Grade 3 Science, Quarter 2, Unit 2.1

The Sun, Moon, and Stars

Overview

Number of instructional days: 7 (1 day = 45 minutes)

Content to be learned

- Observe that the sun, moon, and stars appear to move slowly across the sky.
- Observe that the moon looks slightly different from day to day, but it looks the same again in about four weeks.
- Recognize that throughout history people have identified patterns of stars called *constellations*.

Science processes to be integrated

- Identify the parts of a system.
- Observe and describe how objects interact within the system.
- Observe and collect data over time.
- Examine data to determine patterns of change over time.

Essential questions

- How does the appearance of the moon change over time?
- How does the appearance of the sun change throughout the day?
- What patterns of change can you observe in the stars over time?

Written Curriculum

Grade-Span Expectations

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

ESS2 - The earth is part of a solar system, made up of distinct parts that have temporal and spatial interrelationships.

No further targets for EK ESS2 at the K-4 Grade Span

ESS2 (3-4)-7 Students demonstrate an understanding of temporal or positional relationships between or among the Earth, sun, and moon by …

7a observing that the sun, moon, and stars appear to move slowly across the sky.

7b observing that the moon looks slightly different from day to day**,** but looks the same again in about 4 weeks.

ESS3 - The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.

No further targets for EK ESS3 at the K-4 Grade Span

The GSEs listed below are assessed at the local level only

ESS3 (3-4)-9 Students demonstrate understanding of processes and change over time within the system of the universe (Scale, Distances, Star Formation, Theories, Instrumentation) by…

9a recognizing that throughout history people have identified patterns of stars that we call constellations.

Clarifying the Standards

Prior Learning

In grades K–2, students demonstrated an understanding of temporal or positional relationships between or among the Earth, sun and moon by observing that the sun can only be seen in the daytime, but the moon can be seen both during the day and at night. They observed that the sun and moon appear to move slowly across the sky and that the moon looks slightly different from day to day. Students demonstrated understanding of the processes and change over time within the system of the universe by observing that there are more stars in the sky than can easily be counted, but they are not scattered evenly and not all the same in brightness. Students also identified the sun as a source of heat energy.

Current Learning

Like the primary grades, students in grade 3 focus on using direct observations of the objects in the sky to describe patterns of change that occur over time. At the reinforcement level of instruction, students observe that the sun and moon appear to move across the sky and that the moon looks slightly different from day to day. At the developmental level through the reinforcement level of instruction, students

observe that the stars, similar to the sun and moon, appear to move slowly across the sky and that even though the moon looks slightly different from day to day, it looks the same again in about four weeks. Students at this level do not need to learn to name the various phases of the moon. They simply should recognize and describe the pattern of change that occurs approximately every four weeks. It is appropriate, however, to introduce common terms such as *full moon, quarter moon, new moon*, and *constellation* during this unit of study.

Students will also recognize that throughout history people have identified patterns of stars called *constellations*. It is important that students have enough opportunities to observe the stars in the night sky to recognize that as they observe the apparent motion of the stars across the night sky, the stars do not move independent of one another. Rather, the entire system of stars appears to move across the night sky. Additionally, students should recognize that the pattern of stars appear to move across the sky nightly as well as seasonally. In addition to direct observations of the night sky, students can observe constellations through videos, websites, and/or visits to a planetarium. This concept is new to grade 3 and will not be revisited in grade 4; therefore, it should be taught from the developmental level to the drill-and-practice level of instruction.

Students use science process skills as they make observations of the sun, moon, and stars to describe how they appear to change over time. Although this unit only lasts seven days, students should keep a moon log for approximately one month to observe and record the changes that occur in the appearance of the moon over time. At the end of the month, students discuss the data collected to recognize that the moon follows a pattern of change over four weeks. Students should describe the patterns that they notice in their science journals and should have opportunities to use these patterns to make predictions about what the moon will look like at a future point in time. In addition, students need guidance for their observations of the night sky, since this must occur at home. Teachers should put together an observation packet that includes information for parents as well as recording sheets for students to guide their observations of the moon and stars at night.

