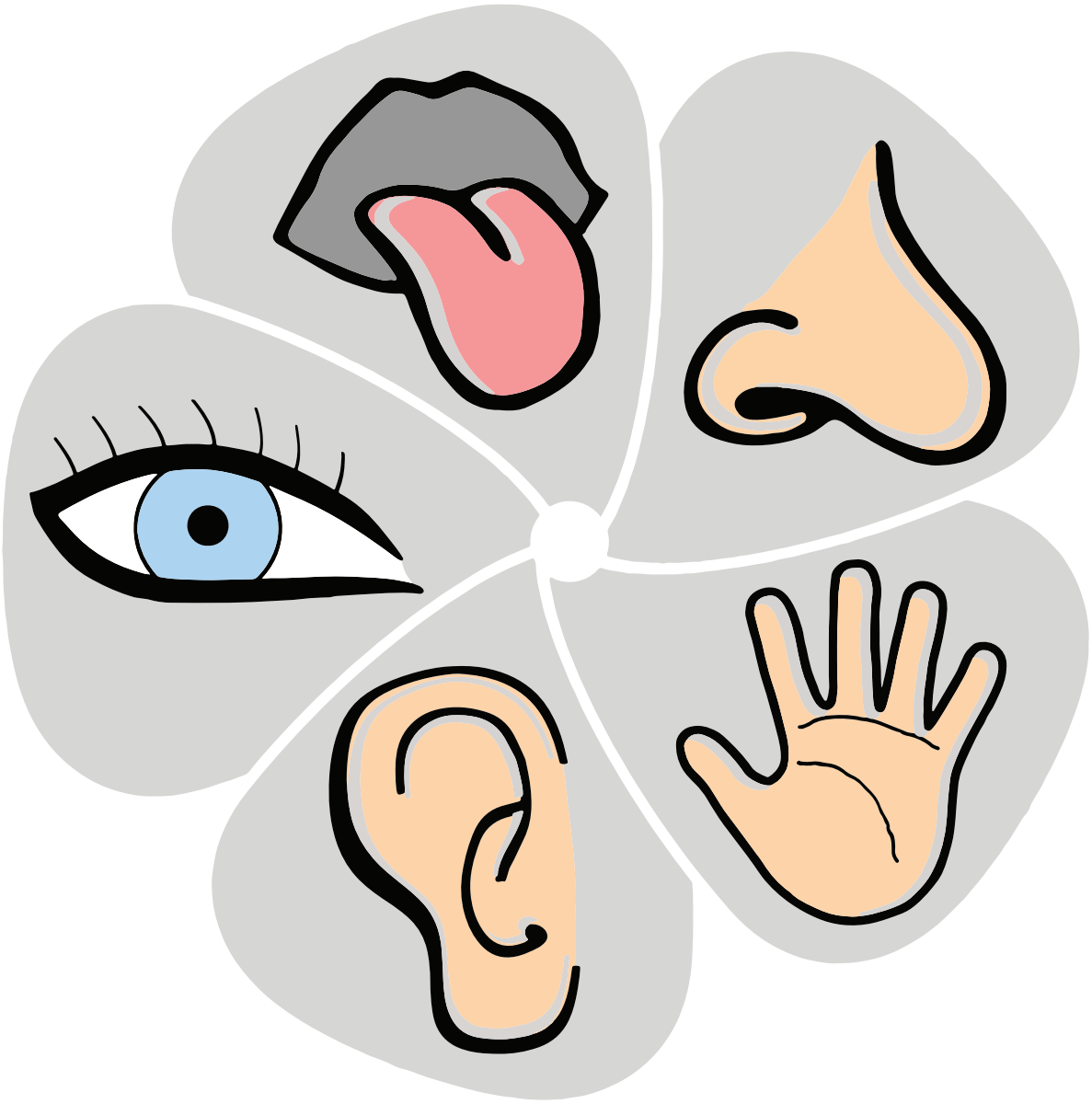
mosaic

an integrated approach to
mathematics, science, technology, & language

Kindergarten

Energize Your Five Senses



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MOSAIC: An Integrated Approach to Mathematics, Science, Technology, and Language represents a significant revision and update of *Integrating Mathematics, Science, and Language: An Instructional Program* (Paso Partners), produced in 1993 by Betty J. Mace-Matluck and Norma G. Hernandez, and developed by a partnership of three public schools, an institution of higher education, and SEDL specialists.

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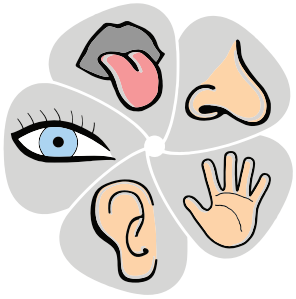


Energize Your Five Senses

Introduction

This lesson on energy is one part of a K–5 instructional cross-curriculum program that integrates science, mathematics, and technology applications. The concepts in the lesson support the implementation of the 2010–2011 Texas Essential Knowledge and Skills (TEKS) as well as the Texas English Language Proficiency Standards (ELPS). The ELPS provide guidance for teachers working with English learners in the core content areas.

