

Grade 6 Science, Quarter 3, Unit 3.1
Processes that Shape the Earth—Weather

Overview

Number of instructional days 20 (1 day = 45 minutes)

Content to be learned

- Explain how clouds affect the climate and weather.
- Develop a model to explain how humidity, temperature, and altitude affect air pressure and local weather.
- Describe the effect of natural/man-made events on climate.
- Explain how differential heating and convection affect earth’s weather patterns.
- Describe how differential heating of the oceans affects oceans currents and climate.
- Explain the relationship between differential heating/convection and the production of winds.
- Analyze global patterns of atmospheric movements to explain weather.

Science processes to be integrated

- Explain how condensation of water vapor forms clouds.
- Describe how clouds affect climate and weather.
- Develop models to explain humidity, temperature, and altitude.
- Research natural and man-made events.
- Use evidence from research to draw conclusions about climate.
- Demonstrate heating and convection through experimental design.
- Use data to observe weather patterns.
- Analyze global patterns of atmospheric movements.
- Use models to explain weather systems.

Essential questions

- How do clouds, humidity, temperature, and altitude affect air pressure and the weather?
- What is the relationship between differential heating and convection?
- How do differential heating and convection affect earth’s weather patterns and winds?
- How do global patterns of atmospheric movements affect weather?
- How do natural/man-made events affect the climate?
- Why does the heating of the oceans affect ocean currents, which in turn influences climate?

Written Curriculum

Grade-Span Expectations

ESS1 - The earth and earth materials as we know them today have developed over long periods of time, through continual change processes.

ESS1 (5-8) SAE–2

Explain the processes that cause the cycling of water into and out of the atmosphere and their connections to our planet’s weather patterns.

ESS1 (5-6)–2 Students demonstrate an understanding of processes and change over time within earth systems by ...

2b explaining how condensation of water vapor forms clouds which affects climate and weather.

2c developing models to explain how humidity, temperature, and altitude affect air pressure and how this affects local weather.

ESS1 (5-8) POC –3

Explain how earth events (abruptly and over time) can bring about changes in Earth’s surface: landforms, ocean floor, rock features, or climate.

ESS1 (5-6)–3 Students demonstrate an understanding of processes and change over time within earth systems by ...

3a describing events and the effect they may have on climate (e.g. El Nino, deforestation, glacial melting, and an increase in greenhouse gases).

ESS1 (5-8) SAE+ POC –4

Explain the role of differential heating or convection in ocean currents, winds, weather and weather patterns, atmosphere, or climate.

ESS1 (5-6)–4 Students demonstrate an understanding of processes and change over time within earth systems by ...

4a explaining how differential heating and convection affect Earth’s weather patterns.

4b describing how differential heating of the oceans affects ocean currents which in turn influence ~~weather~~ and climate.

4c explaining the relationship between differential heating/convection and the production of winds.

4d analyzing global patterns of atmospheric movements to explain effects on weather.

Clarifying the Standards

Prior Learning

In grades K–2 students observed and recorded seasonal changes throughout the school year. They made observations as to how weather events affect their day. They also learned how clouds are related to forms of precipitation. Finally, they used scientific tools to gather data about weather. In grades 3–4 students explained and selected appropriate scientific tools to gather data about weather. They compared and analyzed weather data to describe weather changes and weather patterns. Students were able to describe condensation of water into vapor and explain how this relates to weather and the formation of clouds. In 5th grade, students were introduced to the concept of differential heating of the oceans and how it affects the ocean currents, which in turn influence global patterns of weather. Students also predicted temperature and precipitation changes associated with the passing of various fronts. Students diagrammed, labeled, and explained the processes of the water cycle. Students also identified the composition and layers of the earth's atmosphere.

