

Grade 3 Science, Quarter 3, Unit 3.1

Weather and Water

Overview

Number of instructional days: 12 (1 day = 45 minutes)

Content to be learned

- Identify the four basic earth materials (water, air, soil, rock).
- Record and analyze observations and data about physical properties of earth materials.
- Given certain earth materials (soils, rocks, or minerals), use physical properties to sort, classify, and describe them.
- Make logical predictions about changes in the state of matter when adding or taking away heat (e.g., condensation/evaporation of water).
- Describe water as it changes into vapor in the air and reappears as a liquid when cooled.
- Explain how the water cycle relates to weather and the formation of clouds.
- Explain how the use of scientific tools helps extend the senses and gather data about the weather.
- Select appropriate tools for a given task, and describe the information they provide.
- Observe and record daily weather data.
- Compare and analyze weather data to describe weather changes and weather patterns.

Essential questions

- How do scientists gather data and use it to predict the weather?
- What kinds of changes can be observed in the weather over time?

Science processes to be integrated

- Record and analyze observations and data about physical properties.
- Use physical properties to sort, classify, and describe objects.
- Cite evidence to support classification of objects.
- Make predictions about changes that occur.
- Describe changes that occur over time.
- Select and use appropriate tools to measure and gather data, and describe the information they provide.
- Record, compare, and analyze data to find patterns of change.

Written Curriculum

Grade-Span Expectations

**The Current Learning section explains how the concepts in this unit are taught over time.*

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 ...

1d identifying the four basic materials of the earth (water, soil, rocks, air).

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

PS1 - All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size or amount of substance).

PS1 (K-4) POC –2

Make a prediction about what might happen to the state of common materials when heated or cooled or categorize materials as solid, liquid, or gas.

PS1 (3-4) –2 Students demonstrate an understanding of states of matter by ...

2c making logical predictions about the changes in the state of matter when adding or taking away heat (e.g., ~~ice melting, water boiling, or freezing,~~ condensation/evaporation).

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 ...

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.

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.

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.

ESS1 (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).

Clarifying the Standards*Prior Learning*

In K-2, students used scientific tools to extend the senses and gather data about weather, and they observed, recorded, and summarized local weather data. Students observed and recorded seasonal and weather changes throughout the school year, and they observed recorded and summarized local weather data. Students observed how clouds are related to forms of precipitation and demonstrated when a shadow will be created on a sunny day versus a cloudy day. They also identified the sun as a heat source for land and water.

Current Learning

At the developmental level of instruction, third graders identify the four basic materials of Earth (water, soil, rocks and air). Given samples of certain earth materials (soils, rocks, or minerals), students describe, sort, and classify according to their physical properties, and they record and analyze observations and data to identify physical properties that are similar and different within a grouping at the reinforcement level of instruction. Students use scientific tools (e.g., weather/wind vane: direction; windsock: wind intensity; anemometer: speed; thermometer: temperature; meter sticks/ruler: snow depth; rain gauges: rain amount in inches) and explain how they are used to extend the senses and gather data about weather. In addition, students select appropriate tools for a given task and describe the information they will provide. Students have used tools to gather weather data since the primary grades, which should be taught at the reinforcement level of instruction. However, selecting appropriate tools, describing the information they will provide, and explaining how tools are used are new concepts for grade 3 and should be taught from the developmental level to the reinforcement level of instruction.

In grade 3, students also observe, record, compare, and analyze weather data to describe weather changes or weather patterns, and they make logical predictions about the changes in the state of matter (water) when adding or taking away heat (i.e., condensation and evaporation). These concepts have been addressed in prior grades and should be taught at the reinforcement level of instruction. Students describe

how water, when heated, changes into a vapor in the air and how it changes back into a liquid when cooled. They explain how the water cycle relates to weather and the formation of clouds. These concepts are new to grade 3 and should be taught from the developmental level through the reinforcement level of instruction.