The cross-curricular integration in this lesson includes inquiry-based activities to engage students with content while teaching higher-order thinking skills and facilitating understanding of the connections among math, science, and technology. *The National Science Education Standards* (National Research Council, 1996) describes inquiry-based instruction as "the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world" (p. 23). Inquiry-based instruction must be carefully structured to ensure that students engage in investigations that deepen and expand their scientific knowledge as well as develop their scientific habits of mind. In *A Framework for K–12 Science Education* (2012), the National Research Council has redefined "inquiry" as "scientific and engineering practices." To promote such practices, teachers should provide learning experiences that engage students with fundamental questions and guide them in how to find the answers.

In addition to the integration of math, science, and technology, this module provides a list of related reading resources that may be used during reading or storytelling time. The books could also be used as an additional resource during the investigations and group activities. You may want to consult with the school librarian or a local community library to reserve as many of these books as possible for use during this module.

Language Objectives for English Learners

Effective instruction in second language acquisition involves giving ELs opportunities to listen, speak, read, and write at their current levels of English development while gradually increasing the linguistic complexity of the English they read and hear and are expected to speak and write. The ELPS and Texas English Language Proficiency Assessment System (TELPAS) define four English language proficiency levels: beginning, intermediate, advanced, and advanced high. These levels are not grade-specific, although there is a grade band for grades K–1 and a second for grades 2–12. ELs also may exhibit different proficiency levels within the language domains of listening, speaking, reading, and writing. The proficiency level descriptors outlined in the chart below show the progression of second language acquisition from one proficiency level to the next for each language domain. These descriptors serve as a road map to help content-area teachers instruct ELs in ways that are commensurate with students' linguistic needs.

ELPS-TELPAS Proficiency Descriptors

	Beginning	Intermediate	Advanced	Advanced High
Listening	Beginning English learners (ELs) have little or no ability to understand spoken English used in academic and social settings.	Intermediate ELs have the ability to understand simple, high-frequency spoken English used in routine academic and social settings.	Advanced ELs have the ability to understand, with second language acquisition support, grade-appropriate spoken English used in academic and social settings.	Advanced high ELs have the ability to understand, with minimal second language acquisition support, grade-appropriate spoken English used in academic and social settings.
Speaking	Beginning English learners (ELs) have little or no ability to speak English in academic and social settings.	Intermediate ELs have the ability to speak in a simple manner using English commonly heard in routine academic and social settings.	Advanced ELs have the ability to speak using grade-appropriate English, with second language acquisition support, in academic and social settings.	Advanced high ELs have the ability to speak using grade-appropriate English, with minimal second language acquisition support, in academic and social settings.
Reading	Beginning English learners (ELs) have little or no ability to use the English language to build foundational reading skills.	Intermediate ELs have a limited ability to use the English language to build foundational reading skills.	Advanced ELs have the ability to use the English language, with second language acquisition support, to build foundational reading skills.	Advanced high ELs have the ability to use the English language, with minimal second language acquisition support, to build foundational reading skills.
Writing	Beginning English learners (ELs) have little or no ability to use the English language to build foundational writing skills.	Intermediate ELs have a limited ability to use the English language to build foundational writing skills.	Advanced ELs have the ability to use the English language, with second language acquisition support, to build foundational writing skills.	Advanced high ELs have the ability to use the English language, with minimal second language acquisition support, to build foundational writing skills.

From: *Educator Guide to TELPAS: Grades K–12* (pp. 15, 22, 30, 40, 78, 84) by Texas Education Agency (TEA), Student Assessment Division, 2011, Austin, TX: TEA. Copyright 2011 by TEA. Available from **http://www.tea.state.tx.us/student.assessment/ell/telpas**. Adapted by SEDL with permission.

The 5E Lesson Cycle

The 5E lesson cycle provides a structure for implementing learning activities that elicit and build on students' existing knowledge to expand and deepen their understanding of that knowledge. Each of the 5Es describes a phase of learning: Engage, Explore, Explain, Elaborate, and Evaluate. The lesson cycle should be implemented in its entirety, and educators should avoid pulling selected activities and using them in a piecemeal fashion. The 5Es are designed to introduce and develop deeper conceptual understanding in a carefully constructed sequence.

The ELPS are embedded into the 5E lesson cycle to provide strategies and techniques for teachers to use as they shelter science and mathematics content and academic English.

1 ENGAGE

The introduction to the lesson should capture the students' attention and make connections between students' prior knowledge and the new concept they will be learning.

In this module: Students use their senses to find out about an object in a Secret Sock and identify each sense used. Students listen to the story *My Five Senses* (1989), by Aliki, and identify each sense used by the boy in the story to observe objects.

English learners: English learners (ELs) at the beginning level will require significant facilitation to access prior knowledge, such as materials in their first language and gestures and pictures. ELs at the intermediate level will require opportunities to make associations between the knowledge learned in the two languages, such as working in mixed-language groups with plenty of opportunities to discuss the content in both languages as well as additional time or opportunities to express their understanding orally. ELs at the advanced and advanced high levels will require practice with the appropriate expression of the content's mastery (oral expression at the kindergarten level).

