula (I)

neutron (E)

neutron star (I)

supernova (E)

white dwarf (I)

Big Bang theory (C)

dark matter (I)

Doppler shift (E)

galaxy (E)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.7.B1 (Advanced)	Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars, and the solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth.
3.3.7.B2 (Advanced)	SCALE AND MEASUREMENT - Identify a variety of instruments used to gather evidence about the universe. PATTERNS - Describe repeating patterns in the Sun-Earth-Moon system and the positions of stars. SCALE - Relate planetary size and distance in our solar system using an appropriate scale model.
3.3.7.B3 (Advanced)	Science as Inquiry • Understand how theories are developed. • Identify questions that can be answered through scientific investigations and evaluate the appropriateness of questions. • Design and conduct a scientific investigation and understand that current scientific knowledge guides scientific investigations. • Describe relationships using inference and prediction. • Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows scientists to analyze and quantify results of investigations. • Develop descriptions, explanations, and models using evidence and understand that these emphasize evidence, have logically consistent arguments, and are based on scientific principles, models, and theories. • Analyze alternative explanations and understanding that science advances through legitimate skepticism. • Use mathematics in all aspects of scientific inquiry. • Understand that scientific investigations may result in new ideas for study, new methods, or procedures for an investigation or new technologies to improve data collection.
3.3.8.B1 (Advanced)	Explain how light, measured remotely, can be used to classify objects in the universe.
3.3.8.B2 (Advanced)	SCALE AND MEASUREMENT - Explain measurements and evidence indicating the age of the universe.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS1-2 (Advanced)	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
MS-ESS1-3 (Advanced)	Analyze and interpret data to determine scale properties of objects in the solar system.

Topic: The Sun-Earth-Moon System

Core Lesson Description:	This lesson
Core Lesson Student Learning Objectives:	Students will gain a basic understanding of the Sun-Earth-Moon system. (E)
Core Lesson Essential Questions:	How does the Earth move? Why do we have seasons? How did the Moon form? What are the phases of the Moon? What are eclipses? What are the tides?
Core Lesson Big Ideas:	Earth's seasons change in a yearly cycle because of the tilt of its rotation axis and Earth's motion around the Sun. The end of Earth's axis that is tilted toward the Sun receives more energy from the Sun.

Scientists hypothesize that the Moon formed from rock that was in a ring around Earth. This ring formed when Earth collided with an object about the size of Mars.

A phase is the lit part of the Moon or a planet that can be seen from Earth.

An eclipse happens when a planetary body passes between the sun (or another star) and the Earth.

Core Lesson Materials:

Class notes

labs

worksheets

Core Lesson Key Terminology & Definitions:

equator (C)

equinox (E)

orbit (E)

revolution (E)

rotation (E)

rotation axis (E)

solstice (E)

maria (I)

phase (C)

waning phase (E)

waxing phase (E)

lunar eclipse (E)

penumbra (I)

solar eclipse (E)

tide (E)

umbra (I)

STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

3.3.6.B1 (Advanced)	Compare and contrast the size, composition, and surface features of the planets that comprise the solar system as well as the objects orbiting them. Recognize the role of gravity as a force that pulls all things on or near the earth toward the center of the earth and in the formation of the solar system and the motions of objects in the solar system. Explain why the planets orbit the sun in nearly circular paths. Describe how the planets change their position relative to the background of the stars. Explain how the tilt of the earth and its revolution around the sun cause an uneven heating of the earth which in turn causes the seasons and weather patterns.
3.3.6.B2 (Advanced)	MODELS - Use models to demonstrate that earth has different seasons and weather patterns. MODELS - Use models to demonstrate that the phases of the moon are a result of its orbit around Earth.
3.3.7.B2 (Advanced)	SCALE AND MEASUREMENT - Identify a variety of instruments used to gather

	evidence about the universe. PATTERNS - Describe repeating patterns in the Sun-Earth-Moon system and the positions of stars. SCALE - Relate planetary size and distance in our solar system using an appropriate scale model.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

MS-ESS1-1 (Advanced)	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
MS-ESS1-2 (Advanced)	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
MS-ESS1-3 (Advanced)	Analyze and interpret data to determine scale properties of objects in the solar system.