Current Learning

At this grade level, students explain how condensation of water vapor affects clouds, which affects weather and climate. Students need to understand that the cycling of water in and out of the atmosphere plays an important role in determining climatic patterns. They develop and use models to explain how humidity, temperature, and altitude affect air pressure and how this affects local weather. Models can include weather maps that are available in newspapers or other local resources to make predictions and explain how the environmental factors cause the various weather conditions they observe. Students research man-made and natural events that have an effect on climate.

In 6th grade, students need to apply their understanding of how differential heating of the oceans affects the ocean currents, which in turn influences weather. How these processes impact global climate will be taught using instruction at the developmental level. Since students were introduced to convection as part of their instruction in grade 5, they need to be introduced to how this same process causes winds and ocean currents. It is important to make sure that students have an understanding of convection in place before asking them to apply this understanding to global weather patterns. After students have an understanding of the causes of the different weather and climates on the planet, they need to describe how events like El Niño, deforestation, glacial melting, and the increase in greenhouse gases affect climate.

Future Learning

In grades 7–8, students will begin to make inference about cause and effect and the relationships between global climate and energy transfer. They will also make predictions using evidence from their research about global climate issues. Students will begin to evaluate the effects of weathering and erosions, etc., and the changes to earth overtime. At the high school level, students will describe how interaction of wind patterns, ocean currents, and mountain ranges result in the global patters of latitudinal bands of rainforest and deserts. Students will also use computer modeling and simulations to predict the effects of an increase in greenhouse gases on earth systems.

Additional Research Findings

According to the *Atlas of Science Literacy*, Vol. 2, students tend to think that water just disappears. Students must learn to accept gases as a permanent substance. It is important for students to understand the differential heating of the earth's surface and convection before they can apply this information to weather patterns and climate. Students have the tendency to believe that all environmentally-friendly actions help to solve all environmental problems, however clarity has to be made as to the type of events that would help protect our atmosphere (p. 20).

According to the *Benchmarks for Science Literacy*, before students understand water is converted to an invisible form, they may initially believe that when water evaporates it ceases to exist, or that it changes location but remains a liquid or that it is transformed into some other perceptible form (p. 336).

Notes About Resources and Materials

Prentice Hall Science Explorer: Weather and Climate

- pp. 12–17
- pp. 25–30
- pp. 42–45
- pp. 48–51
- pp. 52–60
- pp. 61–66
- pp. 76–82
- pp. 112–119
- Chapter 4

Make Fog in a Jar

<http://eo.ucar.edu/webweather/cloudact1.html>

Comparing Temperature, Pressure, and Humidity

<http://education.arm.gov/teacherslounge/lessons/comparingdata.pdf>

Grade 6 Science, Quarter 3, Unit 3.2
Processes that Shape the Earth—Geology

Overview

Number of instructional days 15 (1 day = 45 minutes)

Content to be learned

- Plot locations of volcanoes and earthquakes.
- Explain the relationship between the location of these phenomena and faults.
- Represent the processes of the rock cycle.
- Cite evidence to explain the formation of a rock.
- Develop an argument using evidence to explain the formation of a rock, given its characteristics and location.

Science processes to be integrated

- Explain scientific relationships.
- Analyze relationships between geologic factors.
- Make diagrams and use models.
- Conduct scientific research.
- Use evidence to support explanations.

Essential questions

- What is the relationship between the locations of volcanoes, earthquakes, and faults?
- What processes cause rocks to change from one type to another?
- How can the characteristics of rocks be used to determine how the rock was formed?

Written Curriculum

Grade-Span Expectations

ESS1 - The earth and earth materials as we know them today have developed over long periods of time, through continual change processes.

ESS1 (5-8) INQ+ POC –1

Use geological evidence provided to support the idea that the Earth’s crust/lithosphere is composed of plates that move.

ESS1 (5-6)–1 Students demonstrate an understanding of processes and change over time within earth systems by ...

1b plotting location of volcanoes and earthquakes and explaining the relationship between the location of these phenomena and faults.

ESS1 (5-8) INQ+ POC –5

Using data about a rock’s physical characteristics make and support an inference about the rock’s history and connection to rock cycle.