2 EXPLORE

Students receive opportunities to interact socially as they acquire a common set of experiences by actively exploring the new concept through investigations or activities. Students should have common experiences before they are asked to explain their understanding of a new concept. After the initial use of the activities, you may find it helpful to leave the Explore materials out in the classroom to allow students to revisit the centers for further reinforcement of the introduced concept.

In this module: Students rotate through centers to observe everyday forms of light, heat, and sound energy. Centers are used to provide students with common experiences observing light and images through jars, melting ice cubes, and vibrations on a balloon.

English learners: Because they must process both content and academic language, ELs usually need more time to explore at the centers than English-proficient speakers. Grouping ELs with students who speak their first language and have higher levels of English proficiency will give ELs the opportunity to understand content concepts in their native language while learning English. As ELs explore through hands-on experiences at the centers, the teacher should monitor conversations to check for understanding of concepts and engagement.

3 EXPLAIN

Students share information about their observations at the Explore centers and engage in meaningful discussions with one another and the teacher to clarify any misconceptions and deepen their understanding of the concept they are studying. After students have had a direct experience with the concept and the chance to communicate their own operational definitions, the teacher uses targeted questioning strategies to connect student experiences and observations with the concept being taught and to introduce correct terminology.

In this module: Students explain the activities at the Explore centers and participate in a teacher-led discussion as a formative assessment of student understanding.

English learners: Beginning and intermediate ELs may have difficulty explaining or sharing their understanding from the Explore activities without prior practice or preparation. To help them prepare, allow ELs to practice sharing out in pairs before sharing with the whole class. One strategy might be to pair students who have different language proficiency levels. Then have the pairs discuss their personal understanding and use language frames (e.g., "Today I learned . . .") to prepare a response in English to share with the class.

4 ELABORATE

Students have the opportunity to apply the concept in a new context through additional activities, such as reading to learn, or investigations. Providing additional active learning experiences allows students to strengthen and expand their understanding of the concept.

In this module: After the teacher reads *What Makes a Rainbow* (2000), by Betty Ann Schwartz, students explore objects that can help them observe the colors of the rainbow. Students look at indoor light sources using either a Rainbow Peepholes™ or rainbow glasses to observe the colors of the rainbow. Students also explore the concept of capacity with a variety of different-shaped containers.

English learners: The goal during the Elaborate phase is to minimize the language demands and optimize content understanding. While building content knowledge through activities such as reading about rainbows, explicitly share illustrations and vocabulary for ELs. When possible, allow ELs to practice additional investigations and present their findings with an English-proficient partner to help them learn the concepts and demonstrate their understanding.

5 EVALUATE

Students demonstrate their mastery of the concept and process skills, allowing both the teacher and the students to monitor and reflect on the progress made as an outcome of instruction.

In this module: Students work in groups to develop a collage or oral report and a digital story about the five senses and how they are used to detect energy and capacity. Teachers may also elect to have each student complete a multiple-choice assessment.

English learners: Evaluations for ELs should use a variety of formats that reflect students' level of English language proficiency. For example, assessment may include teacher observations and students' alternative expressions of knowledge. For ELs at beginning levels, responses in their first language (when possible), acting out a response, or drawing a response is appropriate. ELs at intermediate levels should be allowed to use oral and written responses using language frames (e.g., "Today I learned that _____ happened because _____."). Advanced and advanced high ELs may be assessed in the same way as their English-speaking peers, but assessment may require linguistic support with academic English terms, such as *define, provide evidence for,* and *give an example of.*

Background Knowledge

The study of energy is abstract and often difficult for kindergarten students. To help them grasp the concept of energy, access their prior knowledge and provide concrete experiences that connect light, heat, and sound to the students' everyday lives. These actions will help your students develop the foundation needed to differentiate among the types of energy introduced in this module. As students experience increasingly complex interactions of matter and energy, they will begin to understand that many of the changes they observe occur in predictable patterns for each form of energy. These changes can often be measured with nonstandard units.

Energy

Because energy is an abstract concept, teachers need to address it with kindergarten students. The U.S. Department of Energy defines energy as the ability to do work or the ability to move an object. At the start of this unit, access students' prior knowledge to determine their definitions of energy. During the unit, ensure that students have multiple opportunities to explore different forms of energy, including light, heat, and sound. Then at the end of the unit, revisit the concept to refine students' operational definition of energy.

Light

Light travels through space as waves of energy. The waves we can detect with our eyes are called visible light. There are many sources of light, but the initial energy for all light sources comes from the sun. Light travels away from its source in straight lines as waves of energy. Patterns in the behavior of light are predictable because light moves in waves through space until it comes in contact with an object or material that changes its direction. Light can pass through, bounce or reflect off, or be blocked by different materials as it moves in a straight line from its source.

Light can pass through transparent materials such as glass or some plastics. Many transparent objects can magnify light, especially if they are curved and filled with water. If the magnifier is curved on only one side, however, it may make magnified objects appear distorted. A hand lens magnifies an object uniformly because it is curved on all sides. Lenses change our perception of objects because they bend, or refract, the light that passes through them and fool our eyes into thinking the object is bigger, because the light from the object enters our eyes at a different angle. What we see through a magnifier is actually an enlarged image of the object.

