



**Science Standard 5**  
**Earth's Dynamic Systems**  
**Grade Level Expectations**

## Science Standard 5 Earth's Dynamic Systems

Earth's dynamic systems are made up of the solid earth (geosphere), the oceans, lakes, rivers, glaciers and ice sheets (hydrosphere), the atmosphere, and organisms (biosphere). Interactions among these spheres have resulted in ongoing changes to the system. Some of these changes can be measured on a human time scale, but others occur so slowly, that they must be inferred from geological evidence.

Strand	Grades K-3	Grades 4-5	Grades 6-8	Grades 9-12
<p><b><u>Components of Earth</u></b></p> <p>Enduring Understanding: Earth's systems can be broken down into individual components which have observable measurable properties.</p> <p>Essential Question: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?</p>	<ol style="list-style-type: none"> <li>1. Components of Earth's system include minerals, rocks, soil, water and air. These materials can be observed, sorted and/or classified based on their physical properties.</li> <li>2. Water can exist as a solid, liquid or gas and in different forms such as rain, snow and ice.</li> <li>3. Sand, clay and humus have distinct physical properties and are components of soils.</li> <li>4. A soil's composition varies from environment to environment.</li> <li>5. Soil type can be identified by testing for grain size and composition.</li> <li>6. Rocks are natural combinations of minerals. Minerals can be classified according to their physical properties (i.e., luster, color and hardness).</li> </ol>	<ol style="list-style-type: none"> <li>1. Water exists in three states (solid, liquid and gas) that are dependent upon the surrounding temperature.</li> <li>2. Rocks and minerals are broken down over time to clay and sand sized particles. These particles combine with plant remains to form soil.</li> <li>3. The ability of water to pass through soil depends on the relative amounts of clay and sand in the soil.</li> </ol>	<ol style="list-style-type: none"> <li>1. Water exists on the Earth in reservoirs (on or within the Earth's surface and atmosphere). The total amount of water in these reservoirs does not change, however, the ratio of water in solid, liquid, or gaseous form varies over time and location.</li> <li>2. The movement of water among the geosphere, hydrosphere and atmosphere affects such things as weather systems, ocean currents, and global climate.</li> <li>3. The formation of sediment and soil requires a long period of time as rocks are weathered, eroded and deposited.</li> <li>4. The atmosphere is a mixture having as its principle components a fixed ratio of nitrogen and oxygen and, depending on the location, variable amounts of carbon dioxide, water vapor, and dust particles.</li> </ol>	<ol style="list-style-type: none"> <li>1. Minerals are the building blocks of rocks. Common rock-forming minerals found in Delaware (calcite, quartz, mica, feldspar, and hornblende) can be identified by their chemical and physical properties.</li> <li>2. Rocks can be classified as igneous, metamorphic and sedimentary based on the method of formation. The natural cycling of rocks includes the formation of new sediment through erosion and weathering and of new rock through heat and compaction of the sediment.</li> <li>3. Earth's geosphere is composed of layers of rocks which have separated due to density and temperature differences and classified chemically into a crust (which includes continental and oceanic rock), a hot, convecting mantle, and a dense metallic core.</li> <li>4. Continental and oceanic rock differ in overall composition, density and age. These differences help explain the distribution and configuration of land masses and ocean basins.</li> </ol>