Classroom investigations for evaporation and condensation could include the following:

- Groups of students place a wet paper towel into each of two cups, one with a cover on top and one with the cover placed underneath the cup. Then both are placed on a scale to indicate equal mass and left overnight. Students should be encouraged to make predictions about what they think will occur. The next school day, students measure the mass of each cup and observe that the uncovered cup has less mass. Students should be given an opportunity to feel the paper towels and are able to draw a conclusion about why the mass is different.
- Students place four cups, each with 50 ml of water, in locations that vary in temperature. After a given amount of time, students measure the volume of water in each cup and then compare the data to determine the effect of temperature on the rate of evaporation. In other words, students should notice that more evaporation occurs in warmer places within a given time frame (see <http://www.fossweb.com/modules3-6/WaterPlanet/index.html>).
- Groups of students each fill a cup about halfway full with tap water, place a lid or piece of clear plastic wrap on the cup, and place the cup in a warm location. Over a short period of time, students observe water condensing on the lid because the water inside the cup is evaporating and then collecting and condensing on the lid.
- Students can also fill a glass with ice water and observe condensation forming on the outside of the cup.
- Place metal spoons into the freezer. Once the spoons are very cold, have students blow hot air onto them in order to observe condensation forming. Students should be able to draw conclusions about why condensation occurs.

Students should also be engaged in investigations such as creating models and diagrams of the water cycle (e.g., creating a water cycle in a bag or cup with a domed lid). Some valuable resources include <http://earthguide.ucsd.edu/earthguide/diagrams/watercycle> and www.weatherwizkids.com/weather-links.htm.

Future Learning

In grade 4, students will explain how the use of scientific tools helps extend sense and gather data. Students will investigate local landforms and how wind, water, or ice have shaped and reshaped them (e.g., severe weather), and they will use or build models to simulate the effects of how wind and water shape and reshape the land. Students will conduct investigations and use observational data to describe how water moves rocks and soils, and they will identify sudden and gradual changes that affect Earth (e.g., sudden change = flood).

In grades 5 and 6, students will diagram, label, and explain the processes of the water cycle, including evaporation, precipitation, runoff, condensation, transpiration, and groundwater, and they will explain how condensation of water vapor forms clouds, which affects climate and weather. Students will identify composition and layers of Earth's atmosphere, and they will develop models to explain how humidity, temperature, and altitude affect air pressure and how this affects local weather. Students will explain how differential heating and convection affect Earth's weather patterns, and they will describe how differential

heating of the ocean affects ocean currents, which in turn influence weather and climate. Students will explain the relationship between differential heating/convection and the production of winds, and they will analyze global patterns of atmospheric movements to explain effects on weather. Students will predict temperature and precipitation changes associated with the passing of various fronts, and they will describe events and the effect they may have on climate (e.g., El Niño, deforestation, glacial melting, an increase in greenhouse gases).

Additional Findings

According to the *Atlas of Science Literacy, Vol. 2*, foundational understandings for this unit include a number of concepts, some of which were taught in the primary grades. Students should understand that the sun warms the air, land, and water, causing changes in weather. Air is a material that surrounds you and takes up space, and when it moves, you feel it as wind. Water can be a liquid or solid and can go back and forth from one form to the other. If water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing. When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled or as a solid if cooled below the freezing point of water. Clouds and fog are made of tiny droplets or frozen crystals of water; when those droplets or crystals become heavy enough, gravity pulls them to the surface of Earth as precipitation. Additionally, the weather is always changing and can be described by measureable quantities such as temperature, wind direction and speed, and precipitation. (p. 21)

The processes of evaporation and condensation are difficult for students to conceptually understand. It is difficult for students to understand that water exists in the air in the form of vapor. Students can conduct investigations that go beyond the observations made in the earlier grades to learn the connection between the liquid and solid forms of water, but recognizing that water can also be a gas, while much more difficult, is still accessible to students in grades 3–5. The main thrust for students at this age is to try to figure out where water in an open container goes. This is neither self-evident nor easy to detect. However, the water cycle is of such profound importance to life on Earth that students should have experiences that in time contribute to their understanding of evaporation, condensation, and the conservation of matter. (*Benchmarks for Science Literacy*, p. 68) One strategy teachers may use to overcome this challenge is to give students multiple opportunities to conduct experiments with heating and cooling water. Observing working models of the water cycle in both open and closed containers may also assist in helping students develop a conceptual understanding of how water changes state as it moves through the water cycle.