Light can also be split into the colors of a rainbow when it passes through a small multisided piece of glass called a prism. Light bends as it passes through the prism and forms a natural pattern of colors called a spectrum. Each one of the colors contained in white light is bent, or refracted, inside the prism by a different amount. Red light is bent the least amount, while violet light is bent the most. The colors in a spectrum are commonly identified by "ROY G. BIV," which stands for red, orange, yellow, green, blue, indigo, and violet. Some scientists now think that indigo should not be included in the description of the spectrum because it is too hard to distinguish from blue and violet. In this learning experience for kindergarten students, indigo is not mentioned.

You may get to see a rainbow in the sky after a rain shower if the sun is low in the sky in the morning or evening. To see a rainbow, the sun must be behind you and the air in front of you must contain water drops. These raindrops act like millions of tiny prisms that bend and separate the light into the colors of the spectrum before it enters your eyes. Red is located on the top arc of the rainbow, violet is on the inside bottom arc, and yellow is found in the middle. The other colors may blend together. The rainbow you see is unique, depending on which raindrops bend the light into the rays that enter your eyes.

Heat

Temperature and heat are not the same thing! Temperature is a measurement of how hot or cold a substance is, whereas heat is the amount of energy contained in a substance or material. This heat energy can be passed or transferred to other cooler objects. Adding heat energy can cause changes in matter, such as melting chocolate. Taking away heat energy can also cause changes in matter, such as liquid water changing to ice in the freezer.

Sound

Vibrations—the rapid back-and-forth movements that pass through air, water, and solid objects—cause all sounds. Vibrations can be heard and felt when they travel through the air or another substance to our ears as sound waves.

Patterns and Comparisons

At the kindergarten level, much of mathematics is focused on recognizing simple patterns and making comparisons based on attributes, as well as making basic quantitative comparisons such as *more, less,* or *the same.* Instead of using separate math activities or numeric values, these basic comparisons can be integrated into science contexts through comparisons such as hotter/colder, heavier/lighter, and so on. For example, the mathematics component can be integrated by ensuring that students associate the terms *hotter* and *lighter* with the ideas of more heat and less weight, respectively.

Capacity

Capacity is explored with a variety of containers that have the same capacity but different shapes, such as tall and thin, and short and wide. Students explore the concept that capacity can be the same in different-shaped containers.

Technology

Students should receive multiple opportunities to use technology to access, interpret, and share information. Technology enables students to document and present data in ways that are visually interesting and easy to understand. Technology also affords students the opportunity to explore and experiment with science that might otherwise be costly, difficult, or dangerous, such as through the use of simulations. And technology is useful to reteach a concept. This module provides an option for students to use technology to create a digital story about energy.

Lesson Overview

This module has been developed so that teachers can adapt it to their schedule and classroom structure. The amount of time required to teach the module and the individual activities will vary depending on how often you teach science and math and for how long. General guidelines for structuring the lessons are provided, but teachers may find that different schedules or structures are more suitable for their classrooms. However, the sequence and order of the individual activities should be followed to achieve the educational goals.

Big Ideas

- Energy is something that has the ability to do work.
- Heat, light, and sound are some of the forms of energy that can do many kinds of work.
- Capacity relates to filling an object.
- Patterns can be used to make predictions of unseen events.

Concepts

By the end of this lesson, kindergarten students should understand the following concepts:

- Our five senses can be used to find out about energy.
- Light, sound, and heat are forms of energy found in everyday life.
- Sounds are vibrations that we can hear and sometimes see and feel.
- Light passing through a hand lens can make objects appear bigger.
- Light contains many colors that can be seen when it passes through a prism or a water drop.
- Basic quantitative comparative terms such as *more, less,* or *the same* may be used when we look for patterns.
- Comparisons can be made and described with the use of our senses and nonstandard units using terms such as *hotter/colder* or *heavier/lighter.*
- Descriptive investigations should be planned and conducted safely.
- Our five senses and hand lenses are tools that can collect data to identify properties and patterns.
- Data can be recorded and organized with pictures, numbers, and words.
- Patterns can be observed to make predictions.
- Student-generated data from simple descriptive investigations can be used to communicate observations and justify explanations.

Language Support for English Learners

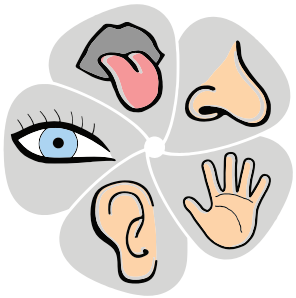
Embedded throughout this lesson are strategies for academic English language support. The following strategies or supports should be used consistently during the instructional process:

- Kindergarten teachers should shelter both content and language for young students. Young ELs can benefit from the use of their first language to make connections to English.

