



## **Kutztown Area School District Curriculum (Unit Map)**

### *Grade 8 Science*

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**Course Description:** This course is designed to interpret and understand the structure and development of the earth over time and concludes with an introduction to astronomy. The course will include units on experimental design, mapping, plate tectonics, the rock cycle, weathering and erosion, the cycle of water, meteorology, climate and world biomes, our solar system and the universe. The course includes mostly hands-on activities, projects, labs, and research.

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<b>Unit #/Title</b>	1/The Scientific Method & Problem Solving	<b>Time Frame</b>	2-3 Weeks
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## Standards

- S8.A.2.1.3** Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.
- S8.A.3.2.1** Describe how scientists use models to explore relationships in natural systems.
- 3.3.8.B3** Compare and contrast scientific theories: Know that scientists to study the natural world and universe use both direct and indirect observations; Identify questions and concepts that guide scientific investigations; Explain the importance of accuracy and precision in making valid measurements; Formulate and revise explanations and models using logic and evidence; Recognize and analyze alternative explanations and models.
- S8.A.2.1.2** Use space/time relationships, define concepts operationally, raise testable questions, or formulate a hypothesis.
- S8.D.3.1.2** Describe the role of gravity as the force that governs the movement on Earth and the universe.
- 3.3.7.B2** Scale and measurement: Identify a variety of instruments used to gather evidence about the universe.
- 3.3.7.B1** Apply appropriate instruments for a specific purpose and describe the information the instrument can provide.
- 3.1.10.A9** Identify questions and concepts that guide scientific investigations.
- 3.1.10.B1** Know that both direct and indirect observations are used by scientists to study the natural world and universe.

## Big Ideas

- The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, and biosphere) that interact over a wide array of spatial and temporal scales.

## Essential Questions

- What do scientists do?
- What information should we gather to prove our point?
- How should we present our information?

## Content

## Skills

- Design and conduct an experimental investigation
- Practice the appropriate use of scientific equipment and tools
- Sequence steps of the scientific method
- Follow predetermined safety protocols in all science settings
- Convert raw data into organized data
- Provide examples of multiple disciplines of science which are essential to understand earth systems
- Conduct analysis
- Support conclusions with investigative evidence comparing to hypothesis
- Communicate results and conclusions citing potential errors
- Propose further questions and investigations based on findings
- Research and apply appropriate safety precautions when designing and conducting scientific investigations.
- Present scientific findings using clear language, accurate data, appropriate graphs, tables, maps and available technology
- Use mathematical models to predict and analyze natural phenomena

	<ul style="list-style-type: none"> <li>• Draw conclusions from inquiries based on scientific knowledge and principles, the use of logic and evidence (data) from investigations</li> <li>• Explain how new scientific data can cause any existing scientific explanation to be supported, revised or rejected</li> </ul>
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<b>Unit #/Title</b>	2/Rocks and Minerals	<b>Time Frame</b>	2-3 Weeks
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<b>Standards</b>
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- 3.3.10.A1** Describe the rock cycle and the processes that are responsible for the formation of igneous, sedimentary, and metamorphic rocks.
- 3.3.10.A1** Explain how the Earth is composed of a number of dynamic, interacting systems exchanging both matter and energy.
- 3.3.7.A1** Define the basic features of the rock cycle.
- 3.3.8.A3** Explain how matter on earth is conserved throughout the geological processes over time.
- 3.3.8.A2** Describe renewable and nonrenewable energy resources.
- 3.3.12.A1** Classify Earth’s internal and external sources of energy such as radioactive decay.
- 3.3.12.A2** Analyze the availability, location, and extraction of Earth’s resources.
- 3.3.12.A3** Describe the absolute and relative dating techniques used to measure geologic time.
- S8.D.1.1.1** Explain the rock cycle as it changes in the solid earth and rock types.
- S8 D.1.1.2** Describe the natural processes that change the Earth’s surface.
- 3.3.10.A1** Relate geochemical cycles to conservation of matter.
- 3.3.7 B1** Describe geologic time as it relates to earth processes.