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Strand	Grades K-3	Grades 4-5	Grades 6-8	Grades 9-12
<p><b><u>Interactions Throughout Earth's Systems</u></b></p> <p>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</p> <p>Essential Question: How do changes in one part of the Earth system affect other parts of the system?</p> <p>Essential Question: In what ways can Earth processes be explained as interactions among spheres?</p>	<ol style="list-style-type: none"> <li>1. Weather influences plants, animals and human activity.</li> <li>2. People who work or play outdoors often dress and base their activities on the speed of the wind and the temperature of the air.</li> <li>3. Water from rain, lakes, and underground, is needed by plants, animals and people for their everyday activities.</li> <li>4. Clouds are shaped by winds and are made of small water droplets or ice crystals. Cloud shapes can be used to help forecast weather.</li> </ol>	<ol style="list-style-type: none"> <li>1. Earth is a dynamic system resulting from interactions among the geosphere, hydrosphere, atmosphere and biosphere.</li> <li>2. Water reshapes Earth's land surface by eroding rock and soil in some areas and depositing them in other areas.</li> <li>3. The flow of water can be affected by human activities, ground cover and the slope of the land affected.</li> <li>4. Water in rivers and streams transports materials. As a general rule, when a stream enters a larger body of water, less massive materials in suspension will travel farther than more massive materials before settling.</li> <li>5. The surface of Earth changes constantly. Some of these changes happen slowly and are difficult to detect on a daily basis. Other changes happen quickly and result from events (i.e., major storms and volcanoes).</li> </ol>	<ol style="list-style-type: none"> <li>1. Water cycles from one reservoir to another through the processes of evaporation, transpiration, condensation and precipitation. Energy transfers and/or transformations are associated with each of these processes.</li> <li>2. Water within a watershed travels over and through the land at various speeds based on the rate of change in elevation and the permeability and porosity of the soil. Water carries with it products of human activity.</li> <li>3. Surface water always flows downhill. Areas of higher elevation separate watersheds. In Delaware, this water eventually reaches the Delaware River, the Delaware Bay, the Atlantic Ocean or the Chesapeake Bay.</li> <li>4. Constructive processes that build up the land and the destructive processes of weathering and erosion shape and reshape the land surface. The height of Earth landforms is a result of the difference between the rate of uplift and the rate of erosion at a particular location.</li> </ol>	<ol style="list-style-type: none"> <li>1. Earth's four spheres interact as part of a dynamic system in which changes over time are the result of external and internal energy sources.</li> <li>2. Tectonic plates press against one another in some places (convergence), pull apart in other places (divergence), or slide past each other. These plate movements may result in the formation of mountain ranges, and can lead to earthquakes, volcanic eruptions, and tsunamis. The consequences of these events impact the surrounding atmosphere, geosphere, hydrosphere, and the life existing within them.</li> <li>3. Earthquakes result when rocks rupture and slide by one another releasing stored energy which travels through the geosphere in the form of waves. Local earthquake risks can be assessed and preparations made to minimize the hazards.</li> <li>4. The type and eruptive style of volcanoes is determined by the viscosity and gas pressure of the magma. The effects of these eruptions can have both local and global consequences.</li> </ol>

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<p><b><u>Interactions Throughout Earth's Systems</u></b> continued from previous page</p>		<p>6. Weather changes daily and seasonally. Weather in Delaware may change little from day to day, but can vary greatly when storm systems move into the area.</p> <p>7. Some weather events, such as snowstorms, hurricanes, thunderstorms or tornadoes are more likely to occur at different times of the year.</p> <p>8. Local weather at any point in time varies at different locations around the world.</p>	<p>5. Some Earth events such as El Nino, volcanism and global warming can affect the entire Earth system and are likely the result of complex interactions among Earth spheres.</p> <p>6. The atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.</p> <p>7. The climate at a location on Earth is the result of several interacting variables such as latitude, altitude and/or proximity to water.</p> <p>8. Energy from the Sun heats the Earth unevenly causing pressure differences and air movements (convection currents) resulting in changing weather patterns.</p> <p>9. Ocean currents, global winds, and storm systems, redistribute heat energy on Earth's surface and therefore affect weather and long-term climatic patterns of a region.</p>	<p>5. The atmosphere can be described as being in a state of dynamic equilibrium which is maintained in part by plate tectonic processes which recycle atmospheric gases trapped in the ground back into the atmosphere.</p>

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<p><b><u>Interactions Throughout Earth's Systems</u></b> continued from previous page</p>			<p>10. Uneven heating and cooling of the Earth's surface produce air masses that differ in density, humidity and temperature. The interaction of these air masses results in significant weather changes.</p> <p>11. Past geological events and environments can be reconstructed by interpreting fossilized remains and successive layering of sedimentary rocks.</p> <p>12. The fit of continental coastlines, the similarity of rock types and fossilized remains provide evidence that today's continents were once a single land mass. The continents moved to their current positions on plates driven by energy from Earth's interior.</p> <p>13. Heat energy stored in the oceans and transferred by currents influence climate. A disruption of the circulation and temperature of the world's oceans would foster climate change and have environmental and economic consequences.</p>	