Future Learning

In grade 4, students will observe that the moon looks slightly different from day to day, but it looks the same again in about four weeks; they will recognize that the rotation of the Earth on its axis every 24 hours produces the day/night cycle. Students will recognize that it takes approximately 365 days for the Earth to orbit the sun. They will also recognize that the sun is the center of our solar system, the Earth is one of several planets that orbits the sun, and the moon orbits the Earth.

In grades 5 and 6, students will demonstrate an understanding of the characteristics of the solar system by identifying and comparing the size, location, distances, and movement of the objects in our solar system, and they will compare the composition, atmosphere, and surface features of objects in our solar system. Students will demonstrate an understanding of temporal or positional relationships between or among the Earth, sun, and moon by using models to describe the relative motion/position of the Earth, sun and moon. Students will explain night, day, seasons, year, and tides as a result of the regular and predictable motion of the Earth, sun, and moon. Students will recreate the phases of the moon using models of the Earth, sun, and moon, and they will define the Earth's gravity as a force that pulls any object on or near the Earth toward its center without touching it. Students will demonstrate an understanding of the structure of the universe by describing the apparent motion/position of the objects in the sky (e.g., constellations and planets), and they will identify the sun as a medium-sized star located near the edge of a disk-shaped galaxy of stars.

Additional Findings

In addition to the concepts mandated by the GSEs, students in grades 3–5 should understand that the sun is a star and that some stars are smaller and some larger than the sun. However, the stars are so much farther away that they look like points of light. (*Atlas of Science Literacy, Vol. 1*, p. 49) Students should also learn that a large light source at a great distance looks like a small light source that is much closer; this phenomenon should be observed directly outside at night. (*Benchmarks for Science Literacy*, p. 63)

According to *National Science Education Standards,* by observing the night sky regularly, children in grades K–4 learn to identify sequences of changes and look for patterns in these changes. As they observe changes (e.g., the movement of an object's shadow during the course of a day, the positions of the sun and moon), they find the patterns in these movements. They can draw the moon's shape for each evening on a calendar and then determine the pattern in the shapes over several weeks. These understandings should be confined to observations, descriptions, and finding patterns. Attempting to extend this understanding into explanations using models is limited by the inability of young children to understand that the Earth is approximately spherical. They also have little understanding of gravity and usually have misconceptions about the properties of light that allow you to see objects such as the moon. (pp. 130 and 134).

Students may have a number of misconceptions about the shape of the Earth, its relationship to the sun and moon, and the cause of day and night. Some of these misconceptions may include that the Earth is flat, the Earth is round like a plate, people live inside the Earth or on the top half of the Earth, the sun hides or turns off, and the sun is hidden by clouds, the moon, or darkness at night. In addition, many children have a lack of understanding regarding the relative sizes and distances between the Earth, sun, and moon. These misconceptions may be compounded by the models used in class and by the diagrams found in books, which do not use true scale for size and distance. (*Making Sense of Secondary Science*, pp. 169–171)

According to *Benchmarks for Science Literacy*, students must understand the concept of light reflection and how the moon gets its light from the sun before they can understand the phases of the moon. Students may not be able to understand explanations of this phenomenon before they reasonably understand the relative size, motion, and distance of the sun, moon, and Earth. (p. 336)

Notes About Resources and Materials

Websites

- www.neok12.com/moon.htm
- www.kidsastronomy.com/astroskymap

Grade 3 Science, Quarter 2, Unit 2.2

Properties of Solids, Liquids, and Gases

Overview

Number of instructional days: 7 (1 day = 45 minutes)

Content to be learned

- Identify, compare, and sort objects by different or similar physical properties such as size, shape, color, texture, smell, weight, temperature, and flexibility.
- Collect and organize data about physical properties to classify objects or draw conclusions about objects and their characteristic properties.
- Cite evidence to support conclusions about why objects are or are not grouped together.
- Describe properties of solids, liquids, and gases.
- Identify and compare solids, liquids, and gases.

Science processes to be integrated

- Identify, describe, compare, and sort objects using physical properties.
- Use scientific tools to observe physical properties.
- Demonstrate safe practices during classroom investigations.
- Use scientific processes to conduct investigations, make and record observations, organize and analyze data, communicate findings, cite evidence, and draw conclusions.
- Use data to classify materials.