<b>Big Ideas</b>	<b>Essential Questions</b>
<ul style="list-style-type: none"> <li>• The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, and biosphere) that interact over a wide array of spatial and temporal scales.</li> </ul>	<ul style="list-style-type: none"> <li>• What can rocks and minerals (geology) tells us about planet earth’s past climate?</li> <li>• How do we actually know how rocks form through the processes of the “Rock cycle” if we don’t observe the entire process all at once?</li> <li>• How and why is earth constantly changing?</li> </ul>

<b>Content</b>	<b>Skills</b>
<ul style="list-style-type: none"> <li>• Hardness, composition, crystal structure, fracture/cleavage, streak, specific gravity of eight local and common minerals in Pennsylvania.</li> <li>• Key minerals based on physical and chemical characteristics</li> <li>• Vocabulary: rock, igneous rock, sedimentary rock, metamorphic rock, rock cycle, magma, lava, weathering, sediments, erosion, deposition, compaction, cementation, intrusive igneous rocks, extrusive igneous rocks, contact metamorphism, regional metamorphism</li> </ul>	<ul style="list-style-type: none"> <li>• Classify rocks as one of three different types and explain the interrelationship of the rock types as part of the rock cycle (E.g., igneous, granite, basalt, obsidian, pumice; sedimentary, limestone, sandstone, shale, coal; and metamorphic: slate, quartzite, marble, gneiss)</li> <li>• Describe how elements are related to minerals</li> <li>• Distinguish between minerals and non-minerals using the five characteristics that define a mineral</li> <li>• Discuss the use of renewable and non-renewable materials within our modern world</li> </ul>

	<ul style="list-style-type: none"> <li>● Apply minerals tests to identify unknown minerals found in Pennsylvania</li> <li>● Use rock layers and types to understand geologic time</li> <li>● Use rock types found in Pennsylvania to identify natural resources</li> <li>● Use rock types to understand Earth's processes</li> <li>● Use of laboratory equipment to identify mineral and rock types</li> <li>● Identify basic features of rocks and minerals in PA</li> <li>● Use scientific method to identify minerals and rocks</li> </ul>
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<b>Unit #/Title</b>	3/Earth's Geologic Past	<b>Time Frame</b>	3-4 weeks
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<b>Standards</b>
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- 3.3.10.A7** Interpret and create models of the Earth's physical features in various mapping representations. Scale: apply an appropriate scale to illustrate major events throughout geologic time.
- 3.3.8.A.3** Explain how matter on earth is conserved throughout the geological processes over time.
- S8.D.1.1.4** Explain how fossils provide evidence about plants and animals that once lived throughout Pennsylvania's history (e.g., fossils provide evidence of different environments).
- 3.3.10.A3** Explain how the evolution of Earth has been driven by interactions between the lithosphere (hard), hydrosphere (H<sub>2</sub>O), atmosphere (gas), and biosphere (living component).
- 3.3.12.A3** Describe the absolute and relative dating methods used to measure geologic time, such as index fossils, radioactive dating, law of superposition, and crosscutting relationships.
- 3.3.10.A.1** Relate geochemical cycles to the conservation of matter.
- S8.D.1.1.1** Explain the rock cycle as it changes in the solid earth and rock types.
- S8.D.1.1.2** Describe the natural processes that change the Earth's surface.
- 3.3.7.A3** 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.
- 3.3.7.A4** Compare geologic processes over time
- 3.3.12.A7** Summarize the use of data in understanding seismic events, meteorology, and geologic time.
- 3.3.12.A1** Classify Earth's internal and external sources of energy such as radioactive decay, gravity, and solar energy.

<b>Big Ideas</b>	<b>Essential Questions</b>
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| <ul style="list-style-type: none"> <li>● The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, and biosphere) that interact over a wide array of spatial and temporal scales.</li> </ul> | <ul style="list-style-type: none"> <li>● How does the interpretation of past environments inform the work of modern paleontologists?</li> <li>● How can rocks and rock structures be used to interpret, date, and reconstruct earth's geologic past?</li> <li>● How are the assessment and measurement of time integral to interpret and summarize Earth's geologic history?</li> </ul> |
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Content	Skills
<ul style="list-style-type: none"> <li>● Use of index fossils to determine relative age of Earth</li> <li>● Use of scientific notation to understand the large numbers associated with geologic time</li> <li>● Understanding of the movements and processes within the earth throughout the Earth's history</li> <li>● Use of relative age dating techniques to understand geologic time</li> <li>● Use of absolute dating to correlate age of earth and geologic time periods</li> <li>● Use of geologic and coal distribution maps of Pennsylvania to determine why coal and dinosaur fossils are found in PA</li> <li>● Vocabulary: Absolute age, crosscutting, Geological record, Geologic time, Index fossil, Law of superposition, Radiometric dating, Relative age, Faunal succession, biodiversity, extinction, evolution, Original horizontality, Contact metamorphism, mold, cast, trace fossil, amber, tar, pit, sedimentary rock, coprolite</li> </ul>	<ul style="list-style-type: none"> <li>● Identify modern methods scientists use to date the age of the Earth</li> <li>● Make correlations between index fossils and geologic age of earth with mass extinctions</li> <li>● Explain difference between absolute and relative dating techniques</li> <li>● Compare and contrast the environment of Pennsylvania today and in the geologic past</li> <li>● Explain the difference between plants and animals throughout geologic time (evolution)</li> </ul>