- Consider the language demands of instruction. Find ways to contextualize abstract concepts. For example, to contextualize the concept of energy, show pictures or video clips of machines or people using energy, or use graphic organizers with content-specific vocabulary.
- Ask beginning ELs to create picture word banks for vocabulary.
- Pair beginning and intermediate ELs with more advanced ELs.
- Encourage more advanced ELs to provide linguistic support in their native language to assist beginning-level students.
- Model demonstrations and procedures explicitly. For example, use body gestures while explaining concepts or provide realia (real examples, such as a flashlight or mirror), illustrations, pictures, and so on.
- Provide opportunities for students to engage actively in academic conversations and hands-on learning. (ELs may disengage or sit passively if they do not understand or cannot communicate their ideas. They need opportunities to practice academic English.)
- Be cognizant of the amount of wait time you give ELs to allow them more time to process thinking.
- Beginning and intermediate ELs may not have the academic English necessary to comprehend assessments. Differentiate assessments by limiting the number of questions and allowing students to show their knowledge by creating drawings and demonstrating experiments.
- The following is a list of high-frequency vocabulary in this lesson that teachers may find helpful for supporting beginning ELs. The list addresses English-Spanish translations; teachers may need additional word-to-word translations for other languages. Visuals for selected terms are also provided in the Resources section of this unit for use on a word wall or during instruction.

English Vocabulary	Spanish Vocabulary
capacity	capacidad
cold	frio
cold water	agua fría
color	color
ear	oido
energy	energía
eye	ojo
feel	siéntase
finger	dedo
flashlight	linterna
freeze	congelar
hand lens (magnifying glass)	lupa
hearing	audición
heat	calor
hot	caliente
hot water	agua caliente

English Vocabulary	Spanish Vocabulary
ice cube	cubo de hielo
light	luz
melt	derretir
nose	nariz
patterns	pautas
prism	prisma
rainbow	arco iris
sight	vista
smell	oler
sound	sonido
sun	sol
taste	sabor
temperature	temperatura
tongue	lengua
touch	toque
vibrate	vibrar
water	agua



Lesson Procedures

ENGAGE

Temperature

Time: Approximately 15 minutes

1. Prior to class: Refer to the Materials List and Details in the Resources section for more information about the setup.
   - Fill one clear pitcher with tap water at room temperature and green food coloring.
   - Fill a second clear pitcher with warm water (but still at a safe temperature) and red food coloring.
   - Fill a third clear pitcher with cold water (ice water but with no ice cubes present) and blue food coloring.
2. Ask each student to dip a finger in each of the three pitchers.
3. Organize students into groups of three to four. Give each group green, red, and blue crayons and a Water Pitchers card, which provides outline pictures of three pitchers. Have students work in their groups to color the pictures of the water pitchers and to rank them in order from coldest to warmest.
4. Set the three pitchers aside to revisit later in the afternoon.

Materials

For the class

- ☐ 3 clear water pitchers
- ☐ Warm, cold, and room-temperature water
- ☐ Green, red, and blue food coloring

For each group

- ☐ Water Pitchers card (see Resources section)
- ☐ Green, red, and blue crayons

Our Five Senses

Time: Approximately 1 hour

1. Prior to class, do the following:
   - Create a Secret Sock for each group: Place a plastic cup containing a small sealed package of cinnamon-flavored graham crackers in the toe of a new large athletic sock.

     Prepare in advance
     Secret Sock and Sense Cards
   - Prepare one pack of the five Sense cards provided in the Resources section for class use. Place double-sided tape on the back of each Sense card.
   - In addition, prepare one pack of Sense cards for each student. Do not put tape on these cards.
   - Prepare a chart with five equal columns, as shown below, for the whole class to see.
2. Direct students to wait for instructions as you place a Secret Sock on each group's desk. Do not mention what is inside the sock.
3. Inform students that the object inside the sock is safe to touch, but they must leave the object in the sock until given further instructions.
4. Explain that each student will have a silent 10-second turn to reach inside the sock to feel the object and that the sound of the timer will end each turn. Remind students that there should be no talking during the observations.

Observing the Secret Sock				

Materials

For the class

- ☐ Prepared 5-column chart
- ☐ Markers
- ☐ Pack of Sense cards (see Resources section)
- ☐ Double-sided tape
- ☐ Timer
- ☐ *My Five Senses* by Aliki
- ☐ Computer logged onto PBS Kids Sid the Science Kid: **http://pbskids.org/sid/isense.html**

For each group

- ☐ Secret Sock (see Materials List and Details in the Resources section)
- ☐ Glue stick
- ☐ Safety scissors

For each student

- ☐ Pack of Sense cards (see Resources section)
- ☐ Resealable bag (to hold pack of Sense cards)
- ☐ My Five Senses Data Sheet (see Resources section)
- ☐ Student journal

5. Ask students the following questions about their observations and write the answers on the chart in the columns indicated below.
   - What did you observe about the object? *It feels like a smooth package with something inside it.*
   - Write students' responses about how the package feels in the first column.
   - Which sense did you use when you observed the object with your hand? *my sense of touch*
   - Place the sense of touch card at the top of the first column of the chart.