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Strand	Grades K-3	Grades 4-5	Grades 6-8	Grades 9-12
<p><b><u>Technology and Applications</u></b></p> <p>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</p> <p>Essential Question: How does technology extend human senses and understanding?</p>	<ol style="list-style-type: none"> <li>1. Earth materials can be observed and described using simple tools (e.g., hand lens and balances).</li> <li>2. Weather can be observed, measured and described through the use of simple tools such as a thermometer, rain gauge and wind vane.</li> </ol>	<ol style="list-style-type: none"> <li>1. Some satellites allow scientists to observe, over time, large-scale changes in the geosphere as well as the development of short term weather events.</li> </ol>	<ol style="list-style-type: none"> <li>1. Global weather data from ground measurements, satellites and radar are recorded on maps, analyzed, and used to predict local weather.</li> <li>2. Water from some natural sources is unfit to drink and requires the use of specialized technology to analyze and purify it.</li> </ol>	<ol style="list-style-type: none"> <li>1. Advances in science and technology (such as satellite imaging, Global Positioning Satellite (GPS), and Geographic Information Systems (GIS)) have improved our understanding of global and local changes that result from Earth system interactions, and our capacity to anticipate and mitigate natural hazards such as volcanoes and earthquakes.</li> </ol>

## Standard 5: Earth’s Dynamic Systems, Grade Level Expectations Grades K-3

<p>Essential Question: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?</p> <p>Essential Questions: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?</p> <p>Essential Question: How does technology extend human senses and understanding?</p>			
<p>Enduring Understanding: Earth’s systems can be broken down into individual components which have observable measurable properties.</p> <p>Enduring Understanding: Earth’s components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</p> <p>Enduring Understanding: Technology enables us to better understand Earth’s systems. It also allows us to analyze the impact of human activities on Earth’s systems and the impact of Earth’s systems on human activity.</p>			
<p>All students in <b>Kindergarten</b> will be able to:</p>	<p>Building upon the Kindergarten expectations, all students in <b>Grade 1</b> will be able to:</p>	<p>Building upon the K-1 expectations, all students in <b>Grade 2</b> will be able to:</p>	<p>Building upon the K-2 expectations, all students in <b>Grade 3</b> will be able to:</p>
<p><b>Enduring Understanding: Earth’s systems can be broken down into individual components which have observable measurable properties.</b></p> <p>Observe and describe the properties of a variety of earth materials (i.e., rock, soil, sand, water) using the senses.</p> <p>Sort, group, and regroup a variety of earth materials based on their physical properties (e.g., shape, color, texture, size, etc.) to describe their similarities and differences.</p>	<p><b>Enduring Understanding: Earth’s systems can be broken down into individual components which have observable measurable properties.</b></p> <p>Identify the earth materials (i.e., rocks, soil, water, air) found in aquatic and terrestrial environments.</p>	<p><b>Enduring Understanding: Earth’s systems can be broken down into individual components which have observable measurable properties.</b></p> <p>Observe and identify basic components of soil. Use the senses to observe and then describe the physical properties of soil components.</p> <p>Conduct simple tests to identify the three basic components of soil (sand, clay, humus) and to compare and contrast the properties of each of the components.</p> <p>Interpret test results (touch and roll, smear, settling, ability to absorb and retain water) and draw conclusions about a soil’s components.</p> <p>Record and organize the results of soil tests and explain these results through writing, drawing, and discussion.</p> <p>Reflect on the test results and predict how plants will grow in different soil components. Apply this knowledge to describe how the properties of each soil component contribute to an appropriate soil mixture in growing plants.</p>	<p><b>Enduring Understanding: Earth’s systems can be broken down into individual components which have observable measurable properties.</b></p> <p>Examine rocks in order to observe their composition and describe the many components found in rocks.</p> <p>Identify minerals as materials that cannot be physically broken apart any further and may be a rock component.</p> <p>Sort and group an assortment of minerals based on similarities and differences in their physical properties.</p> <p>Sort and group minerals based on the physical properties of hardness, color, luster, and reaction to vinegar (weak acid). Use these properties to identify common minerals (quartz, fluorite, calcite, and gypsum).</p> <p>Describe water in terms of its observable properties (transparency, shapelessness, flow).</p>

