

## Grade 2 Science, Quarter 2, Unit 2.1

# Solids and Liquids

### Overview

**Number of instructional days:** 10 (1 day = 40 minutes)

#### Content to be learned

- Describe the properties of solids and liquids.
- Identify and compare solids and liquids.
- Make logical predictions about the changes in the state of matter when adding or taking away heat.
- Use simple tools to explore the property of weight.
- Explain that objects change in temperature by adding or subtracting heat.

#### Science processes to be integrated

- Use tools to explore physical properties.
- Make and record predictions.
- Collect and organize data.
- Make and record observations.
- Use physical properties to compare and sort objects.
- Demonstrate safe practices during classroom investigations.

#### Essential questions

- What might happen to matter when it is heated or cooled?
- How can you use the properties of matter to categorize objects?
- 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) 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 ...**

**2a** describing properties of solids and liquids.

**2b** identifying and comparing solids and liquids.

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

***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.

**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+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...**

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

### Clarifying the Standards

*Prior Learning*

In kindergarten, students identified, compared, and sorted objects by similar or different physical properties and used attributes of properties to state why objects are grouped together. They used simple tools to explore the property of weight.

In grade 1, students also identified, compared, and sorted objects by similar or different physical properties and learned to use simple tools to explore the weight of objects. Students used attributes of properties to state why objects are grouped together, and they learned to record their observations and data about physical properties. They also explained that objects change in temperature when adding or subtracting heat.

### *Current Learning*

At the drill-and-practice level of instruction, students in grade 2 use simple tools to explore the property of weight. At the reinforcement level of instruction, students explain that objects change in temperature by adding or subtracting heat. At the developmental level of instruction, second graders describe the properties of solids and liquids and identify and compare solids and liquids. They make logical predictions about changes in the state of matter when adding or taking away heat.

During this unit, students first need multiple opportunities to interact with a large variety of solids and liquids to describe the properties that distinguish solids from liquids and to identify and compare solids and liquids that are found in their everyday environment. Students also need opportunities to conduct investigations to observe the effect of adding and taking away heat from various solids and liquids. For example, students can observe changes in temperature and appearance when melting various solids (e.g., wax, chocolate chips, ice, butter pats) as well as the changes that occur when freezing liquids (e.g., juice, water, liquid detergents, cooking oil, honey, saltwater, rubbing alcohol). Students should be guided to observe the physical properties of each solid and liquid both before and after adding or taking away heat.

During this unit of study, students can

- observe various solids and liquids, describe the properties of each, and then sort and classify the samples. Students can record their observations in their science journals and describe each sample in terms of shape, color, size, and texture.
- sort and classify objects as solids and liquids, giving evidence to support their thinking.
- predict how long it will take to melt an ice cube and then conduct an investigation to test their predictions.
- predict and test ways to increase/decrease the rate of melting of ice cubes.
- classify challenging substances such as sand, sugar, and toothpaste as either solid or liquid and then give evidence to support their claims.

### *Future Learning*

In grades 3 and 4, students will identify, compare, and sort objects by similar or different physical properties (including size, shape, color, texture, smell, weight, temperature, and flexibility), and they will cite evidence to support conclusions about why objects are grouped/not grouped together. Students will describe properties of solids, liquids, and gases, and they will identify and compare solids, liquids, and gases. They will measure the weight of objects to prove that all matter has weight. Students will use measure of weight to prove that the whole equals the sum of its parts and will show that the weight of an object remains the same despite a change in its shape. They will observe and describe physical changes and make logical predictions about changes in the state of matter when adding or taking away heat.

### **Additional Findings**

Young children have a difficult time understanding a complex concept such as energy. Students have intuitive notions of energy (e.g., energy is needed to get things done, humans get energy from food), and teachers should build on their intuitive notions. By experimenting with light, heat, and sound, students can begin to understand that energy can be observed, measured, and controlled without requiring them to memorize technical definitions. (*National Science Education Standards*, p. 126)

Energy is a mysterious concept even though its various forms can be precisely defined and measured. People in general are likely to think of energy as a substance, with flow and conservation analogous to that of matter. Although learning about energy does not make it much less mysterious, it is worth trying to understand because a wide variety of scientific explanations are difficult to follow without some knowledge of the concept of energy. 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. At the simplest level, children can think of energy as something needed to make things go, run, or happen. (*Benchmarks for Science Literacy*, p. 81)

Students most likely made music from the first day in school, and this provides an opportunity to introduce vibrations as a phenomenon that can be observed. With drums, bells, stringed instruments, and their own voices, students can feel vibrations as they hear sounds. These experiences help students know that things make sound vibrate (*Benchmarks for Science Literacy*, p. 89).