Sense Cards (larger versions are provided in the Resources section)

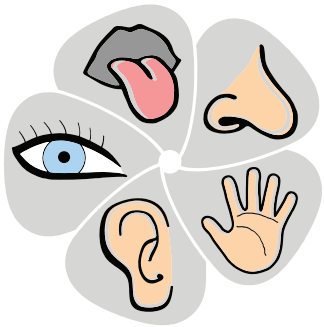
6. Instruct one student from each group to take the object out of the sock and place it in the middle of the table. Ask another student from each group to open the package without touching the crackers inside.
   - Ask students for some words to describe how the object sounds.
   - Write any response related to sound, such as the wrapper sounds crackly, in the second column.
   - Which sense did you use when you observed the sound of the object? *my sense of hearing*
   - Place the sense of hearing card at the top of the second column.
7. Ask students to look carefully at the objects in the package and think of descriptive words to tell what they observe.
   - Write responses about how the objects in the package look in the third column.
   - Which sense did you use when you observed how the objects looked? *my sense of sight*
   - Place the sense of sight card at the top of the third column.
8. Demonstrate how scientists waft air toward themselves to safely observe odors. Ask students to waft the air near the package to observe any odors emanating from it that they can describe, such as cinnamon.
   - Write responses about how the object smells in the fourth column.
   - Which sense did you use when you observed the odor of the object? *my sense of smell*
   - Place the sense of smell card at the top of the fourth column.
9. Discuss with students that it is never safe to eat or drink anything in science class without permission from the teacher. Instruct students to carefully place a cracker in their mouth and chew it. Allow students a moment to enjoy the cracker, then ask them to describe their observations.
   - What did you observe about the object? *It tasted sweet or like cinnamon.*
   - Which sense did you use when you placed the object in your mouth? *my sense of taste*
   - Place the sense of taste card at the top of the fifth column.

10. Distribute a pack of Sense cards to each student and ask students to place their cards in a row in front of them so they can see the cards as you read a story to the class. Instruct students that whenever they hear a certain sense being described in the story, they should hold up the card for that sense to show they recognize it. This activity may be used as a formative assessment of student understanding of the five senses.

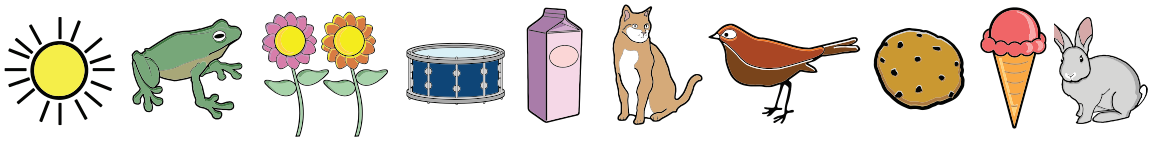
11. Read aloud to the class the story *My Five Senses* (1989) by Aliki.

12. After the story, instruct students to return the Sense cards to your desk. As they do, distribute to each group a My Five Senses Data Sheet (includes the graphic and pictures below), glue sticks, and safety scissors.

My Five Senses Data Sheet



Pictures



13. Instruct students to cut out each picture. Students should then glue the pictures around the graphic on the data sheet to record the objects that the young boy in the story observed with each of his senses. Encourage students to draw additional pictures around the graphic to represent any other items the boy observed.

    Then ask the following:

    - What did the boy observe using his sense of touch? *rabbit, kitten*
    - What did the boy observe using his sense of smell? *flowers, cookies*
    - What did the boy observe using his sense of taste? *ice cream, milk*
    - What did the boy observe using his sense of hearing? *drum, bird*
    - What did the boy observe using his sense of sight? *sun, frog*
    - Why are senses important? *Senses help us to observe the world around us.*

14. After the data sheet is completed, instruct students to glue it into their journal.

15. While the students are cutting and pasting the pictures, let individual or pairs of students go to the class computer to play the PBS game "Sid the Science Kid," which provides a good review of the five senses: **http://pbskids.org/sid/isense.html**.

Temperature Revisited

Time: Approximately 15 minutes

1. Return to the three water pitchers. Announce to students that these are the same pitchers of water they examined earlier and that nothing has been done to them.
2. Ask students to repeat the process they did earlier. Each student is to come up and dip a finger in each of the three pitchers.
3. Next, have students work in their groups to rank the pitchers in order from coldest to warmest. (This activity should generate some interesting discussion because all the pitchers should now contain water that is at room temperature.)
4. After a short while, ask whether any groups are having trouble ranking the pitchers. Then announce to the class that something is different from that morning.
5. Change the task from ranking the pitchers from coldest to warmest to an oral report where each group explains what happened to the water in the three pitchers. Ask students to include their ideas as to why the changes to the water might have happened. Look for the idea of heat loss/transfer in the group responses.

English Language Support

- Model the sequence of this section explicitly (e.g., by using pictures, models, and hand gestures).
- Use word-to-picture translations. Illustrated English-Spanish vocabulary cards for key terms are provided in the Resources section.
- Pair beginning ELs with more advanced ELs.
- When asking questions, institute wait time to allow students time to process information.
- Provide opportunities for ELs to participate in the hands-on activities and the class discussion experience.
- Provide language stems to shelter student responses (e.g., "The boy saw/observed . . .").

EXPLORE

General Instructions for Explore Centers

Time: Approximately 1 hour, including about 15 minutes per center (monitor center activity to see if students finish sooner)

This activity consists of three centers. Organize students into groups of two to three members and assign one third of the groups to work at each center. Then rotate. A class of 25 students will need approximately three centers each for light, heat, and sound.