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<p>Enduring Understanding: Earth’s systems can be broken down into individual components which have observable measurable properties.</p> <p>Enduring Understandings: Earth’s components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</p> <p>Enduring Understandings: Technology enables us to better understand Earth’s systems. It also allows us to analyze the impact of human activities on Earth’s systems and the impact of Earth’s systems on human activity.</p>			
<p>All students in <b>Kindergarten</b> will be able to:</p>	<p>Building upon the Kindergarten expectations, all students in <b>Grade 1</b> will be able to:</p>	<p>Building upon the K-1 expectations, all students in <b>Grade 2</b> will be able to:</p>	<p>Building upon the K-2 expectations, all students in <b>Grade 3</b> will be able to:</p>
<p><b>Enduring Understanding: Earth’s components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</b></p> <p><i>There are no grade level expectations for this understanding.</i></p>	<p><b>Enduring Understanding: Earth’s components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</b></p> <p>Keep daily records of weather conditions (wind speed, type and amount of precipitation, cloud cover and type, temperature) and use these records to identify patterns over short and long periods of time.</p> <p>Demonstrate that there is air all around and that the wind is moving air. Use instruments to qualitatively measure wind speed and describe this by using a simplified Beaufort scale.</p>	<p><b>Enduring Understanding: Earth’s components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</b></p> <p>Use worms to enhance decomposition of plant material in composting. Explain how composting is an effective method to recycle plants and other discarded organic matter.</p>	<p><b>Enduring Understanding: Earth’s components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</b></p> <p><i>There are no grade level expectations for this understanding.</i></p>

## Standard 5: Earth’s Dynamic Systems, Grade Level Expectations Grades K-3

Essential Question: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?  
 Essential Questions: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?  
 Essential Question: How does technology extend human senses and understanding?

Enduring Understanding: Earth’s systems can be broken down into individual components which have observable measurable properties.  
 Enduring Understandings: Earth’s components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.  
 Enduring Understandings: Technology enables us to better understand Earth’s systems. It also allows us to analyze the impact of human activities on Earth’s systems and the impact of Earth’s systems on human activity.

All students in <b>Kindergarten</b> will be able to:	Building upon the Kindergarten expectations, all students in <b>Grade 1</b> will be able to:	Building upon the K-1 expectations, all students in <b>Grade 2</b> will be able to:	Building upon the K-2 expectations, all students in <b>Grade 3</b> will be able to:
	<p>Use a thermometer to measure temperature in degrees Fahrenheit. Describe how hot or cold an object or weather event feels by using a thermometer.</p> <p>Identify three basic cloud types (cirrus, cumulus, stratus) all of which are made of water and/or ice. Conclude that wind moves clouds in the sky.</p> <p>Use a rain gauge to measure precipitation and describe how this measurement would change when frozen precipitation such as snow or ice melts.</p> <p>Organize weather data on graphs and on long-term data collection charts and use this data to describe typical seasonal weather patterns.</p> <p>Describe different weather conditions and discuss how these conditions affect plants, animals, and human activity.</p>		

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<p>Essential Question: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?</p> <p>Essential Questions: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?</p> <p>Essential Question: How does technology extend human senses and understanding?</p>			
<p>Enduring Understanding: Earth's systems can be broken down into individual components which have observable measurable properties.</p> <p>Enduring Understandings: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</p> <p>Enduring Understandings: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</p>			
<p>All students in <b>Kindergarten</b> will be able to:</p>	<p>Building upon the Kindergarten expectations, all students in <b>Grade 1</b> will be able to:</p>	<p>Building upon the K-1 expectations, all students in <b>Grade 2</b> will be able to:</p>	<p>Building upon the K-2 expectations, all students in <b>Grade 3</b> will be able to:</p>
<p><b>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</b></p> <p>Use a hand lens (magnifier) to inspect a variety of earth materials and demonstrate through discussion or drawings how the lens extends the sense of sight.</p>	<p><b>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</b></p> <p>Select and use appropriate instruments such as wind scales, thermometers, cloud charts, and rain gauges to measure weather conditions.</p> <p>Identify a meteorologist as a scientist who uses technology to study, observe, and record information about the weather and who uses this information to forecast the weather. Use weather forecasts to make decisions such as choice of clothing or outdoor activities.</p>	<p><b>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</b></p> <p>Select and use appropriate instruments (e.g., hand lens/magnifier, droppers, funnels, filter paper, sieves) to analyze soil samples.</p>	<p><b>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</b></p> <p>Examine an assortment of rocks and use appropriate measuring tools (balances, meter tapes, syringes) to gather data about the rocks' physical properties (length, circumference, weight).</p> <p>Identify rocks and minerals as natural resources and list ways that humans use these resources to meet needs and wants (i.e., fluorite for toothpaste, marble for statues).</p>