*Making Sense of Secondary Science* states that the scientific concept of energy is above the developmental level of grade 2 students. Second graders tend to describe energy in terms of force (or drive), using ideas they have gained from their everyday experiences. Children often believe fuel “contains” or is “a source of” energy. (pp. 143–147)

## Notes About Resources and Materials

### Websites

- <http://streaming.discoveryeducation.com/index.cfm> (Discovery Education)
- [www.fossweb.com](http://www.fossweb.com)
- [www.primaryresources.co.uk/online/solids4.swf](http://www.primaryresources.co.uk/online/solids4.swf)
- [www.Teacherz-pet.co.uk/?p=2372](http://www.Teacherz-pet.co.uk/?p=2372)
- [http://teacher.scholastic.com/activities/studyjams/matter\\_states](http://teacher.scholastic.com/activities/studyjams/matter_states) (Scholastic website)
- [www.gamequarium.org/cgi-bin/search/linfo.cgi?id=7685](http://www.gamequarium.org/cgi-bin/search/linfo.cgi?id=7685) (Bill Nye Phases of Matter video)
- [www.fossweb.com/modulesK-2/SolidsandLiquids/index.html](http://www.fossweb.com/modulesK-2/SolidsandLiquids/index.html) (Change It website)

### Trade Books

- Curry, D. (2005). *What is Matter*. Danbury, CT: Children’s Press.
- Garret, G. (2005). *Solids, Liquids, and Gases*. Danbury, CT: Children’s Press.
- Modell, F. (1988). *Ice Cream Soup*. Greenwillow.  
Two friends plan their own birthday party, but the ice cream and cake will not cooperate. After making cocoa ice, children will understand what the characters forgot to do.
- Berger, M. (1993). *Make Mine Ice Cream*. Doubleday.  
A Big Book and teaching guide are also available.

### Videos

- The Magic School Bus at the Waterworks

Grade 2 Science, Quarter 2, Unit 2.2  
**Force and Motion**

**Overview**

**Number of instructional days:** 10 (1 day = 40 minutes)

**Content to be learned**

- Show how pushing/pulling moves or does not move an object.
- Predict the direction an object will or will not move if a force is applied to it.
- Show that different objects fall to Earth unless something is holding them up.

**Science processes to be integrated**

- Use data to predict how a change in force (greater/less) might affect the position, direction of motion, or speed of an object (e.g., ramps and balls).
- Identify and describe the structures found in a simple system (e.g., the structures in a ramp system could include a ball, ramp, and surface).
- Observe and describe patterns of change within a simple system.
- Demonstrate safe practices during classroom and field investigations.
- Use scientific processes such as making predictions, recording observations, conducting investigations, and collecting and analyzing data.

**Essential questions**

- How do forces (pushes and pulls) affect objects?
- How can you change the direction of a moving object?
- What effect does gravity have on objects?

## Written Curriculum

### Grade-Span Expectations

#### PS 3 - The motion of an object is affected by forces.

##### *PS3 (K-4)-INQ+SAE –7*

*Use data to predict how a change in force (greater/less) might affect the position, direction of motion, or speed of an object (e.g., ramps and balls).*

##### **PS3 (K-2) –7 Students demonstrate an understanding of motion by...**

**7a** showing how pushing/pulling moves or does not move an object.

**7b** predicting the direction an object will or will not move if a force is applied to it.

##### **Students demonstrate an understanding of force by...**

**7c** showing that different objects fall to earth unless something is holding them up.

### Clarifying the Standards

#### *Prior Learning*

In kindergarten, students demonstrated an understanding of motion by showing how pushing and pulling moves or does not move an object, and they predicted the direction an object will or will not move if a force is applied to it. Students also demonstrated an understanding of magnetic force by observing and sorting objects that are and are not attracted to magnets.