1. Prior to class, set up the center materials in areas of the classroom that allow space for students to work together in small groups of two to three. Refer to the Materials List and Details in the Resources section for more information about setting up each center.
2. Instruct students that their job involves making careful observations about the activity at each of the three centers they visit with their group. Emphasize the importance of recording detailed information on their data sheets or in their journals.
3. Carefully read aloud the instructions for each center. Many children may not be able to read yet, so it may be necessary to ask the students to repeat the instructions back to you.
4. Demonstrate the activities for each center to students and ask if they have any questions.
5. While students are at each center, move about the room to monitor their activities. After about 15 minutes, have groups rotate centers.
6. You may want to leave the Explore centers set up for several days, if possible, to allow students to return to the activities and complete them more than once.

Light Center: Jar Lens

Students observe and record in their journals how light can pass through a clear jar filled with water and how pictures or letters placed behind the jar seem to change.

Materials

For each center

- ☐ Light Center Instructions (see Resources section)
- ☐ Clear 2-liter plastic jug or glass jar with vertical sides filled with water
- ☐ Flashlight or laser pen
- ☐ 2 Rabbit cards (see Resources section)
- ☐ Alphabet Letter cards (see Resources section)

Heat Center: Melting Ice Alphabetically

Students observe the change in an ice cube as they use it to trace over the letters in the word *HEAT*.

Materials

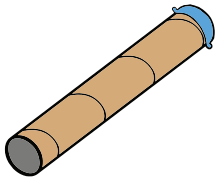
For each center

- ☐ Heat Center Instructions (see Resources section)
- ☐ Heat card (see Resources section)
- ☐ Hot water bottle (full) or waterproof heating pad
- ☐ Tape
- ☐ Clear rectangular plastic dish
- ☐ Ice cubes
- ☐ Small ice chest (for ice cubes)

Sound Center: Sound Tube

Students observe the vibrations of a sound tube after a student repeats letters of the alphabet into the tube. To make the sound tube, stretch a balloon over the end of a tube and use a rubber band to hold the balloon in place.

PREPARE IN ADVANCE
Sound Tube



Materials

For each center

- ☐ Sound Center Instructions (see Resources section)
- ☐ Sound tube (see Materials List and Details in Resources section)

English Language Support

- For beginning and intermediate ELs, provide visual support of the center materials by pointing to each item and stating its English name (e.g., "This is a hot water bottle") or providing cards with illustrated and labeled terms.
- Explicitly model each center procedure or demonstration and monitor your pacing to ensure that ELs have enough time to process the information. Make intentional efforts to ask ELs questions while modeling a demonstration.
- Monitor the rate, tone, and enunciation of your speech.
- For the sound center, use the think-pair-share strategy to have mixed language-proficient pairs of students predict what they think will happen when a student speaks into the tube.
- Check for understanding as students engage in discussion.
- Provide language stems to support student responses (e.g., "Use the ice to _____ over the word _____.").

EXPLAIN

General Instructions

Time: Will vary with the level of discussion

Students explain their observations from the Explore centers and participate in a teacher-led discussion as a formative assessment of student understanding. The teacher provides additional activities to give students more experiences related to energy and capacity.

Heat Center: Ice

Materials

For the class

- ☐ Clear 2-liter jar full of ice

1. Start the day with one large clear jar full of ice.
2. At certain time intervals (say every half hour), stop the class and have students observe the ice in the jar and draw what changes have occurred.
3. When the ice has totally melted, have students stick a finger in the water and note how cold or warm it feels. Continue to have students do this activity every half hour or so.
4. At some point, the students will notice that the water is remaining the same temperature. Ask the students if the amount of ice and then water changed.
5. Then have the students discuss in their groups what has happened and ask them to suggest causes or reasons.

Light Center: Jar Lens

Materials

For the class

- ☐ Clear 2-liter jar of water
- ☐ Clear 2-liter jar stuffed with paper
- ☐ Flashlight or laser pen
- ☐ 2 Rabbit cards (see Resources section)
- ☐ 5 hand lenses
- ☐ Several objects to view (e.g., feather, rock, or coin)

1. Place a clear jar of water on a table where all the students can see the jar. Shine a flashlight or a laser pen through the jar of water so that students can see the spot of light on the wall behind it. Ask:
   - What happens to the light when I shine it on the jar of water? *It goes through the jar and the water to the wall.*
   - What is another word for materials that let light pass through? *clear*
   - What are some other clear objects that let light pass through? *clear windows, the lenses of eyeglasses, aquariums*