## Standard 5: Earth's Dynamic Systems, Grade Level Expectations Grades 4-5

<p>Essential Question: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?</p> <p>Essential Question: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?</p> <p>Essential Question: How does technology extend human senses and understanding?</p>	
<p>Enduring Understanding: Earth's systems can be broken down into individual components which have observable measurable properties.</p> <p>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</p> <p>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</p>	
Building upon the K-3 expectations, all students in <b>Grade 4</b> will be able to:	Building upon the K-4 expectations, all students in <b>Grade 5</b> will be able to:
<p><b>Enduring Understanding: Earth's systems can be broken down into individual components which have observable measurable properties.</b></p> <p>Examine materials that compose soil (i.e., sand, clay, humus, gravel, water) and describe these on the basis of their properties (i.e., color, luster, granularity, texture, mass relative to size, particle size, ability to absorb water, pore space, ability to compact). Describe how certain soil properties affect the way in which soil is eroded and deposited by water.</p> <p><b>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</b></p> <p>Create a model that can be used to describe how water moves from one place on Earth to another in a continuous cycle through the processes of evaporation, condensation, and precipitation.</p> <p>Use stream tables to observe the creation of landforms as water flows over and through the land. Describe changes that result from the flowing of water, using correct geographic terminology (i.e., canyon, delta, tributary). Describe changes to the water as it flows over land (i.e., color, transparency).</p> <p>Describe how fast-moving water and slow-moving water over the land affect erosion and deposition.</p> <p>Use stream tables to model and describe the effects of slope. Describe how the flow of water (fast or slow) is affected by the slope of the land, the amount and type of vegetation, and the landforms.</p> <p>Use stream tables to model the effect of human activity on erosion and deposition. Describe how human activity (i.e., building a dam, clear cutting a forest, bulldozing a roadway) affects the amount of erosion and deposition and changes the environment.</p>	<p><b>Enduring Understanding: Earth's systems can be broken down into individual components which have observable measurable properties.</b></p> <p><i>There are no grade level expectations for this understanding.</i></p> <p><b>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</b></p> <p><i>There are no grade level expectations for this understanding.</i></p>

## Standard 5: Earth's Dynamic Systems, Grade Level Expectations Grades 4-5

<p>Essential Question: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?</p> <p>Essential Question: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?</p> <p>Essential Question: How do the systems interact and allow us to explain observations or events and make predictions?</p> <p>Essential Question: How does technology extend human senses and understanding?</p>	
<p>Enduring Understanding: Earth's systems can be broken down into individual components which have observable measurable properties.</p> <p>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</p> <p>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</p>	
<p><b>Building upon the K-3 expectations, all students in <b>Grade 4</b> will be able to:</b></p>	<p><b>Building upon the K-4 expectations, all students in <b>Grade 5</b> will be able to:</b></p>
<p>Research and report on a specific landform created by the interaction of land and water (i.e., Cape Henlopen, Delaware Bay, Mississippi Delta, Appalachian Mountains).</p> <p>Keep daily records of weather conditions (wind speed and direction, type and amount of precipitation, cloud cover and type, temperature) and use these records to identify short term and seasonal patterns in Delaware.</p> <p>Identify and describe different types of storm systems that occur in Delaware (i.e., tornadoes, hurricanes, thunderstorms, blizzards). From observed and gathered historical data, identify times of the year when these storms are most likely to occur.</p> <p>Using newspapers, computer internet sites, and other information resources, identify weather conditions in different parts of the world. Compare this with the local weather in Delaware and discuss how weather conditions for a specific day may vary around the USA and world.</p> <p><b>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</b></p> <p>Observe satellite photos showing change over time of landforms (i.e., Chesapeake Bay, Cape Henlopen, Delaware coastline) and predict future changes that may occur. Describe how these predictions may affect human activities (i.e., locations for building).</p> <p>Select and use a variety of appropriate instruments (i.e., graduated cylinders, stream tables, hand lens, ruler, balances) for collecting, recording, and analyzing data obtained from stream table investigations. Communicate the results of stream table investigations through record sheets, oral and written observations, and drawings.</p>	<p><b>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</b></p> <p><i>There are no grade level expectations for this understanding.</i></p>