Before students understand that water is converted to an invisible form, they may initially believe that when water evaporates it ceases to exist, it changes location but remains a liquid, or it is transformed into some other perceptible form such as fog, steam, or droplets. (*Atlas of Science Literacy*, p. 20; *Benchmarks for Science Literacy*, p. 336) At ages 5 to 7, students commonly think that when it rains, someone opens a reservoir. An alternative notion is that clouds are bags of water and when they collide with each other, they explode, tear, or split open. At ages 7 to 10, some students visualize clouds as sponges that have drops of water inside. (*Making Sense of Secondary Science*, p. 101)

Grade 3 Science, Quarters 3 and 4, Unit 3.2

Plants

Overview

Number of instructional days: 15 (10 in Quarter 3, 5 in Quarter 4) (1 day = 45 minutes)

Content to be learned

- Cite evidence to distinguish between living and nonliving things.
- Observe that plants need water, air, food, light, and space to grow and reproduce.
- Identify, sort, and compare based on similar and/or different external features.
- Record and analyze observations/data about external features.
- Cite evidence to draw conclusions explaining why organisms are grouped/not grouped together.
- Observe changes and record data to scientifically draw and label the stages in the life cycle of a familiar plant.
- Sequence the life cycle of a plant when given a set of data/pictures.
- Compare the life cycles of two plants when given a set of data or pictures.

Essential questions

- How do you distinguish between living and nonliving things?
- What do plants need to survive and reproduce?
- How do external features vary among different plants?

Science processes to be integrated

- Cite evidence and draw conclusions.
- Make and record observations and collect data.
- Identify, sort, and compare organisms based on external features.
- Analyze observations and data.
- Observe, compare, and scientifically draw and label changes that occur over time.
- Sequence events using data or pictures.

- In what ways can plants be classified?
- How do plants change over time?
- Do all plants go through similar life cycles? Use pictures and words to explain your thinking.

Written Curriculum

Grade-Span Expectations

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, and species).

LS1 (K-4) - INQ+POC –1

Sort/classify different living things using similar and different characteristics. Describe why organisms belong to each group or cite evidence about how they are alike or not alike.

LS1 (3-4) –1 Students demonstrate an understanding of classification of organisms by ...

1a citing evidence to distinguish between living and non-living things.

LS1 (K-4) SAE -2

Identify the basic needs of plants and animals in order to stay alive. (i.e., water, air, food, space).

LS1 (3-4)-2 Students demonstrate understanding of structure and function-survival requirements by...

2a observing that plants need water, air, food, light and space to grow and reproduce; ~~observing that animals need water, air, food, and shelter/space to grow and reproduce.~~

LS1 (K-4) - INQ+POC –1

Sort/classify different living things using similar and different characteristics. Describe why organisms belong to each group or cite evidence about how they are alike or not alike.

LS1 (3-4) –1 Students demonstrate an understanding of classification of organisms by ...

1b identifying, sorting and comparing based on similar and/or different external features.

1c recording and analyzing observations/data about external features (e.g., within a grouping, which characteristics are the same and which are different).

1d citing evidence (e.g., prior knowledge, data) to draw conclusions explaining why organisms are grouped/not grouped together (~~e.g. mammal, bird, and fish~~).

LS1 (K-4) POC –3

Predict, sequence or compare the life stages of organisms – plants and animals (e.g., put images of life stages of an organism in order, predict the next stage in sequence, compare two organisms).

LS1 (3-4)–3 Students demonstrate an understanding of reproduction by ...