Essential questions

- How are gases different from solids and liquids?
- What similarities and differences can be observed between liquids and solids?
- In what ways can you group or exclude objects? Why?

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 (3-4)–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, temperature, flexibility).

1b citing evidence (e.g., prior knowledge, data) to support conclusions about why objects are grouped/not grouped together.

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 …

2a describing properties of solids, liquids, and gases.

2b identifying and comparing solids, liquids, and gases.

Clarifying the Standards

Prior Learning

In grades K–2, students identified, compared, and sorted objects by similar or different physical properties (e.g., size, shape, color, texture, smell, weight) and recorded observations and data about physical properties. Students used simple tools such as balance scales to explore the property of weight, and they used attributes of properties to state why objects are grouped together. Students described properties of solids and liquids, and they identified and compared solids and liquids. Students also made logical predictions about the changes in the state of matter when adding or taking away heat.

Current Learning

In grade 3, students identify, compare, and sort objects by similar or different physical properties (including size, shape, color, texture, smell, weight, temperature, and flexibility), and they cite evidence to support conclusions about why objects are or are not grouped together. Students describe properties of solids, liquids, and gases, and they identify and compare solids, liquids, and gases. Most portions of these concepts were addressed in previous grade levels, and they are taught at a reinforcement level of instruction. However, the portions that are new to this grade level must be taught at the developmental level to reinforcement level of instruction. This includes identifying comparing and sorting objects using

the physical properties of temperature and flexibility; describing the properties of gases; and identifying and comparing gases to other forms of matter.

During this unit of study, students use scientific tools such as hand lenses and thermometers to gather data and classify objects. Because students have prior experience with the concepts in this unit, teachers can build on students' previous learning to introduce the physical properties of flexibility and temperature. For example, a variety of objects/materials can be used (e.g., clay, wood, paper, rubber, plastic) to investigate flexibility as well as other physical properties. When learning about gases, teachers can again use students' prior experiences with solids and liquids to introduce gases. Once students understand the characteristics of each state of matter, they can sort a given set of items as solids, liquids, or gases. To assess their understanding, students can be asked to classify difficult substances such as powder, sugar crystals, and sand, which are collections of solids but have similar characteristics to liquids (i.e., they pour). Students should cite evidence and provide an explanation to support their work.

Future Learning

Students will apply the knowledge acquired in this unit to a subsequent grade 3 unit addressing physical changes in matter. Third graders will observe and describe physical changes and make logical predictions about the changes in the state of matter when adding or taking away heat. Students will describe how heat moves from warm objects to cold objects until both objects are the same temperature, and they will show that heat moves from one object to another, causing temperature change.

In grade 4, students will demonstrate an understanding of physical changes by observing and describing physical changes (e.g., freezing, thawing, torn piece of paper). They will make logical predictions about the changes in state of matter when adding or taking away heat (e.g., ice melting, water boiling or freezing, condensation/evaporation) and will demonstrate an understanding of conservation of matter by measuring the weight of objects to prove that all matter has weight. Students will use measures 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.

In grades 5 and 6, students will demonstrate an understanding of characteristic properties of matter by comparing the masses of objects of equal volume made of different substances. Students will recognize that different substances have properties that allow them to be identified regardless of the size of the sample and will classify and compare substances using characteristic properties. They will demonstrate an understanding of conservation of matter by explaining that regardless of how parts of an object are arranged, the mass of the whole is always the same as the sum of the masses of its parts. Students will demonstrate an understanding of states of matter by differentiating among the characteristics of solids, liquids, and gases and by predicting the effects of heating and cooling on the physical state, volume, and mass of a substance. They will demonstrate an understanding of the structure of matter by distinguishing between solutions, mixtures, and "pure" substances (i.e., compounds and elements). Students will demonstrate an understanding of heat energy by identifying real-world applications where heat energy is transferred and showing the direction that the heat energy flows.