Unit #/Title	4/Earth's Dynamic Processes: Plate Tectonics	Time Frame	3-4 Weeks
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Standards
<p><b>3.3.10.A3</b> Explain how the evolution of Earth has been driven by interactions between the lithosphere (hard), hydrosphere (H<sub>2</sub>O), atmosphere (gas), and biosphere (living component).</p> <p><b>3.3.10.A.1</b> Relate geochemical cycles to the conservation of matter.</p> <p><b>S8.D.1.1.1</b> Explain the rock cycle as it changes in the solid earth and rock types.</p> <p><b>3.3.10.A1</b> Relate plate tectonics to both slow and rapid change in the earth's surface.</p> <p><b>3.3.12. A1</b> Analyze the processes that cause the movement of material in the Earth's systems.</p> <p><b>3.3.7.A1</b> Define the basic features of the rock cycle.</p> <p><b>3.3.7.A1</b> Describe the layers of the Earth.</p> <p><b>3.3.7.A6</b> Describe geologic time as it relates to earth processes.</p> <p><b>3.3.8.A3</b> Explain how matter on earth is conserved throughout geological processes over time.</p> <p><b>3.3.10. A2</b> Analyze the effects on the environment and the carbon cycle of using both renewable and nonrenewable sources of energy.</p> <p><b>3.3.12.A7</b> Interpret and analyze a combination of ground based observations, satellite data, and computer models to demonstrate Earth systems and their interconnections.</p>

<b>Big Ideas</b>	<b>Essential Questions</b>
<ul style="list-style-type: none"> <li>The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, and biosphere) that interact over a wide array of spatial and temporal scales.</li> </ul>	<ul style="list-style-type: none"> <li>Why does the earth's surface change?</li> <li>How do the earth's tectonic plates interact, and how do these plate interactions affect the humans and the environment?</li> </ul>
<b>Content</b>	<b>Skills</b>
<ul style="list-style-type: none"> <li>Use of sea floor rock location to determine relative age of different parts of the Earth</li> <li>Understanding of the movements and processes within the earth throughout the earth's history</li> <li>Use of volcano occurrence databases to understand plate motion as it relates to island formation</li> <li>Use of space satellites to measure plate motion and stress build up and how it can relate to crustal deformation</li> <li>Vocabulary: Theory of continental drift, sea-floor spreading, spreading boundary, subduction, Pangaea, trench, ridge, strike-slip fault, gravity fault, convection currents, focus, seismic wave, p-wave, s-wave, love wave, hot spots, shield volcanoes, lava, epicenter, convergent and divergent plate boundaries, stratovolcano, space geodesy</li> </ul>	<ul style="list-style-type: none"> <li>Identify modern methods scientists use to date the age of the Earth, specifically the sea-floor rocks</li> <li>Make correlations between earthquake and volcano occurrence and plate boundaries</li> <li>Explain difference between different types of seismic waves such as S-wave, P-wave, and L-wave</li> <li>Identify topographic features on a physical map of the Atlantic Ocean basin</li> <li>Use earthquake occurrence databases to understand plate tectonic movement</li> <li>Explain the difference between the Theory of Continental Drift and sea-floor spreading</li> <li>Use speed of seismic waves to locate the epicenter of an earthquake</li> </ul>

<b>Unit #/Title</b>	<b>Time Frame</b>
5/Weathering & Erosional Processes	2-3 Weeks

<b>Standards</b>	
<p><b>3.3.8.A1</b> Distinguish between physical and chemical weathering.</p> <p><b>3.3.8.A6</b> Explain changes in earth's systems in terms of energy transformation and transport.</p> <p><b>3.3.7.A2</b> Explain land use in relation to soil type and topography.</p> <p><b>3.3.6.A2</b> Explain how soil fertility, composition, resistance to erosion, and texture are affected by many factors</p> <p><b>4.2.6.B</b> Analyze how soil types and geographic regions have impacted agriculture in Pennsylvania.</p> <p><b>4.4.6.B</b> Describe the characteristics of soils found in wetlands.</p>	
<b>Big Ideas</b>	<b>Essential Questions</b>
<ul style="list-style-type: none"> <li>The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, and biosphere) that interact over a wide array of spatial and temporal scales.</li> </ul>	<ul style="list-style-type: none"> <li>How and why is the Earth constantly changing?</li> <li>How do Earth's processes and human activities affect each other?</li> <li>How do tectonic and hydrologic forces work together to shape and reshape the land?</li> </ul>

