

**Grade 4 Science, Quarter 1, Unit 1.1**  
**Weather and the Water Cycle**

**Overview**

**Number of instructional days:** 10 (1 day = 45 minutes)

**Content to be learned**

- Explain how scientific tools help extend the senses.
- Explain how scientific tools help gather data about weather.
- Select appropriate tools for a given task.
- Describe information that scientific tools can provide.
- Observe, record, compare, and analyze weather data to describe weather changes or patterns.
- Describe water as it changes into vapor when it is heated and reappears as a liquid when it is cooled.
- Explain how the water cycle relates to weather and the formation of clouds.

**Processes to be used**

- Select and use tools to gather data.
- Compare and analyze data to describe changes and find patterns.
- Observe changes in states of matter.
- Explain how parts of a system interact.
- Demonstrate safe practices during classroom and field investigations.
- Use scientific processes to conduct investigations, make observations, organize and analyze data, cite evidence, and build explanations.

**Essential questions**

- Why do scientists collect and analyze weather data over time?
- How do we know which tools to use when collecting weather data?
- What would happen if one of the processes were removed from the water cycle? Give two examples.
- How do changes in the weather affect the water cycle?

## 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.**

***ESS 1 (K-4) NOS –3***

*Explain how the use of scientific tools helps to extend senses and gather data about weather. (i.e., weather/wind vane: direction; wind sock: wind intensity; anemometer: speed; thermometer: temperature; meter sticks/rulers: snow depth; rain gauges: rain amount in inches).*

**ESS 1(3-4) –3 Students demonstrate an understanding of how the use of scientific tools helps to extend senses and gather data by...**

**3a** explaining how the use of scientific tools helps to extend senses and gather data about weather (i.e., weather/wind vane: direction; wind sock: wind intensity; anemometer: speed; thermometer: temperature; meter sticks/rulers: snow depth; rain gauges: rain amount in inches).

**3b** selecting appropriate tools for a given task and describing the information they will provide.

***ESS1 (K-4) POC –5***

*Based on data collected from daily weather observations, describe weather changes or weather patterns.*

**ESS1 (3-4) –5 Students demonstrate an understanding of processes and change over time within earth systems by ...**

**5a** observing, recording, comparing, and analyzing weather data to describe weather changes or weather patterns.

**5b** describing water as it changes into vapor in the air and reappears as a liquid when it's cooled.

**5c** explaining how this cycle of water relates to weather and the formation of clouds.

### Clarifying the Standards

#### *Prior Learning*

In grades K–2, students used a variety of weather tools to collect data. In third grade, students demonstrated understanding by explaining the functions of scientific tools—including those used during the primary grades—such as wind vanes, windsocks, anemometers, thermometers, meter sticks, rulers, and rain gauges. Third-graders also observed, recorded, and compared weather data to describe patterns and changes. They explained how the water cycle relates to weather and the formation of clouds, and described how water changes into vapor when heated and reappears as liquid when cooled.

#### *Current Learning*

Students in grade 4 continue to explain the use of tools, including wind vanes, windsocks, anemometers, thermometers, meter sticks, rulers, and rain gauges, as they gather weather data. Because this is the

second year that students are exposed to this content, it should be initially taught at the reinforcement level and then should progress into the drill-and-practice level.

Fourth-graders select appropriate tools for a given task and describing the information provided by those tools. These concepts are taught at the developmental level.

Students record and compare weather data to describe changes in weather and weather patterns. Students will perform multiple investigations using a variety of weather tools and collect data necessary to meet expectations. After collecting data, students will analyze the data to describe weather changes and patterns. In addition, students explain how the water cycle relates to weather and the formation of clouds, and they describe how water changes states. These concepts are taught from the reinforcement level to the drill-and-practice level of instruction.

### *Future Learning*

In grade 5, students will apply prior learning of changes in weather patterns and the water cycle as they diagram, label, and explain the processes of the water cycle (evaporation, condensation, precipitation, run-off, and transpiration). Students will describe how differential heating of the oceans affects currents, which then influence weather. They will also use their understanding of weather patterns to predict temperature and precipitation changes associated with the passing of various fronts.

### **Additional Research Findings**

According to *Making Sense of Secondary Science*, students often mistakenly think that water disappears or changes location (while still in liquid form) when it evaporates, and that water reappears during condensation. By this level, students should have a beginning understanding that evaporated liquid does not disappear, but just changes form (pp. 99–100). See also the Weather and Climate section of the *NSDL Science Literacy Maps* (<http://strandmaps.nsd.org/>).