3a observing changes and recording data to scientifically draw and label the stages in the life cycle of a familiar plant ~~and animal~~.

3b sequencing the life cycle of a plant ~~or animal~~ when given a set of data/pictures.

3c comparing the life cycles of 2 plants ~~or 2 animals~~ when given a set of data/pictures.

Clarifying the Standards

Prior Learning

In grades K–2, students distinguished between living and nonliving things, and they identified and sorted based on similar and different external features of an organism. Students also observed and recorded the external features that make up living things (e.g., roots, stems, leaves, flowers), and they identified the specific function of the physical structures of plants. Students observed that plants need water, food, light, and air to grow, and they cared for plants by identifying and providing for the plants' needs. In addition, students experimented with a plant's growth under different conditions, including light and no light. Students observed and scientifically drew and labeled the life cycle of a familiar plant, and they sequenced the life cycle of plant when given a set of pictures.

Current Learning

Students in grade 3 demonstrate an understanding of classification of organisms by citing evidence to distinguish between living and nonliving things. Students identify, sort, and compare based on similar and different external features, and they record and analyze observations/data about external features. Students cite evidence to draw conclusions to explain why organisms are grouped or not grouped together. They observe that plants need water, air, food, light, and space to grow and reproduce. Students demonstrate an understanding of reproduction by observing changes and recording data to scientifically draw and label the stages in the life cycle of a familiar plant. They sequence and compare the life cycle of a given plant when given a set of data/pictures. In addition, students compare the life cycle of two plants when given a set of data or pictures. Portions of each of these concepts have been addressed in previous grade levels and should be taught at the reinforcement level to drill-and-practice level of instruction. Skills/concepts new to third graders include learning to make comparisons using data and pictures, citing evidence, and drawing conclusions. These skills, in the context of the content taught during this unit, should be taught at the developmental level to drill-and-practice level of instruction.

In the grade 3 classroom, students can sort pictures into living and nonliving categories and should use evidence to explain why each picture represents something that is living or nonliving. Students should also have opportunities to group plants based on their external features, including leaves, stems, and root structures. They should also have an opportunity to grow two different types of plants from seeds in order to make observations of the stages of growth for each type of plant. Students should record their observations using both data and pictures to compare the life cycle of two plants. As students care for their plants, they can observe that plants have certain basic needs (including air, water, light, and space) to survive and reproduce.

Future Learning

In grade 4, student learning in life science will focus on the cycling of matter and flow of energy that occur in ecosystems. Students will identify sources of energy for the survival of organisms and demonstrate in a food web that all animals' food begins with the sun. Students will use information about organisms to design a habitat and explain how the habitat provides for the needs of the organisms that live there, and they will explain the way that plants and animals in that habitat depend on each other. Students will demonstrate an understanding of equilibrium in an ecosystem by explaining how the balance of the ecosystem can be disturbed and what organisms might do if their environment changes.

In grades 5 and 6, students will demonstrate an understanding of biodiversity by recognizing that organisms have different features and behaviors for meeting their needs to survive. They will also

demonstrate an understanding of structure and function-survival requirements by describing structures or behaviors that help organisms survive in their environment (e.g., defense, obtaining nutrients, reproduction, eliminating waste). Students will demonstrate an understanding of reproduction by defining reproduction as a process through which organisms produce offspring, and they will describe reproduction in terms of being essential for the continuation of a species. Students will investigate and compare a variety of plant and animal life cycles.