In grade 1, students demonstrated an understanding of motion by showing how pushing and pulling moves or does not move an object, and they predicted the direction an object will or will not move if a force is applied to it. They demonstrated an understanding of force by showing that different objects fall to Earth unless something is holding them up. Students also demonstrated an understanding of magnetic force by observing and sorting objects that are and are not attracted to magnets.

#### *Current Learning*

At the reinforcement level of instruction, second graders show how pushing and pulling moves or does not move an object and predict the direction an object will or will not move if a force is applied to it. Students also show that things near Earth fall to the ground unless something holds them up.

When learning about force and motion, students should see that things move in many different ways (e.g., straight, zigzag, round and round, back and forth, fast and slow). They need multiple opportunities to investigate and explain that different amounts of force can change the direction and/or speed of an object in motion. In addition, they need opportunities to conduct investigations to observe that there is a force that causes objects fall to Earth unless something is holding them up.

During this unit of study, students can

- act out the pushing and pulling of objects and record observations on a class T-Chart labeled “Push or Pull.”

- observe, describe, record, and discuss different types of motion and how different objects move in different ways. Some examples include tops, cars, balls, coins, cans, and blocks.
- apply force to various objects to determine the direction objects take when in motion. For example, using a whiffle ball on a string, students can demonstrate the direction of straight, back and forth, and round and round.
- squeeze a turkey baster's bulb and direct the air at a cotton ball so that it moves. Students conclude that they were able to move the cotton ball longer or shorter distances depending on how much force they applied when they squeezed the bulb. In addition, students can observe that forces can be applied without touching an object.
- hold two objects at the same height and drop them at the same time to see which one hits the floor first. Similar to air, students can observe the effect of a force (gravity) on an object from a distance.

### *Future Learning*

In grades 3 and 4, students will demonstrate an understanding of motion by predicting the direction and describing the motion of objects of different weights, shapes, and sizes if a force is applied to it, and by describing change in position relative to other objects or background. Students will demonstrate an understanding of force by investigating and describing that different amounts of force can change direction and/or speed of an object in motion and by conducting experiments to demonstrate that different objects fall to Earth unless something is holding them up. They will also show and describe that heat can be produced by friction. Students will demonstrate an understanding of magnetic force by using prior knowledge and investigations to predict whether an object will be attracted to a magnet. Students will describe what happens when like and opposite poles of a magnet are placed near each other and will explore relative strength of magnets (e.g., size of magnets, number of magnets, properties of materials).

### **Additional Findings**

Young children have a difficult time understanding a complex concept such as energy. Students have intuitive notions of energy (e.g., energy is needed to get things done, humans get energy from food), and teachers should build on their intuitive notions. By experimenting with light, heat, and sound, students can begin to understand that energy can be observed, measured, and controlled without requiring them to memorize technical definitions. (*National Science Education Standards*, p. 126)

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## Notes About Resources and Materials

### Trade Books

- Barton, B. (1997). *Machines at Work*. HarperCollins Juvenile Books.
- Bradley, K. (2005). *Forces Make Things Move*. New York, NY: Harper Collins.
- Branley, F. (2007). *Gravity is a Mystery*. New York, NY: Harper Collins.
- Fowler, A. (2001). *Rookie Read-About Science: Simple Machines*. Children’s Press.
- Knapp, B. (2002). *Forces in Action*. United Kingdom: Atlantic Europe Publishing Co.
- Macaulay, D. (2000). *The Way Things Work*. DK Publishing.
- Nankivell-Aston, S., & Jackson, D. (2000). *Science Experiments with Simple Machines*. Orchard Books.
- Mason, A. (2005). *Move it! Motion, Forces and You*. Toronto, Canada: Kids Can Press.
- Wells, R. (1996). *How Do You Lift a Lion?* Albert Whitman & Co.

### Videos

- The Magic School Bus Gains Weight
- The Magic School Bus Plays Ball

### Websites

- [www.discoveryeducation.com](http://www.discoveryeducation.com)
- <http://classroom.jc-schools.net/sci-units/force.htm#2>
- [www.bbc.co.uk/schools/scienceclips/ages/5\\_6/pushes\\_pulls\\_fs.shtml](http://www.bbc.co.uk/schools/scienceclips/ages/5_6/pushes_pulls_fs.shtml)