Understanding that water exists in different states can be challenging for students at this level. Students were introduced to gases in third grade, but they may still struggle to conceptually understand gases because, unlike solids and liquids, matter in gaseous form cannot be directly observed.

In addition, many students hold the misconception that wind speed relates to temperature. They associate cold temperatures with high winds and warm temperatures with gentle, slow winds. Students often believe that wind is made or caused by something moving—for example, that winds are propelled by moving tree branches rather than the uneven heating and cooling of the earth's surface (*Making Sense of Secondary Science*, p. 111).

You may help students overcome these challenges by exposing them to ways of measuring wind speed and temperature. Students need multiple opportunities to experiment with weather tools and to explain the functions of these tools in writing. In addition, students benefit from building models that demonstrate how the natural world works. When learning difficult processes, such as those that make up the water cycle, students often need to work with more than one type of model.

## Notes About Resources and Materials

### General Resource Material for All GSEs

*Houghton Mifflin Science: Discovery Works*

- Unit B, Chapter 2
- Unit E, Chapters 1–4

### Websites

- [www.WeatherWizKids.com](http://www.WeatherWizKids.com)
- [www.TheWeatherChannelKids.com](http://www.TheWeatherChannelKids.com)
- [www.KidZone.ws/WATER](http://www.KidZone.ws/WATER)
- [StrandMaps.nsd.org](http://StrandMaps.nsd.org)

### DVDs

- *Schoolhouse Rock: Science Classroom Edition* [Interactive DVD] (2007)
- *Magic School Bus: Kicks up a Storm* [VHS] (1996)
- *Eye Witness Video: Weather* [VHS] (1996)

### Books

- Cole, J., & Relf, P. (1996). *The Magic School Bus—Wet All Over: A Book About the Water Cycle*. New York: Scholastic Paperbacks.
- Cole, J. (1988). *Magic School Bus at the Waterworks*. New York: Scholastic Press.
- Richardson, J. (1992). *The Water Cycle*. New York: Watts.
- Rosinsky, N. M. (2002). *Water: Up, Down, and All Around*. Mankato, MN: Picture Window Books.

### Magazines

- *Science & Children* magazines, [http://learningcenter.nsta.org/browse\\_journals.aspx?journal=sc](http://learningcenter.nsta.org/browse_journals.aspx?journal=sc)

## Grade 4 Science, Quarter 1, Unit 1.2

# Earth Materials

### Overview

**Number of instructional days:** 8 (1 day = 45 minutes)

#### Content to be learned

- Describe, compare, and sort rocks and soils using physical properties, including size, shape, color, texture, smell, weight, temperature, hardness, and composition.
- Describe, compare, and sort minerals using physical properties, including color, texture, smell, weight, temperature, hardness, and composition.
- Record and analyze observations and data about physical properties of earth materials.
- Identify similarities and differences between earth materials within a group.
- Cite evidence to explain why earth materials are classified or not classified together.
- Select appropriate tools for a given task related to earth materials.
- Describe the information that tools can provide about the physical properties of earth materials.

#### Processes to be used

- Describe, compare, sort, and classify earth materials using physical properties.
- Select and use tools to gather data.
- Record and analyze data.
- Cite evidence for classifying objects.
- Demonstrate safe practices during classroom and field investigations.
- Use scientific processes to conduct investigations, make observations, record and analyze data, communicate findings, cite evidence, and draw conclusions.

#### Essential questions

- How do the physical properties of two given minerals compare?
- Why are earth materials (rocks, soils, minerals) classified or not classified together?
- What tools could be used to determine the physical properties of a given mineral? What information will those tools provide?

## 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 (K-4) INQ –1***

*Given certain earth materials (soils, rocks or minerals) use physical properties to sort, classify, and describe them.*

**ESS1 (3-4) –1 Students demonstrate an understanding of earth materials by ...**

**1a** describing, comparing, and sorting rocks, soils, and minerals by similar or different physical properties (e.g., size, shape, color, texture, smell, weight, temperature, hardness, composition).

**1b** recording and analyzing observations/data about physical properties (e.g., within a grouping, which characteristics are the same and which are different).

**1c** citing evidence (e.g., prior knowledge, data) to support why rocks, soils, or minerals are classified/not classified together.

***ESS 1 (K-4) NOS –3***

*Explain how the use of scientific tools helps to extend senses and gather data about weather. (i.e., weather/wind vane: direction; wind sock: wind intensity; anemometer: speed; thermometer: temperature; meter sticks/rulers: snow depth; rain gauges: rain amount in inches).*

**ESS 1(3-4) –3 Students demonstrate an understanding of how the use of scientific tools helps to extend senses and gather data by...**

**3b** selecting appropriate tools for a given task and describing the information they will provide.

### Clarifying the Standards

*Prior Learning*

In grades K–2, students described, compared, and sorted rocks and soils by physical properties, such as size, shape, color, texture, smell, and weight. They recorded observations and data about physical properties and explained how and why certain objects were grouped together.