Content	Skills
<ul style="list-style-type: none"> <li>Using lab measurement tools with accuracy.</li> <li>Describing and analyzing local rock formations.</li> <li>Observing and analyzing local soil samples.</li> <li>Soil chemistry analysis.</li> <li>Reading and using topographic maps.</li> <li>Reading and using highway maps.</li> <li>Stream development.</li> <li>Identification of macroinvertebrates</li> <li>Vocabulary: Physical weathering, Chemical weathering, exfoliation, Potassium, Nitrogen, Phosphorous, erosion, watershed, deposition, landform, momentum, volume, gradient, profile, knickpoint, waterfalls</li> </ul>	<ul style="list-style-type: none"> <li>Plan and carry out investigations that investigate models of the chemical and physical processes that cycle the earth materials and form rocks.</li> <li>Compare and contrast various soil types and their characteristics found in different biomes (e.g, regionally, nationally, globally) and explain how they were formed.</li> <li>Describe three major landforms shaped by weathering and erosion.</li> <li>Assess the physical characteristics of a stream to the types of organism found in a freshwater environment.</li> <li>Practice laboratory techniques for determining soil texture and the sediment size of fine sediment.</li> </ul>

<b>Unit #/Title</b>	6/Contour Mapping & Landforms	<b>Time Frame</b>	2-3 Weeks
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## Standards

- 3.3.6.A1** Recognize and interpret various mapping representations of Earth’s common features.  
**3.3.6.A6** Create models of Earth’s common physical features.  
**3.3.7.A2** Explain land use in relation to soil type and topography.  
**3.3.7.A6** Locate significant geologic structures using various mapping representations.

Big Ideas	Essential Questions
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The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, and biosphere) that interact over a wide array of spatial and temporal scales.

- How and why is the earth constantly changing?
- How do tectonic forces and the hydrologic cycle work together to shape and reshape the earth over time?
- How do Earth’s processes and human activities affect each other?

Content	Skills
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- First Order stream identification
- Topographic map concepts
- Topographic map activities
- Pennsylvania watershed identification
- Stream development
- Vocabulary: contour line, contour interval, landform, latitude, longitude, hachure line, depression contour, youth stage, mature stage, old age, meander, velocity, v-shaped valley, oxbow lake

- Construct an explanation based on evidence for how various processes have changed Earth’s surface at varying time and spatial scales.
- Discuss how stream shape indicates their age.
- Compare a drainage basin to a drainage divide and explain how a drainage divide changes over time.
- Interpret landforms and features, using a topographic maps and contour rules.
- Demonstrate how to make a cross section, using a topographic map.
- Locate positions using latitude and longitude.

<b>Unit #/Title</b>	7/The Cycle of Water	<b>Time Frame</b>	2-3 Weeks
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## Standards

- 3.3.7.A4** Differentiate among Earth's water systems.
- 3.3.7.A4** Describe the motions of tides and identify their causes.
- 3.3.6.A4** Describe how water on Earth cycles in different forms and in different locations, including underground and in the atmosphere.
- 3.3.6.A5** Explain the effects of oceans on climate.
- 3.3.8.A4** Explain how the oceans are interconnected.
- 3.3.10.A5** Explain how there is only one ocean, Explain the processes of the hydrologic cycle, Explain the dynamics of ocean currents and their relationship to global circulations within the marine environment.
- 3.3.10.A7** Relate constancy and change to the hydrologic cycle and geochemical cycles.
- 4.2.10.C** Explain the relationship between water quality and the diversity of life in a freshwater ecosystem.
- 4.2.10.B** Examine how human interactions impact wetlands and their surrounding environments.
- 4.2.10.A** Describe how topography influences the flow of water in a watershed, describe how vegetation affects water runoff, investigate and analyze the effects of land use on the quality of water in a watershed.
- 4.5.10.A** Explain how public policy encourages or discourages the sustainable use of natural resources.
- 4.5.10.B** Describe the impact of integrated pest management practices on the environment.
- 4.5.10.C** Analyze real-world data and explain how point and non-point source pollution can be detected and eliminated.

