

Grade 2 Science, Quarter 2, Unit 2.1
Forms of Energy

Overview

Number of instructional days: 6 (1 day = 45 minutes)

Content to be learned

- Demonstrate when a shadow is created on sunny versus cloudy days.
- Describe the observable effects of light from a variety of light sources.
- Experiment and describe how vibrating objects make sound.
- Describe that the sun warms land and water.
- Describe that objects change in temperature by adding or subtracting heat.

Processes to be used

- Observe, identify, and record observations.
- Observe, describe, and measure temperature changes.
- Conduct experiments.
- Demonstrate and explain the interactions among the components of a system.
- Observe and describe patterns of change within systems.
- Demonstrate safe practices during classroom and field investigations.

Essential questions

- How are shadows created?
- How is sound created?
- What can cause the temperature of objects to change?

Written Curriculum

Grade Span Expectations

- **Light**

PS 2 - Energy is necessary for change to occur in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.

PS2 (K-4) SAE – 5

Use observations of light in relation to other objects/substances to describe the properties of light (can be reflected, refracted, or absorbed).

PS2 (K-2)-5 Students demonstrate an understanding of energy by...

5a demonstrating when a shadow will be created using sunny versus cloudy days.

PS2 (K-4) SAE -4

Given a specific example or illustration (e.g., simple closed circuit, rubbing hands together), predict the observable effects of energy (i.e., light bulb lights, a bell rings, hands warm up (e.g., a test item might ask, “what will happen when...?”)).

PS2 (K-2)-4 Students demonstrate an understanding of energy by...

4a describing observable effects of light using a variety of light sources.

- **Sound**

PS2 (K-2)-4 Students demonstrate an understanding of energy by...

4b experimenting and describe how vibrating objects make sound (e.g., guitar strings, seeing salt bounce on a drum skin).

- **Heat**

PS2 (K-4) SAE+INQ – 6

Experiment, observe, or predict how heat might move from one object to another.

PS2 (K-2)-6 Students demonstrate an understanding of energy by...

6a describing that the sun warms land and water.

6b describing that objects change in temperature by adding or subtracting heat.

Clarifying the Standards

Prior Learning

In kindergarten, students demonstrated under what conditions shadows are created. Kindergarteners and first-graders identified the sun as a source of heat energy. First-graders also recognized that the sun warms land and water, and that objects change in temperature when heat is added.

Current Learning

At the reinforcement level of instruction, second-graders identify the sun as a source of heat energy, and understand that the sun warms land and water. Students also conduct experiments and record observations in order to describe the change in temperature in objects when they are heated.

At the developmental level of instruction, students learn that objects also change in temperature when heat is taken away. Students should conduct investigations in which various objects are cooled, such as placing sand, liquids, or other objects in a dark, shaded area or in the refrigerator. In second grade, students also describe the observable effects of light, using a variety of light sources. Students need opportunities to experiment with natural light and manmade light (flashlight, laser light, etc.). They also describe how vibrating objects make sound by experimenting with stringed instruments, elastics, tuning forks, and any other objects that can be made to vibrate.

Future Learning

In third grade, students will describe how heat moves from warm objects to cold objects until both objects are the same temperature. They will use experimental data to classify a variety of materials as conductors or insulators. Third-graders will also investigate the observable effects of light using a variety of light sources. They will predict, describe, and investigate how light rays are reflected, refracted, or absorbed. Experiments will be conducted to identify and classify different pitches and volumes of sounds produced by different objects. Students will use data to explain what causes sound to have different pitches or volumes.

Additional Research Findings

Energy is a mysterious concept, even though its various forms can be defined and measured. Energy is a major exception to the principle that students should understand ideas before being given labels for them. Children benefit from talking about energy before they are able to define it. Heat energy itself is a surprisingly difficult idea for students, who thoroughly confound it with the idea of temperature. A great deal of work is required for students to successfully make the distinction. By the end of grade 2, students should know that the sun produces heat that warms the land, air, and water (*Benchmarks for Science Literacy*, pp. 81, 83).