In third grade, students identified the four basic earth materials as water, soil, rocks, and air. They described, compared, and sorted rocks and soils by physical properties, including size, shape, color, texture, smell, and weight. Students also recorded observations and data about physical properties, including similarities and differences between samples, and they cited evidence to support why rocks and soils were or were not classified together.

*Current Learning*

Students in grade 4 continue to record observations and data about physical properties of earth materials. They continue to describe, compare, and sort rocks and soils by similar or different physical properties,

including size, shape, color, texture, smell, and weight. This is taught at the drill-and-practice level of instruction. However, identifying and describing minerals using the physical properties of hardness and composition is new to fourth-graders and should be taught at the developmental level of instruction.

Grade 4 students continue to identify the four basic earth materials as water, soil, rocks, and air, and are introduced to minerals. They continue to cite evidence to support why rocks, soils, and minerals are or are not classified together. Even though rocks and soils will be observed in investigations at a drill-and-practice level of instruction, minerals will be observed and described at a developmental level. Students will need many opportunities to explore these materials in order to determine similarities and differences among their physical properties.

### *Future Learning*

In grades 5–6, students will use prior learning of the physical properties of earth’s materials to identify and describe earth’s layers. They will also begin to explore the processes that change the earth’s surface.

### **Additional Research Findings**

According to *Making Sense of Secondary Science*, young students have difficulty identifying similarities and differences between rocks and minerals. Despite the fact that all rocks are made up of minerals, most primary-level students do not immediately associate minerals with rocks. In addition, they often associate the word *rock* with size. They believe, for example, that rocks are large and jagged, while stones are small. Many students also consider certain rocks to be man-made rather than natural. For example, they do not consider polished marble to be a naturally made rock because it is shiny and smooth (p. 112).

To address these misconceptions, provide several opportunities to sort and classify rock and mineral samples. Students need hands-on experiences to fully comprehend these concepts. The *National Science Education Standards* state children should have multiple opportunities to develop their observational and descriptive skills. Older children can keep journals, use instruments, and record their observations and measurements (p.134).

## **Notes About Resources and Materials**

### **General Resource Material for All GSEs**

*Houghton Mifflin Science: Discovery Works*

- Chapter 2 Investigations 1 and 2
- Experiment, pp. A34–35
- Art Connection, p. A41

### **Websites**

- [www.rocksforkids.com](http://www.rocksforkids.com)
- [www.kidsgeo.com](http://www.kidsgeo.com)
- [www.geography4kids.com](http://www.geography4kids.com)
- [www.rockhounds.com](http://www.rockhounds.com)
- [www.minsocam.org](http://www.minsocam.org) (mineral games)

**DVDs**

- *EyeWitness: Rock and Mineral* [DVD] (2007)

**Books**

- Gans, R. (1997). *Let's Go Rock Collecting*. New York: Harper Collins.
- Pellant, C. and Pellant, H. (2008). *Rocks*. United Kingdom: TickTock books.

**Magazines**

- *Science & Children* magazines, [http://learningcenter.nsta.org/browse\\_journals.aspx?journal=sc](http://learningcenter.nsta.org/browse_journals.aspx?journal=sc)

**Grade 4 Science, Quarter 1, Unit 1.3**  
**Changes to the Earth's Surface**

**Overview**

**Number of instructional days:** 8 (1 day = 45 minutes)

**Content to be learned**

- Conduct investigations to describe how water moves rocks and soils.
- Use observational data to describe how water moves rocks and soils.
- Investigate how wind, water, or ice have shaped and reshaped local landforms.
- Build and use models to simulate how wind and water shape and reshape the land (e.g., erosion, sedimentation, deposition, and glaciation).
- Determine the best building material for a specific purpose.
- Support explanations of the best building materials for a specific purpose.
- Determine which rock size will best prevent erosion.

**Processes to be used**

- Explain and describe the processes that cause change to the surface of the earth.
- Use models to simulate processes that occur in the natural world.
- Select appropriate materials for a specific purpose.
- Demonstrate safe practices during classroom and field investigations.
- Use scientific processes to ask questions, conduct investigations, make observations, record data, communicate findings, and draw conclusions.

**Essential questions**

- How does wind, water, or ice shape and reshape landforms over time?
- How does water move rocks and soils?
- What materials best prevent erosion and why?