Additional Findings

Physical science during the elementary years includes topics that give students a chance to increase their understanding of the characteristics of objects and materials that they encounter daily. Through the observation, manipulation, and classification of common objects, they 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. 123)

In grades 3–5, the study of materials should continue and become more systematic and quantitative. Objects and materials can be described by more sophisticated properties. Students should measure, estimate, and calculate sizes, capacities, and weights. If young children cannot feel the weight of something, they may believe it to have no weight at all. Many experiences weighing (if possible on increasingly sensitive balances) help, including weighing piles of small things and dividing to find the weight of each. It is not obvious that the wholes weigh the same as the sum of their parts. That idea is preliminary to, but far short of, the conservation principle to be learned later that weight does not change in spite of striking changes in other properties as long as all the parts are accounted for. With magnifiers, students should inspect substances composed of large collections of particles (e.g., salt, talcum powder) to discover the unexpected details at smaller scales. They should also observe and describe the behavior of large collections of pieces—powders, marbles, sugar cubes, or wooden blocks (which can be "poured" out of a container) —and consider that the collections may have properties that the pieces do not. (*Benchmarks for Science Literacy*, p. 76)

Research indicates that younger children tend to regard any rigid material as a solid, any powder as a liquid, and any nonrigid material (e.g., sponge, cloth) as intermediate between a solid and liquid. Students explain that powders are liquids because they can be poured and that nonrigid materials are neither solid nor liquid because they are soft and can be torn or crumbled. Teachers can encourage the development of the idea that a powder is composed of small pieces of solid by using hand lenses and hand-held microscopes so that students can observe the particles that make up powders. Students often identify a liquid as a material that is "runny" or "can be poured." Consequently, some children find the task of classifying more viscous liquids such as paste, honey, and tomato sauce to be more problematic than classifying runny ones. (*Making Sense of Secondary Science*, pp. 79–80)

Several researchers have found that students do not initially appear aware that air and other gases do not possess material character. Later, as students begin to develop an awareness of the properties of gases, many still do not regard gases as having mass or weight. Research suggests that this is because children's most common related experience is that gases tend to rise or float. This view is supported by studies that show that children (ages 9–13) tend to predict that gases have the property of negative weight and hence that the more gas that is added to a container the lighter the container becomes. (*Making Sense of Secondary Science*, p. 80)

Notes About Resources and Materials

Websites

- www.scientificamerican.com/article.cfm?id=oobleck-bring-science-home

Grade 3 Science, Quarter 2, Unit 2.3

Physical Change

Overview

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

Content to be learned

- Observe and describe physical changes in matter (e.g., melting, boiling, freezing).
- Make logical predictions about the changes in the states of matter when adding or taking away heat (e.g., water boiling).
- Show that heat moves from one object to another, causing temperature change.
- Describe how heat moves from warm objects to cold objects until both are the same temperature.

Science processes to be integrated

- Make and record observations to describe change over time.
- Use scientific tools to measure and gather data.
- Make predictions based on investigations.
- Observe, describe, and explain how objects and energy interact within systems.
- Demonstrate safe practices during classroom investigations.
- Cite evidence and draw conclusions based on investigations.

Essential questions

- When an object is heated or cooled, what physical changes occur?
- How does heat transfer or move from one object to another?
- When heat is transferred from one object to another, what happens to the temperature of both objects?

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 (3-4)–1 Students demonstrate an understanding of characteristic properties of matter by…

Students demonstrate an understanding of physical changes by …

1c observing and describing physical changes (e.g. freezing, thawing, ~~torn piece of paper~~).

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~~).

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 (3-4)–6 Students demonstrate an understanding of energy by…

6a describing how heat moves from warm objects to cold objects until both objects are the same temperature.

6b showing that heat moves from one object to another causing temperature change (e.g., when land heats up it warms the air).

Clarifying the Standards

Prior Learning

In grades K–2, students identified, compared, and sorted objects by similar or different physical properties (e.g., size, shape, color, texture, smell, weight) and recorded observations and data about physical properties. Students used simple tools such as balance scales to explore the property of weight, and they used attributes of properties to state why objects are grouped together. Students described properties of solids and liquids, identified and compared solids and liquids, and made logical predictions

about the changes in the state of matter when adding or taking away heat. They explained that the sun warms land and water and that objects change in temperature by adding or subtracting heat.

In the previous unit of study, students identified, compared, and sorted objects by similar or different physical properties (including size, shape color, texture, smell, weight, temperature, and flexibility), and they cited evidence to support conclusions about why objects are or are not grouped together. Students described properties of solids, liquids, and gases, and they identified and compared solids, liquids, and gases.