## Standard 5: Earth's Dynamic Systems, Grade Level Expectations Grades 6-8

<p>Essential Questions: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?</p> <p>Essential Question: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?</p> <p>Essential Questions: How does technology extend human senses and understanding?</p>		
<p>Enduring Understandings: Earth's systems can be broken down into individual components which have observable measurable properties.</p> <p>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</p> <p>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</p>		
<p>Building upon the K-5 expectations, all students in <b>Grade 6</b> will be able to:</p>	<p>Building upon the K-6 expectations, all students in <b>Grade 7</b> will be able to:</p>	<p>Building upon the K-7 expectations, all students in <b>Grade 8</b> will be able to:</p>
<p><b>Enduring Understandings: Earth's systems can be broken down into individual components which have observable measurable properties.</b></p> <p>Use appropriate instruments and tools to identify the sedimentary rocks: limestone, shale, and sandstone. Infer the environmental conditions in which these rocks formed.</p> <p>Examine sedimentary rock formations. Use relative dating and fossil evidence to correlate sedimentary rock sequences. Infer the succession of environmental events that occurred from one rock sequence to another (transgression or regression of the seas). Use the correlated sedimentary rock sequences to support Earth's geologic time scale.</p> <p><b>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</b></p> <p>Investigate and describe how factors such as abrasion, frost/ice wedging, temperature changes, and plant growth cause physical weathering of rocks. Infer the environment in which the sedimentary particles were formed based on the results of weathering.</p> <p>Investigate how weathered materials are transported (i.e., mass movement and wind, water, and ice processes) in the process of erosion. Explain how erosion shapes rock particles.</p> <p>Describe the process by which eroded materials can form horizontal layers of sedimentary rock.</p>	<p><b>Enduring Understandings: Earth's systems can be broken down into individual components which have observable measurable properties.</b></p> <p>Create models that simulate the amount of salt, frozen, fresh, and potable water available on Earth's surface. Compare total water supply on Earth to the amount of potable water available for human use.</p> <p>Calculate the ratio/percent of water generally found in solid, liquid and gaseous form on or within the Earth's surface and use this ratio to compare the amounts of water stored in different states.</p> <p><b>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</b></p> <p>Use diagrams of the hydrologic cycle to show and describe the circulation of water through the Earth's crust, oceans, and atmosphere.</p> <p>Use the particle model to describe solids, liquids, and gases in terms of the packing, motion of particles, and energy gain or loss. Apply this to the processes of evaporation, condensation, and precipitation in the water cycle. Explain how heat energy drives the water cycle.</p> <p>Use models or diagrams to explain how water stored underground (groundwater and aquifers) and water stored above ground (lakes, rivers, air, etc.) interact to</p>	<p><b>Enduring Understandings: Earth's systems can be broken down into individual components which have observable measurable properties.</b></p> <p><i>There are no grade level expectations for this understanding.</i></p> <p><b>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</b></p> <p>Observe, measure, and predict changes in weather using atmospheric properties (wind speed and direction, cloud cover and type, temperature, dew point, air pressure, and relative humidity). Describe how air pressure and temperature change with increasing altitude and/or latitude.</p> <p>Explain how uneven heating of Earth's components – water, land, air – produce local and global atmospheric and oceanic movement. Describe how these local and global patterns of movement influence weather and climate.</p>

## Standard 5: Earth's Dynamic Systems, Grade Level Expectations Grades 6-8

<p>Essential Questions: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?</p> <p>Essential Question: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?</p> <p>Essential Questions: How does technology extend human senses and understanding?</p>		
<p>Enduring Understandings: Earth's systems can be broken down into individual components which have observable measurable properties.</p> <p>Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</p> <p>Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.</p>		
<p>Building upon the K-5 expectations, all students in <b>Grade 6</b> will be able to:</p>	<p>Building upon the K-6 expectations, all students in <b>Grade 7</b> will be able to:</p>	<p>Building upon the K-7 expectations, all students in <b>Grade 8</b> will be able to:</p>
<p>Explain how sedimentary rocks are formed through the processes of weathering, erosion, and deposition.</p> <p>Cite three lines of evidence such as the fit of coastlines, the similarity of rock type and contiguousness of bedding areas, and similarity of fossilized remains that indicate that the continents were once a large land mass.</p>	<p>form a continuous cycle.</p> <p>Investigate, through the use of models, how water acts as a solvent and as it passes through the water cycle it dissolves minerals, gases, and pollutants and carries them to surface water and ground water supplies.</p> <p>Conduct investigations and use the data to describe the extent to which the permeability and porosity of a soil sample affect the rate of water percolation.</p> <p>Describe the role of wetlands and streamside forests (riparian) in filtering water as it runs off into local streams, rivers, and bays or seeps into ground water.</p>	<p>Investigate the rate at which different Earth materials absorb heat. Explain how these differences in heat absorption causes air pressure differences that result in convection currents (i.e., local land and sea breezes).</p> <p>Use a variety of models, charts, diagrams, or simple investigations to explain how the Sun's energy drives the cycling of water through the Earth's crust, oceans, and atmosphere.</p> <p>Examine maps of ocean currents and trace the origin and flow of such currents to explain the transfer of heat energy. Identify which currents have dominant influence on the Delaware coast.</p> <p>Differentiate between weather, which is the condition of the atmosphere at a given time, and climate, which is the weather averaged over a long period of time.</p> <p>Discuss the origin and identify characteristics (i.e., air circulation pattern, wind speed, temperature and dew point, and air pressure) of storm systems including hurricanes, Nor'easters, tornadoes, thunderstorms, and mid-latitude cyclones. Explain how these weather events can transfer heat. Describe the environmental, economic, and human impact of these storms.</p> <p>Compare and contrast different storm systems in terms of size, formation, and associated weather.</p>