## 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 (K-4) INQ –2***

*Use results from an experiment to draw conclusions about how water interacts with earth materials (e.g., percolation, erosion, frost heaves).*

**ESS1 (3-4)–2 Students demonstrate an understanding of processes and change over time within earth systems by ...**

**2a** conducting investigations and using observational data to describe how water moves rocks and soils.

***ESS1 (K-4) INQ+SAE –4***

*Explain how wind, water, or ice shape and reshape the earth.*

**ESS1 (3-4)–4 Students demonstrate an understanding of processes and change over time within earth systems by ...**

**4a** investigating local landforms and how wind, water, or ice have shaped and reshaped them (e.g. severe weather).

**4b** using or building models to simulate the effects of how wind and water shape and reshape the land (e.g., erosion, sedimentation, deposition, glaciation).

***ESS1 (K-4) FAF -6***

*Given information about earth materials explain how their characteristics lend themselves to specific uses*

**ESS1 (3-4)-6 Students demonstrate an understanding of properties of earth materials by...**

**6a** determining and supporting explanations of their uses (e.g., ~~best soils to grow plants~~, best building material for a specific purpose, determining which rock size will best prevent erosion).

### Clarifying the Standards

*Prior Learning*

In grades K–2, students observed and recorded daily and seasonal weather changes throughout the school year. They conducted tests to determine the water-retention capabilities of different soils, and they identified earth materials best suited for different uses (e.g., soils for growing plants, sand for a sand box).

In third grade, students conducted investigations and used observational data to describe how water moves rocks and soils. Students also determined which soils are best for growing plants. Models were used to simulate the effects of wind and water in shaping and reshaping the land. Third-grade students identified sudden and gradual changes that affect the earth (e.g., a flood is an example of a sudden change, whereas erosion caused by oceans is a gradual change).

### *Current Learning*

Students in grade 4 continue to conduct investigations and use observational data to describe how water moves rocks and soils, which should be taught at the drill-and-practice level of instruction. Students investigate local landforms to determine how wind, water, or ice have shaped and reshaped them. This is a new concept, which must be taught at a developmental level. They continue to use models and begin to build their own models to simulate ways that wind and water shape and reshape land. Given information about properties of earth materials, students now determine the best building materials for a specific purpose, including which rock size will best prevent erosion. These concepts are new and need to be taught at the developmental level of instruction.

### *Future Learning*

Students in grades 5–6 will use prior knowledge of the water cycle, the properties of earth materials, and earth processes as they begin to diagram, label, and explain earth processes in further detail.

### **Additional Research Findings**

This unit of study can be challenging for students, so the concepts may need continuous reinforcement. Students of all ages may assume that the world has always been as it is now, or that any changes that have occurred must have been sudden and comprehensive (Freyberg, *Implications Across the Curriculum*, 1985).

According to the *National Science Education Standards*, in the elementary grades, students begin to develop the physical and intellectual abilities of science inquiry. Therefore, they can use investigations to try things to see what happens (p. 122).

According to *Making Sense of Secondary Science*, children have difficulty accepting the idea that water expands when frozen. They also associate volume increase with rising temperature. With these perceptions, children will have difficulty “accounting for the breaking of rocks when water freezes within them” (p. 114).

To overcome these challenges, students need multiple opportunities to observe the interactions among rocks, soils, and water. Conducting investigations will allow students to develop an understanding of the processes that cause change to the surface of the earth. According to *Benchmarks for Science Literacy*, students can build models for demonstrating how wind and water shape the land and how forces acting on materials can make wrinkles, folds, and faults (p.72). Drawing pictures and labeling diagrams can also be useful in helping students develop an understanding of processes of change.

## **Notes About Resources and Materials**

### **General Resource Material for All GSEs**

*Houghton Mifflin Science: Discovery Works*

- Chapter 1, Investigations 1 and 2
- Chapter 2, Investigations 1 and 2
- NECAP 2010, released inquiry task—Sand Movers

### **Websites**

- [www.KidsGeo.com](http://www.KidsGeo.com)
- [www.Geography4Kids.com](http://www.Geography4Kids.com)
- [www.Rocks4Kids.com](http://www.Rocks4Kids.com)
- [www.HistoryforKids.com](http://www.HistoryforKids.com)
- [www.Kids.NationalGeographic.com/kids/activities](http://www.Kids.NationalGeographic.com/kids/activities)
- [www.Scholastic.com/MagicSchoolBus/Games/Teacher](http://www.Scholastic.com/MagicSchoolBus/Games/Teacher)

### **Magazines**

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