## Big Ideas

## Essential Questions

- The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, and biosphere) that interact over a wide array of spatial and temporal scales.

- How and why is the Earth constantly changing?
- How do Earth's processes and human activities affect each other?

## Content

## Skills

- Density difference between salt and freshwater.
- Local water testing (groundwater)
- Water /sewer systems
- World ocean currents
- Concentration of dissolved oxygen
- Thermocline and halocline identification
- The Water Cycle
- Evaporation and Condensation
- Vocabulary: evaporation, condensation, runoff, river, lake, groundwater, thermocline, halocline, salinity, dissolved oxygen, aquifer, copper, chlorine, hardness, bacteria, ocean currents, gyre

- Develop models for the movement of water within the Earth's spheres.
- Compare and contrast characteristics of freshwater and saltwater systems on the basis of their physical characteristics.
- Explain why groundwater is a critical natural resource.
- Reproduce by diagram or illustration the hydrologic cycle and discuss its parts and driving force.

<b>Unit #/Title</b>	8/Introduction to Meteorology	<b>Time Frame</b>	3-4 Weeks
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## Standards

- 3.3.8.A5** Compare and contrast water vapor, clouds and humidity.
- 3.3.6.B2** Use models to demonstrate that earth has different seasons and weather patterns.
- 3.3.7.A1** Differentiate among the mechanisms by which heat is transferred through the Earth's system.
- 3.3.7.A5** Describe the basic elements of meteorology.
- 3.3.7.A6** Describe changes in atmospheric conditions associated with various weather patterns.
- 3.3.7.A5** Explain the relationship between energy provided by the sun and the temperature differences among land, water and atmosphere.
- 3.3.6.A5** Describe the composition and layers of the atmosphere.
- 3.3.6.A6** Describe the scales involved in characterizing Earth and its atmosphere.
- 3.3.6.A5** Describe how global patterns such as jet stream and water currents influence local weather patterns in measurable terms such as temperature, wind direction and speed and precipitation.
- 3.3.10.A6** Interpret meteorological data to describe and/or predict the weather, Explain the phenomena that cause global atmospheric processes such as storms, currents and wind patterns.
- 3.3.12.A1** Explain how parts are related to other parts in weather systems, solar systems, earth systems, including how the output from one can become the input into another system.
- 3.3.12.A6** Relate transfer of energy through radiation, conduction, convection to global atmospheric processes, Explain how the unequal heating of the Earth's surface leads to global atmospheric circulation changes such as climate and weather.

## Big Ideas

- The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, and biosphere) that interact over a wide array of spatial and temporal scales.

## Essential Questions

- How and why is the Earth constantly changing?
- How do Earth's processes and human activities affect each other?

## Content

- The atmosphere and energy transfer.
- Air pressure and winds.
- Evaporation and condensation.
- Air masses
- Energy and dangerous storms
- Weather forecasting techniques.
- Vocabulary: conduction, convection, radiation, troposphere, stratosphere, mesosphere, thermosphere, isobars, cold front, warm front, occluded front, hurricane, tornado, prevailing westerlies, trade winds, doldrums

## Skills

- Collect data and generate evidence to show how changes in weather conditions result from the movement, interactions, and area of origin of air masses.
- Analyze weather patterns using cloud types, wind directions, and barometric pressure.
- Distinguish each layer of the atmosphere based on temperature and density.
- Explain how predominant air masses that influence weather.

<b>Unit #/Title</b>	9/Climate and World Biomes	<b>Time Frame</b>	2-3 Weeks
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## Standards

- 3.3.8.A5** Explain how the curvature of the earth contributes to its climate.
- 3.3.6.B2** Use models to demonstrate that earth has different seasons and weather patterns.
- 4.4.6.A** Explain how different plants and animals in the United States have specific growing requirements related to climate and soil conditions.
- 3.3.6.B1** 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.
- 3.3.10.A7** Describe the factors that contribute to global climate change.
- 4.3.10.A** Evaluate factors affecting the use of natural resources.
- 4.3.10.B** Analyze how humans manage and distribute natural resources.
- 4.4.10.A** Explain the relationships between and among components of the food and fiber system.
- 4.4.10.B** Analyze the effects of agriculture on a society's economy, environment, standard of living, and foreign trade.
- 4.4.10.C** Analyze how agricultural sciences and technologies strive to increase efficiency while balancing the needs of society with the conservation of our natural resources.