By the end of second grade, students should be familiar with a variety of ways of making things go. A formal introduction to energy as a scientific idea can wait, as long as students understand that energy is something that is needed to make things go or happen. Students should view, describe, and discuss all kinds of moving things—themselves, insects, birds, trees, doors, rain, fans, swings, balls, wagons, stars, etc.—keeping notes, drawing pictures to suggest their motion, and raising questions: Do they move in a straight line? Is their motion fast or slow? How can you tell? How many ways does a growing plant move? The questions count more than the answers, at this stage. And students should gain varied experiences in getting things to move or not to move and in changing the direction or speed of things that are already in motion. Students should know that things move in many different ways, such as straight, zigzag, round and round, back and forth, and fast and slow, and that the way to change how something is moving (or not moving) is to give it a push or pull (*Benchmarks*, p. 89).

As children begin “making music” from the first day of school, they have an opportunity to experience vibrations as a phenomenon rather than a theory. With drums, bells, stringed and other instruments they use (including their own voices) they can feel vibrations as they hear sounds. These experiences are important and at this point do not need elaboration (p. 89). Students should know that things make sound vibrate.

Notes About Resources and Materials

- Many valuable resources can be found by visiting the Stone Hill School website and clicking on the library link.

<<http://www.ricat.net/cataloging/servlet/presentviewpubliclistsform.do?12m=ResourceLists>>

- *Houghton Mifflin Science, Discovery Works*, Unit B—Energy and Motion

Grade 2 Science, Quarter 2, Unit 2.2
Properties of Solids and Liquids

Overview

Number of instructional days: 6 (1 day = 45 minutes)

Content to be learned

- Describe physical properties of solids.
- Describe physical properties of liquids.
- Use balances to explore the weight of solids and liquids.
- Record observations and collect data about physical properties of solids and liquids.
- Use physical properties to identify, compare, and sort solids and liquids.
- Use physical properties to state why objects are grouped together.

Processes to be used

- Use balances to explore the property of weight.
- Make and record observations.
- Collect and organize data.
- Use physical properties to compare and sort objects.
- Identify similarities and differences.
- Demonstrate safe practices during classroom investigations.
- Use scientific processes, such as conducting investigations, making observations, and organizing data.

Essential questions

- How are solids and liquids similar?
- How are solids and liquids different?

Written Curriculum

Grade Span Expectations

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) INQ –1

Collect and organize data about physical properties in order to classify objects or draw conclusions about objects and their characteristic properties (e.g., temperature, color, size, shape, weight, texture, flexibility).

PS1 (K-2)–1 Students demonstrate an understanding of characteristic properties of matter by ...

1a identifying, comparing, and sorting objects by similar or different physical properties (e.g., size, shape, color, texture, smell, weight).

PS1 (K-4) SAE –3

Use measures of weight (data) to demonstrate that the whole equals the sum of its parts.

PS1 (K-2)–3 Students demonstrate an understanding of conservation of matter by ...

3a using simple tools (e.g. balance scale, see-saw) to explore the property of weight.

PS1 (K-4) INQ –1

Collect and organize data about physical properties in order to classify objects or draw conclusions about objects and their characteristic properties (e.g., temperature, color, size, shape, weight, texture, flexibility).

PS1 (K-2)–1 Students demonstrate an understanding of characteristic properties of matter by ...

1b recording observations/data about physical properties.

1c using attributes of properties to state why objects are grouped together (e.g., things that roll, things that are rough).

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 (K-2) POC –2**

PS1 (K-2) POC –2 Students demonstrate an understanding of states of matter by ...

2a describing properties of solids and liquids.

2b identifying and comparing solids and liquids.

Clarifying the Standards

Prior Learning

Students in kindergarten and first grade identified, compared, and sorted objects based on physical properties and learned to use simple tools to explore the weight of objects. Students in first grade learned how to record their observations. Students were introduced to the properties of solids and liquids and used those properties to compare the two states of matter.

Current Learning

At a drill-and-practice level of instruction, students in second grade identify, compare, and sort objects based on physical properties (e.g. size, shape, color, texture, smell, and weight). They also use simple tools to explore the property of weight.

At a reinforcement level of instruction, students record their observations. They observe and describe physical properties of solids and liquids, and identify similarities and differences between these two states of matter.

Future Learning

Students in third grade will continue to identify, compare, and sort objects based on physical properties such as size, shape, and color, and they will be introduced to the physical properties of temperature and flexibility. They will use data and prior knowledge to cite evidence as to why objects are or are not grouped together. Students will describe, identify, and compare solids and liquids, and will begin to identify physical properties of gases. Students will begin observing and describing physical changes such as freezing, thawing, cutting, breaking, bending, and tearing. They also begin to understand that the weight of an object will remain the same despite a change in its shape.