Current Learning

During this unit of study, third graders make logical predictions about the changes in the state of matter when adding or taking away heat; this is taught at the reinforcement level of instruction. At the developmental level of instruction, students observe and describe physical changes in matter such as freezing or thawing. They describe how heat moves from warm objects to cold objects until both objects are the same temperature and show that heat moves from one object to another, causing temperature change. While learning the content in this unit, students' observations should initially focus on how heat energy causes change to matter and then on how heat energy transfers from warmer to colder objects. Students should make and record observations, using tools such as thermometers and hand lenses to gather data (including changes in state of matter and changes in temperature). Students should use drawings and writing to describe the changes they observe and should cite evidence when drawing conclusions about the interaction between heat and matter.

In the classroom, students can use thermometers and observe the effects of adding and removing heat to/from water. For example, students should experience changes to water caused by adding and taking away heat, including freezing, melting, and boiling. Teachers should use demonstrations when safety is an issue, but students need opportunities to directly investigate and measure changes in temperature caused by the addition or subtraction of heat. For example, students can safely apply heat to crayon shavings, butter pats, chocolate chips, ice, or water using heating pads, sunlight, or a warm ceramic hot plate closely monitored by the teacher. With multiple opportunities to investigate these types of phenomena, students should be able to make predictions about the physical changes in matter when heat is added or removed.

While conducting these types of investigations, third graders also begin to describe heat transfer. Students can use evidence to explain how heat transfers from a source of heat (e.g., heating pad) to an object (e.g., chocolate chips), causing the object to begin to soften and melt. It is also important to provide additional experiences such as having students place one hand in warm water and one in cold water simultaneously and then taking both hands and putting them in room temperature water. This gives students direct experience with heat transfer. Students should understand that heat is leaving, or transferring from, the warm hand to warm the room temperature water and heat from the room temperature water is warming (or transferring to) the cool hand, ultimately balancing the temperature of the water and their hands. Another experiment to demonstrate heat transfer is to submerge a vial of warm, colored water into cold water to observe how the warm water disperses into cold until they are the same temperature. These kinds of experiences help students begin to understand that heat moves from warmer objects to colder objects until both are the same temperature.

Future Learning

In the subsequent unit of study, third graders will apply their understanding of evaporation and condensation to weather-related concepts. Students will make logical predictions about the changes in the state of matter when adding or taking away heat (condensation and evaporation). They will describe water

as it changes into vapor in the air and reappears as a liquid when it is cooled and will explain how the water cycle relates to weather and the formation of clouds.

In grade 4, students will demonstrate an understanding of physical changes by observing and describing physical changes (e.g., freezing, thawing, torn piece of paper). They will make logical predictions about the changes in state of matter when adding or taking away heat (e.g., ice melting, water boiling or freezing, condensation/evaporation) and will demonstrate an understanding of conservation of matter by measuring the weight of objects to prove that all matter has weight. Students will use measures 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.

In grades 5 and 6, students will demonstrate an understanding of characteristic properties of matter by comparing the masses of objects of equal volume made of different substances. They will recognize that different substances have properties that allow them to be identified regardless of the size of the sample and will classify and compare substances using characteristic properties. Students will demonstrate an understanding of conservation of matter by explaining that regardless of how parts of an object are arranged, the mass of the whole is always the same as the sum of the masses of its parts. Students will demonstrate an understanding of states of matter by differentiating among the characteristics of solids, liquids, and gases and by predicting the effects of heating and cooling on the physical state, volume, and mass of a substance. They will demonstrate an understanding of the structure of matter by distinguishing between solutions, mixtures, and "pure" substances (i.e., compounds and elements). Students will demonstrate an understanding of heat energy by identifying real-world applications where heat energy is transferred and showing the direction that the heat energy flows.