<b>Big Ideas</b>	<b>Essential Questions</b>
<ul style="list-style-type: none"> <li>The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, and biosphere) that interact over a wide array of spatial and temporal scales.</li> </ul>	<ul style="list-style-type: none"> <li>How and why is the Earth constantly changing?</li> <li>How do Earth's processes and human activities affect each other?</li> </ul>
<b>Content</b>	<b>Skills</b>
<ul style="list-style-type: none"> <li>Understanding North American precipitation maps.</li> <li>Climate factors model</li> <li>Biome research</li> <li>Vocabulary: Hours of daylight, Sun angle, Solar energy rating, Rain shadow effect, Climate, Rainforest, Tundra, Temperate rainforest, Savannah, Desert, Antarctic icecap, Taiga, Mountain/alpine, Freshwater. Open ocean</li> </ul>	<ul style="list-style-type: none"> <li>Investigate water systems to identify seasonal and annual variations in precipitation and streamflow and the causes of those variations.</li> <li>Construct and use models to support the explanation of how the uneven distribution of solar energy affects global patterns in atmospheric and oceanic circulation.</li> <li>Construct explanations from models of oceanic and atmospheric circulation, and for the development of local and regional climates.</li> <li>Explain scientific reasons for Earth's changing seasons.</li> </ul>

<b>Unit #/Title</b>	10/Astronomy	<b>Time Frame</b>	3-4 Weeks
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## Standards

**3.2.7.B5** Demonstrate that visible light is a mixture of many different colors. Explain the construct of the electromagnetic spectrum.

**3.3.6.B1** 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.

**3.3.7.B1** 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.

**3.3.8.B1** Explain how light, measured remotely, can be used to classify objects in the universe. 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. Models: Use models to demonstrate that the phases of the moon are a result of its orbit around Earth.

**3.3.7.B2** 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.

**3.3.8.B2** Scale and Measurement: Explain measurements and evidence indicating the age of the universe.

**3.3.10.1.** Explain how gravity is responsible for planetary orbits. Explain what caused the sun, earth, and most of the other planets to form between 4 and 5 billion years ago. Provide evidence to suggest the Big Bang Theory. Describe the basic nuclear processes involved in energy production in a star.

**3.3.10.2.** Scale and Measurement: Explain how scientists obtain information about the universe by using technology to detect electromagnetic radiation that is emitted, reflected, or absorbed by stars and other objects. Constancy and Change: Describe changes in the universe over billions of years. Scale and Measurement: Explain the scale used to measure the sizes of stars and galaxies and the distance between them.

**3.3.12.B1** Describe the life cycles of stars based on their mass, analyze the influence of gravity on the formation and life cycles of galaxies, including our own Milky Way galaxy; stars; planetary systems; and residual material left from the creation of the solar system; Relate the nuclear processes involved in energy production in stars and supernovas to their life cycle.

**3.3.12.B2** Apply mathematical models and computer simulations to study evidence collected relating to the extent and composition of the universe; Analyze the evidence supporting theories of the origin of the universe to predict the future.

## Big Ideas

- The Universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.

## Essential Questions

- What is the Universe, and what is Earth's place in it?
- How do we know about distant space objects in if we can't travel there?
- How do modern astronomers study the universe?

## Content

- Relative sizes, the orbits, and various components of objects in our solar system
- Students will know the characteristics to classify stars
- Apply parallax to determine relative distance to stars

## Skills

- Identify and classify objects in our solar system based on tools currently used by Astronomers
- Make correlations concerning distance between planetary orbits and distance from sun

- Use of scientific notation to convert and understand the very large numbers and associated with Astronomy
- Understanding of the movements of objects in our solar system and galaxies in general
- Use of electromagnetic spectrum to obtain information about celestial objects
- Use of parallax, Doppler effect, and HR diagram to obtain information about celestial objects
- Vocabulary: Sun: solar wind, sunspot core, nuclear fusion, terrestrial planets, gas giant, ring, comet, solar system, Jovian planets
- Electromagnetic vocabulary: Electromagnetic spectrum, spectroscopy, apparent brightness Absolute brightness, parallax, Hertzsprung-Russell diagram, main sequence Black hole, nebula, proto star, white dwarf, pulsar Super nova, neutron star, Scientific notation, Galaxy, Red super giant, Orion, Betelgeuse (expand), Nuclear fusion

- Explain difference between inner and outer planets
- Compare and contrast the fate of our sun
- Compare and contrast the fate of various types of stars using a HR diagram