## Standard 5: Earth's Dynamic Systems, Grade Level Expectations Grades 6-8

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		<p>Describe how origin affects the temperature and moisture content of an air mass. Describe how the interaction of air masses produces different fronts (warm, cold, and stationary) that influence our weather.</p> <p>Describe how the formation of clouds is influenced by the dew point, environmental temperature and amount of particles in the air. Explain how various lifting mechanisms affect cloud formation.</p> <p>Use cloud characteristics (altitude, composition, and form) to predict the weather. Discuss how different cloud types are indicators of weather and weather systems such as frontal systems and hurricanes.</p>

## Standard 5: Earth’s Dynamic Systems, Grade Level Expectations Grades 6-8

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<p><b>Enduring Understanding: Technology enables us to better understand Earth’s systems. It also allows us to analyze the impact of human activities on Earth’s systems and the impact of Earth’s systems on human activity.</b></p> <p><i>There are no grade level expectations for this understanding.</i></p>	<p><b>Enduring Understanding: Technology enables us to better understand Earth’s systems. It also allows us to analyze the impact of human activities on Earth’s systems and the impact of Earth’s systems on human activity.</b></p> <p>Use topographic maps to locate Delaware watersheds and to identify the bodies of water into which they drain. Analyze and describe the relationship between elevation of land and the flow rate of water in a watershed.</p> <p>Conduct tests including temperature, pH, salinity, dissolved oxygen, turbidity, nitrate, and phosphate to determine the potability of local water samples.</p> <p>Identify macro-invertebrates in a local stream and apply this identification in determining the stream’s ecological health.</p> <p>Explain the impact of human activities (e.g., building roads, fertilizing golf courses, etc.) on the quality of Delaware’s waters.</p> <p>Research and report on the processes used by municipalities to ensure water taken from local reservoirs is safe to return to the environment.</p> <p>Investigate and report on legislation such as the Clean Water Act and its impact on the quality of Delaware water.</p>	<p><b>Enduring Understanding: Technology enables us to better understand Earth’s systems. It also allows us to analyze the impact of human activities on Earth’s systems and the impact of Earth’s systems on human activity.</b></p> <p>Examine isobars on weather maps to describe how wind (moving air) travels from a region of high pressure to a region of low pressure. Apply this knowledge to explain the cause of wind.</p> <p>Record and interpret daily weather measurements over an extended period of time using a variety of instruments (i.e., barometer, anemometer, sling psychrometer, rain gauge, and thermometer) in order to predict and to identify weather patterns.</p> <p>Construct and use surface station models to represent local atmospheric data and interpret weather patterns on meteorological maps.</p> <p>Examine satellite imagery pictures and use these images to identify cloud patterns and storm systems.</p> <p>Use weather maps to describe the movement of fronts and storms and to predict their influence on local weather.</p>

## Standard 5: Earth’s Dynamic Systems, Grade Level Expectations Grades 6-8

<p>Essential Questions: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?</p> <p>Essential Question: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?</p> <p>Essential Questions: How does technology extend human senses and understanding?</p>		
<p>Enduring Understandings: Earth’s systems can be broken down into individual components which have observable measurable properties.</p> <p>Enduring Understanding: Earth’s components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.</p> <p>Enduring Understanding: Technology enables us to better understand Earth’s systems. It also allows us to analyze the impact of human activities on Earth’s systems and the impact of Earth’s systems on human activity.</p>		
<p>Building upon the K-5 expectations, all students in <b>Grade 6</b> will be able to:</p>	<p>Building upon the K-6 expectations, all students in <b>Grade 7</b> will be able to:</p>	<p>Building upon the K-7 expectations, all students in <b>Grade 8</b> will be able to:</p>
	<p>List ways in which human intervention can help maintain an adequate supply of fresh water for human consumption. Apply knowledge and skills learned about water as a resource to study local sources of drinking water and devise a water quality stewardship plan.</p>	

## Standard 5: Earth's Dynamic Systems, Grade Level Expectations Grades 9-12

Essential Question: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?  
Essential Question: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?  
Essential Questions: How does technology extend human senses and understanding?