Additional Findings

Young children begin their study of matter by examining and qualitatively describing objects and their behavior. The important but abstract ideas of science (e.g., atomic structure of matter, the conservation of energy) all begin with observing and keeping track of the way the world behaves. When carefully observed, described, and measured, the properties of objects, changes in properties over time, and the changes that occur when materials interact provide the necessary precursors to the later introduction of more abstract ideas in the upper grade levels. (*National Science Education Standards*, p. 126)

Students are familiar with the change of state between water and ice, but the idea of liquids having a set of properties is more nebulous and requires more instructional effort that working with solids. Most students have difficulty with the generalization that many substances can exist as either a liquid or solid. K–4 students do not understand that water exists as a gas when it boils or evaporates; they are more likely to think that water disappears or goes into the sky. Despite that limitation, students can conduct simple investigations with heating and evaporation that develop inquiry skills and familiarize them with the phenomena. Students should understand that objects have many observable properties, including size, weight, shape, color, temperature, and the ability to react with other substances. Those properties can be measured using tools such as rulers, balances, and thermometers. Materials can exist in different states—solid, liquid, and gas. Heating or cooling can change some common materials such as water from one state to another. (*National Science Education Standards*, p. 126)

When investigating physical changes, children should learn to write clear descriptions of what they observe. They should subject materials to treatments such as mixing, heating, freezing, cutting, wetting, dissolving, and bending to see how they change. Students should also be encouraged to describe what they did and how materials responded to the physical changes. (*Benchmarks for Science Literacy*, p. 76) Students need multiple opportunities to physically change objects in order to observe the effect on the

physical properties of those objects. In other words, students should be asked if the physical properties of an object change or remain the same when an object undergoes a physical change (e.g., when the shape of a ball of clay is changed, the color and mass of the clay remains the same).

According to *Making Sense of Secondary Science*, heat is one of the most confusing scientific concepts for many students. They tend to think of heat as a substance that flows from place to place, similar to air. Students do not necessarily think of hot and cold as part of the same continuum. Rather, they perceive these as two different phenomena, with cold often thought to be the opposite of heat. Distinguishing between heat and temperature is also one of the most difficult tasks for children. They tend to view temperature as the mixture of heat and cold inside an object or simply as a measure of the amount of heat possessed by that object, with no distinction between the intensity of heat and the amount of heat possessed. Misconceptions regarding heat include that cold—rather than heat—is transferred and that objects that keep you warm (e.g., mittens and sweaters) are sources of heat. (p. 138)

Therefore, investing much time and effort in developing formal energy concepts can wait. The importance of energy, after all, is that it is a useful idea. It helps make sense out of a very large number of things that go on in the physical, biological, and engineering worlds. The one aspect of energy that students in grades 3–5 can make sense of is heat, which is produced almost everywhere. In their science activities during these years, students should be alerted to look for things and processes that give off heat and those that do not give off heat. In addition, the time is appropriate to explore how heat spreads from one place to another and what can be done to contain it or shield things from it. (*Benchmarks for Science Literacy*, p. 83)

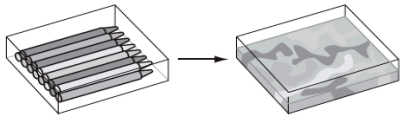
Students' ideas about heat may not always be correct. In some situations, students may think that cold is transferred rather than heat. They may believe that some materials are intrinsically warm (blankets) or cold (metals). Objects that keep things warm such as sweaters or mittens may be thought to be sources of heat. Only a continuing mix of experiment and discussion is likely to dispel these ideas. In addition, students in grades 3–5 do not necessarily need to understand heat or its difference from temperature. Students should, however, become familiar with the warming of objects that start out cooler than their environment, and vice versa. Because many students think of cold as a substance that spreads like heat, there may be some advantage in translating descriptions of transfer of cold into terms of transfer of heat. (*Benchmarks for Science Literacy*, pp. 83 and 84)

Notes About Resources and Materials

Websites

- http://lhsfoss.org/fossweb/schools/teachervideos/index.html
- NECAP released items, such as the following, can be found at http://www.ride.ri.gov/assessment/necap_releaseditems.aspx

4 On Day 1, a tray of crayons is left inside a car on a hot afternoon. On Day 2, the temperature is cool. The crayons form one piece of solid wax that takes the shape of the tray.



Day 1 Day 2

a. Explain how the crayons formed one piece of solid wax.

b. Explain why the crayons took the shape of the tray.