Additional Findings

Students in grades 3–5 should have the opportunity to learn about an increasing variety of living organisms, both the familiar and exotic, and should become more precise in identifying similarities and differences among them. Although the emphasis should still be on external features, finer detail than before should be included. Students should observe living organisms using hand lenses routinely. Microscopes should also come into use, not to study cell structure, but to begin exploring the world of organisms that cannot be seen by the unaided eye. As students become more familiar with the characteristics of more organisms, they should be asked to classify living organisms in different ways. Hopefully, their classification schemes vary according to gross anatomy, behavior patterns, habitats, and other features. The aim is to move students toward the realization that there are many ways to classify things, but how good any classification is depends on its usefulness. A scheme is useful if it contributes either to making decisions on some matter or to a deeper understanding of the relatedness of organisms. By the end of grade 5, students should know that a great variety of living things can be sorted into groups in many ways using various features to decide which things belong to which group, and the features used for grouping depend on the purpose of the grouping. (*Benchmarks for Science Literacy*, p. 103)

Students should also begin to look for ways in which organisms in one habitat differ from those in another and consider how some of those differences are helpful to survival. The focus should be on the consequences of different features of organisms for their survival and reproduction. Evidence for the similarity within the diversity of existing organisms can draw upon students' expanding knowledge of anatomical similarities and differences. By the end of grade 5, students should know that individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing. (*Benchmarks for Science Literacy*, p. 123)

Students need to understand that the kinds of plants that grow in an area depend on the climate and soil. People living in places too cold or too dry to grow certain crops can obtain food from places with more suitable climates. Much of the food eaten by Americans comes from other parts of the country and other places in the world. (*Benchmarks for Science Literacy*, pp. 184 and 185) Since students must understand that sunlight, water, air, and space are necessary for plant life, they can design experiments to see the effects of changing the amount of water, light, air, and/or space on plants.

During the elementary years, children build understanding of biological concepts through direct experience with living things, their life cycles, and their habitats. These experiences emerge from a sense of wonder and natural interests of children who ask questions such as, "How do plants get food? How many different animals are there? Why do some animals eat other animals?" An understanding of the characteristics of organisms, life cycles of organisms, and the complex interactions among all components of the natural environment begins with questions such as these and an understanding of how individual organisms maintain and continue life. Making sense of the way organisms live in their environments develops some understanding of the diversity of life and how all living organisms depend on the living and nonliving environment for survival. Because the child's world at grades K–4 is closely associated with the home, school, and the immediate environment, the study of organisms should include observations and interactions within the natural world of the child. The experiences and activities in

grades K–4 provide a concrete foundation for the progressive development in the later grades of major biological concepts such as interdependence, the behavior of organisms, and matter and energy in living systems. (*National Science Education Standards*, pp. 127 and 128)

Young children think very concretely about individual organisms. The idea that organisms depend on their environment is not well developed in young children. In grades K–4, the focus should be on establishing the primary association of organisms with their environments and the secondary ideas of dependence on various aspects of the environment. Students should also understand that organisms have basic needs and can survive only in environments in which their needs can be met. The world has many different environments, and distinct environments support the life of different types of organisms. Each plant (or animal) has different structures that serve different functions in growth, survival, and reproduction. It is important for students to understand that plants closely resemble their parent; that many plants have life cycles that include germination, growth, reproduction, and death; and that the details of the life cycle vary among different organisms. In addition, young children need to be given opportunities to observe living organisms in their environments and as they progress through the stages of the life cycle. (*National Science Education Standards*, pp. 128 and 129)

Children tend to have a much narrower meaning of the word *plant* than that of a biologist. In interviews with students ages 9 to 15, researchers noted that very few use generalized criteria such as *grows in the ground*, *has leaves*, *has roots*, or *is green* to categorize all the instances of plants. Many often did not consider a tree to be a plant, although many said that “it was a plant when it was little.” About half of students also did not consider a seed to be a plant, and many did not view weeds or vegetables as subsets of the set of plants. (*Making Sense of Secondary Science*, p. 23)

Acquiring a wide enough variety of plants to give students a broad view of plant life may be challenging. In addition to proper materials, students also need adequate time to observe changes in plant growth and to observe and compare the features of different plants. In grade 3, teachers should avoid having students group plants simply by attributes such as *has leaves*, *has roots*, *grows in the ground*, and *is green*. Students at this level need to observe plants with different types of leaves, petals, and stems.