Enduring Understanding: Earth's systems can be broken down into individual components which have observable measurable properties.  
Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.  
Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.

Building upon the K-8 expectations, all students in **Grade 9** will be able to:

**Enduring Understanding: Earth's systems can be broken down into individual components which have observable measurable properties.**

Identify mineral specimens according to their chemical and physical properties. Mineral specimens include calcite, quartz, mica, feldspar, and hornblende. Properties include hardness (Moh's scale), streak, specific gravity, luster, cleavage, crystal shape, and color, and other properties that are useful for identification of specific minerals such as reaction with hydrochloric acid.-

Identify a few of the most common elements in the Earth's crust, oceans, and atmosphere and confirm their location on the periodic table. (Example: Si, O, C, N, H, Al). Compare the relative abundance of elements found in the Earth's crust, oceans, and atmosphere. Trace carbon as it cycles through the crust, ocean, and atmosphere.

Classify and describe features that are used to distinguish between igneous, sedimentary, and metamorphic rocks.

Describe energy sources, processes, and transformations of Earth materials as they progress through the rock cycle to form new sedimentary, metamorphic, and igneous rocks. Discuss how the cycling of rock is continuous.

Describe how igneous rocks are formed. Classify igneous rocks according to crystal size and mineral assemblage.

Identify sandstone, shale and limestone by their composition and texture. Explain how sandstone, shale, and limestone can be changed into the metamorphic rocks quartzite, slate, and marble.

Investigate the densities, composition, and relative age of continental (felsic) and oceanic (mafic) rocks. Explain why the continental crust, although thicker in most places, overlies oceanic crust. Use this information to explain why oceanic crust subducts below continental crust in convergent plate boundaries and explain the configuration of land masses and ocean basins.

**Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.**

Explain how expositivity, type (shield, strato, etc.) and shape of a volcano is related to the properties of its magma and its location along different plate margins.

Identify volcanic products (lava, mudflow, pyroclastic projectiles, ash, gases) associated with various types of volcanoes and their eruptions. Describe the effect of these products on life and property. Explain how the products of volcanic activity influence both long-term and short-term changes in the Earth system.

Describe how energy within the Earth's interior is released in the form of earthquake waves, and explain how these waves affect Earth's surface.

## Standard 5: Earth's Dynamic Systems, Grade Level Expectations Grades 9-12

Essential Question: How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?

Essential Question: How do changes in one part of the Earth system affect other parts of the system? In what ways can Earth processes be explained as interactions among spheres?

Essential Questions: How does technology extend human senses and understanding?

Enduring Understanding: Earth's systems can be broken down into individual components which have observable measurable properties.

Enduring Understanding: Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.

Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.

Building upon the K-8 expectations, all students in **Grade 9** will be able to:

Describe how earthquake energy is represented on seismograms and describe how these waves can be used to determine the origin and intensity of earthquakes.

Describe the effects on life and property from consequences of earthquake such as landslides, liquefaction, surface faulting and tsunamis. Cite ways these hazards can be minimized.

Use models or computer simulations to demonstrate the processes and origin of landforms at diverging, converging and transform plate boundaries. Show on a map how plate tectonics, earthquakes, and volcanoes are spatially related.

Investigate how thermal convection relates to movement of materials. Apply this knowledge in explaining the cause of movement of the Earth's plates.

Research and describe evidence that supports the Theory of Plate Tectonics to include rock magnetism and the age of the sea floor.

Explain how the Theory of Plate Tectonics demonstrates that scientific knowledge changes by evolving over time. Recognize that although some theories are initially rejected, they may be re-examined and eventually accepted in the face of new evidence.

**Enduring Understanding: Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity.**

Explain how data from Global Positioning Systems can be used to predict and determine the direction and rate of movement of Earth's plates and sea floor spreading.

Explain how technology such as GPS, tilt meters, etc., can be used to predict earthquake and volcanic activity.

Describe ways in which people use historical data, geologic maps, and technologies to minimize earthquake damage.