Additional Research Findings

During their early years, children's natural curiosity leads them to explore the world by observing and manipulating common objects and materials in their environment. Children compare, describe, and sort as they begin to form explanations of the world. Developing a knowledge base to explain and predict the world requires many experiences over a long period. Young children bring experiences, understanding, and ideas to school; teachers provide opportunities to continue children's explorations in focused settings with other children using simple tools, such as magnifiers and measuring devices. Physical science in grades K–4 includes topics that give students a chance to increase their understanding of the objects and materials they encounter daily. Through the observation, manipulation, and classification of common objects, children reflect on the similarities and differences of the objects. As a result, their initial sketches and single-word descriptions lead to increasingly more detailed drawings and richer verbal descriptions. (*National Science Education Standards*, p. 126)

According to *Benchmarks for Science Literacy*, students should examine and use a wide variety of objects when learning to describe, compare, and sort objects using physical properties. They should categorize objects according to their various physical properties and begin to create written/pictorial recordings. (p. 76).

Students should begin to consider how the properties of objects might differ from properties of the materials they are made of. They should begin to inspect things with a magnifying glass to discover features not visible without it. By the end of second grade, students should know that objects can be

described in terms of the materials they are made of and their physical properties (color, size, shape, weight, texture, flexibility, etc.) (*Benchmarks*, p. 76).

According to *Making Sense of Secondary Science*, students have many misconceptions about solids and liquids. Students may believe that any rigid material is a solid. Solids are considered to be hard, strong, and non-malleable. On the other hand, powders are considered to be liquids because powders can be poured. Students may believe that any nonrigid materials (i.e., sponges, cloth) fall somewhere between a solid and a liquid because they are soft and can be torn. Many students categorize liquids as something that is runny and can be poured, and associate liquids as watery or made of water. Students also have a difficult time classifying viscous liquids, such as honey and paste, and collections of small solids, such as sand and powder. In addition, students have a difficult time exploring the property of weight, because they believe that liquids weigh less than solids (pp. 79–80).

Notes About Resources and Materials

Houghton Mifflin Science, Discovery Works, Unit D (Solids, Liquids and Gases), Lessons 1, 2, and 3. (Experiments from these lessons can be conducted, but teachers should address only solids and liquids.)

Science Materials

- Balance scale
- Liquids—cola, seltzer water, water, cooking oil, molasses, pancake syrup, orange juice, etc.
- See-saw
- Solids—plastic tube, cloth squares, plastic triangle, metal screw, craft stick, wood cylinder, wire, etc.

Websites

- RIEPS
<http://rieeps.rsmart.com/xsl-portal/site/2010%20RITTI_E2T2/page/fe2012fd-3b87-4ce8-8551-7dd90f9f0ee7>
- Bar grapher
<www.illuminations.nctm.org/ActivityDetail.aspx?id=63>
- Grouping materials
<www.bbc.co.uk/schools/scienceclips/ages6_7/grouping_materials.shtml>
- Is it waterproof?
<http://www.bbc.co.uk/schools/ks2bitesize/science/materials/characteristic_materials/play.shtml>

Trade Books

(These books can be ordered through Scholastic Website Glen Hills / Stone Hill's School Library list of trade books: <<http://www.ricat.net/cataloging/servlet/handlebooklistform.do>>)

- Curry, D. (2005). *What is Matter*. Danbury, CT: Children's Press.
- Garret, G. (2005). *Solids, Liquids, and Gases*. Danbury, CT: Children's Press.

Grade 2 Science, Quarter 2, Unit 2.3
Changes to Solids and Liquids

Overview

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

Content to be learned

- Make predictions about changes in the state of matter when adding or taking away heat.
- Record observations and collect data about physical properties of solids and liquids.
- Use simple tools, such as a balance scale, to explore the weight of solids and liquids.

Processes to be used

- Use balances to explore the property of weight.
- Make and record observations.
- Collect and organize data.
- Observe changes in the state of matter when adding or taking away heat.
- Demonstrate safe practices during classroom investigations.
- Use scientific processes to make predictions, conduct investigations, make observations, collect and organize data, and communicate results.