ESS1 (5-6)–5 Students demonstrate an understanding of processes and change over time by ...

5a representing the processes of the rock cycle in words, diagrams, or models.

5b citing evidence and developing a logical argument to explain the formation of a rock, given its characteristics and location. (e.g. classifying rock type using identification resources).

Clarifying the Standards

Prior Learning

In grades K–2, students began to sort and group rocks according to physical properties such as size, shape, color, and texture. In grades 3–4, students continued the grouping process by including physical attributes such as temperature, hardness, and composition. This grouping process was a prerequisite to the classification process, which is far more detailed. At this level, students begin to provide evidence for their rock groups. In 5th grade, students identified and described the layers of the earth. Also students were introduced to the processes of the rock cycle.

Current Learning

Students need to use maps to locate and plot earthquakes and volcanoes. After students have plotted this data, they need to analyze the locations of these events and the locations of faults. This instruction is at the developmental level. Students should be able to make connections between breaks in the earth’s crust and movement of the crust that result in earthquakes. They also need to make connections between breaks in the crust and the emergence of volcanic materials from beneath the crust. This information will serve as a foundation for instruction about plate tectonics that will take place in grades 7–8.

Although it was introduced the prior year as new information, rock formation will be reintroduced at this grade level. This content has proven to be very challenging for students, therefore the use of some

developmental instruction will be necessary to make sure that students have a complete understanding of the processes involved. Students research the formation of a rock, given its characteristics and location and communicate an argument using the evidence from their research.

Future Learning

Seventh and eighth grade students will develop arguments for plate tectonics, fossil evidence, layers of rock, location of mineral deposits, and the shape of continents. They will evaluate slow and fast processes to determine how the earth has changed and will continue to change over time. At the high school level, students will plot the location of mountain ranges, recent earthquakes, and volcanic eruptions to identify any existing patterns using given data and advances in technology to explain how scientific knowledge regarding plate tectonics has changed over time. They will explain how heat affects the rock cycle; and will investigate and use evidence to explain that conservation in the amount in earth materials occurs during the rock cycle. They will explain how physical and chemical processes of the earth alter the crust. Students will also describe various dating methods to determine the age of different rock structures.

Additional Research Findings

According to *Making Sense of Science* (pp. 112–114) children tend to think of rocks as being hard or large. Most children do not necessarily associate minerals with rocks, but think of “mineral” water or vitamins. Children have difficulties associating sedimentary, igneous, and metamorphic rocks with the process in which they were formed. Vocabulary terms for the size of rocks was also often confused. Many children describe mountains as high rocks, clumps of soil, or dormant volcanoes. Some also thought that volcanoes occur on fault lines or over weak spots where magma just comes up through the ground at that spot. Most children were unable to relate in any way a theory of mountain building and its relationship to plate tectonics.

According to *Benchmarks for Science Literacy* (p. 336), middle school students taught by conventional means were not able to construct coherent thoughts about how earthquakes and volcanoes are formed.

Notes About Resources and Materials

- <http://www.scilinks.org/MyScilinks/SearchByCode.aspx?Enc=1&Scilink=Yb0UjNL7GohwPs7syW9Ursw==&EntPt=YwkU/jb1sML+8JeNA+6MA/s3bOrjucxkz>
- <http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=cfk&wcsuffix=1000>
- http://www.rocksandminerals4u.com/rock_cycle_lesson.html
- <http://www.leo.lehigh.edu/envirosci/geology/rocks/pdf/lesson4.pdf>
- Plate Tectonics- <http://massmarineeducators.org/curriculum/pdf/Tectonics.pdf>
- http://www.msc.ucla.edu/oceanglobe/pdf/earth_volcano.pdf
- http://www.globalchange.umich.edu/globalchange1/current/lectures/nat_hazards/nat_hazards.html
- Volcano~ <http://www.pbs.org/wgbh/nova/volcano/>