Essential questions

- What happens when we add heat to a solid? To a liquid?
- What happens when we take heat away from a solid? From a liquid?

Written Curriculum

Grade Span Expectations

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) INQ –1

Collect and organize data about physical properties in order to classify objects or draw conclusions about objects and their characteristic properties (e.g., temperature, color, size, shape, weight, texture, flexibility).

PS1 (K-2)–1 Students demonstrate an understanding of characteristic properties of matter by ...

1b recording observations/data about physical properties.

PS1 (K-4) SAE –3

Use measures of weight (data) to demonstrate that the whole equals the sum of its parts.

PS1 (K-2)–3 Students demonstrate an understanding of conservation of matter by ...

3a using simple tools (e.g. balance scale, see-saw) to explore the property of weight.

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 (K-2) POC –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 freezing).

Clarifying the Standards

Prior Learning

Students in kindergarten and first grade sorted objects based on physical properties. In addition, first-graders spent time learning about the properties of solids and liquids.

In unit 2.2 (Properties of Solids and Liquids), second-graders identified, compared, and sorted objects based on physical properties. They used simple tools to measure the physical property of weight. Students identified physical properties of solids and liquids, and compared solids and liquids based on their physical properties.

Current Learning

At a developmental level of instruction, second-grade students make logical predictions about changes in the state of matter when adding or taking away heat. Children conduct experiments and observe the melting of various solids (e.g., wax, chocolate, ice, and butter), as well as the freezing of liquids (e.g.,

juice, water, detergents, cooking oil, honey, saltwater, and rubbing alcohol). Students should weigh solids and liquids before heat is added or taken away to demonstrate that weight remains the same.

Future Learning

Students in third grade will continue to identify, describe, and compare solids and liquids, and will be introduced to gases. They will observe and describe physical changes, such as freezing and thawing. Students will begin to develop an understanding of the conservation of matter by showing that the weight of an object remains the same despite a change in its shape.

Additional Research Findings

Objects have many observable properties, including size, weight, shape, color, and temperature. Those properties can be measured using tools. Most objects are made of one or more materials. These materials can exist in different states and can be changed from one state to another by heating and cooling. Students are familiar with the change of state between water and ice, but understanding the characteristic properties of each state of matter requires instructional time and effort. Most students will have difficulty with the generalization that many substances can exist as either a liquid or a solid (*National Science Education Standards*, pp. 126–127).

According to *Benchmarks for Science Literacy*, students should examine and use a wide variety of objects, categorizing them according to their various observable properties. Students should subject materials to such treatments as mixing, heating, freezing, cutting, wetting, dissolving, bending, and exposing to light to see how they change. Even though it is too early to expect precise reports or even consistent results from the students, they should be encouraged to describe what they did and how materials responded. Students should also see that things can be done to materials to change some of their properties, but not all materials respond the same way to what is done to them (p. 76).

According to *Making Sense of Secondary Science*, when students observe a solid changing to a liquid, they think that it loses weight. Young children tend to think that melting and dissolving are interchangeable because they consider melting to be gradual and not related to temperature. They also do not regard a change of state as being related to a specific temperature (pp. 80–81).

Notes About Resources and Materials

Houghton Mifflin Science, Discovery Works

- Unit D, Lesson 6
- Unit D, Lesson 9

Trade Books

- Knapp, B. (2002). *Changing Materials*. United Kingdom: Atlantic Europe Publishing Co.
- Knapp, B. (2002). *Changing from Solids to Liquids to Gases*. United Kingdom: Atlantic Europe Publishing Co.
- Rivera, S. (2007). *Bending*. Minneapolis, MN: Lerner Publishing.
- Rivera, S. (2007). *Cooling*. Minneapolis, MN: Lerner Publishing.
- Rivera, S. (2007). *Heating*. Minneapolis, MN: Lerner Publishing.

- Rivera, S. (2007). *Cutting*. Minneapolis, MN: Lerner Publishing.

Websites

- Scholastic website
<http://teacher.scholastic.com/activities/studyjams/matter_states/>
- Bill Nye Phases of Matter video
<<http://www.gamequarium.org/cgi-bin/search/linfo.cgi?id=7685>>
- Change It website
<<http://www.fossweb.com/modulesK-2/SolidsandLiquids/index.html>>