2. Place an identical jar that is stuffed with white paper on the table. Try to shine a flashlight or a laser pen through the jar and note that no light appears on the wall behind the jar.
   - What happens to the light when I shine it on the jar filled with white paper? *The light cannot go through.* Why? *You cannot see through the paper, and light cannot go through the paper.*
   - Ask how students would use math to express the amount of light that passed through the paper. Explain that since no light got through, this amount is expressed as a zero (or 0) in math—when we have none or nothing of something, the amount is zero.
3. Hold up the jar of water next to your face.
   - How do I look when the jar is next to my face? *the same*
4. Hold up the jar of water in front of your face.
   - How do I look when the jar is in front of my face? *bigger, funny, different*
5. Show students that you have two identical pictures of a rabbit. Hold one picture on each side of the jar of water.
   - What do you think will happen if I place one of the pictures of a rabbit behind the jar of water? *The rabbit behind the jar will look bigger.*
   - Why do we need two rabbit pictures? *So we can see how the rabbit picture changes when it is placed behind the jar of water.*
6. Hold up a hand lens and ask students if light will be able to pass through it. Test the lens in the same way as the jars and note that light can be seen on the wall behind it.
   - How is the hand lens like the jar of water? *It is clear and makes objects look bigger when light shines through it.*
7. Demonstrate the steps to focus a hand lens on a small object of great visual interest, such as a feather, rock, or coin.
   - Place the object on a flat table or desk.
   - Hold the hand lens just above the object.
   - Slowly move the lens away from the object while looking through the lens.
   - Move the lens until the object is in clear focus.
8. Place a hand lens and several objects at tables or desks around the room. Allow extra time for the students to take turns looking at objects through a hand lens.

Heat Center: Melting Ice Alphabetically

Ask students the following questions about their observations at the heat center:

- How did the hot water bottle feel to your hand? *very warm*
- How did the ice cube feel when you picked it up? *cold, hard, sharp edges*
- Explain the difference between heat and temperature to students. Ask whether hot water or ice has the higher or lower temperature. Then have students rank the following in order from coldest to hottest: water in a glass at room temperature, water in a hot water bottle, and ice.
- What did you observe when you traced the letter *H* with the ice cube? *The end of the ice cube next to the letter started to melt into water.*
- What did you observe when you traced the letter *E* with the ice cube? *The end of the ice cube next to the letter melted into water.*
- What did you observe when you traced the letter *A* with the ice cube? *The end of the ice cube next to the letter kept melting into water. More water was in the dish than at the beginning.*
- What did you observe when you traced the letter *T* with the ice cube? *The end of the ice cube next to the letter kept melting into water. Even more water was in the dish, and the ice cube was much smaller.*
- What other materials melt in warm conditions? *ice cream, snow, chocolate*

Sound Center: Sound Tube

Time: Approximately 30 minutes

Materials

For the class

- ☐ Hand-held fan
- ☐ Wooden ruler
- ☐ Large balloon (not inflated)
- ☐ Sound tube (made previously)
- ☐ Chart paper/whiteboard
- ☐ Markers

1. Use a small hand-held fan to make small back-and-forth movements near students. Ask:
   - What happens to the air when the fan moves back and forth? *The air gets waved or moved around by the back-and-forth movement of the fan.*
2. Place a ruler on your desk so that one end of the ruler hangs over the edge. While using one hand to secure the end of the ruler on the desk, push down on the free end of the ruler and then let go. Repeat the process several times.
   - What happens to the ruler when I apply a pushing force with my hand? *The ruler moves back and forth, and I hear a twang sound.*
   - What happens to the air when the ruler moves back and forth? *The air gets waved or moved around by the back-and-forth movement of the ruler.*
   - Where does the air move in order for us to hear it? *It moves to our ears.*
3. Explain that another word for a back-and-forth movement is *vibration* and that the moving ruler causes air vibrations that keep moving until they reach our ears.

4. Blow up a large balloon in front of the class.
   - What am I putting into the balloon? *air*
5. Stretch the neck of the open balloon and let some air out so it makes a surprising screeching sound.
   - What is causing that noise? *The neck of the stretched balloon is vibrating as air moves out of the balloon.*
   - Can we hear sounds travel through air? *Yes, the screeching sound traveled through the air to my ears.*
6. Demonstrate how you made the sound tube by stretching a balloon over the end of a tube and then placing a rubber band around the balloon to hold it in place.
   - What did you hear when your partner said letters into the sound tube? *I could hear the letters of the alphabet.*
7. Ask students to put one hand on the base of their throat and say the first three letters of the alphabet.
   - What did you feel when you placed your hand on your throat while saying the letters? *I felt tiny movements or vibrations in my throat each time I said a letter.*
8. Explain that there are small rubber band-like structures in your throat called vocal chords that cause air to vibrate when you speak. Ask students to hold one hand in front of their mouth and say the first three letters of the alphabet.
   - What did you feel when you were speaking? *air moving out of my mouth as I said each letter*
   - What did you feel when you placed your hand on one end of the sound tube covered by a balloon? *I felt tiny movements or vibrations each time my partner said a letter.*
   - Where did the vibrations come from? *When my partner said a letter, vibrations travelled through the air to the balloon material, which I could feel with my hand.*

English Language Support

The language demands of this part of the lesson are very high. To make the learning more contextualized (concrete), the teacher should consider the following:

- For beginning ELs, use visuals (labeled pictures) as you discuss each center. Illustrated English-Spanish vocabulary cards are available in the Resources section for selected terms.
- Explicitly model each process or discussion, using objects in each center to support students' questions.
- Pair beginning ELs with more advanced ELs.
- Provide opportunities for ELs to speak by asking recall questions and by using language frames (e.g., "I saw . . .," "I heard . . .").
- Intermediate ELs may need the same support as beginners as both groups are learning new concepts.
- During question and discussion sessions, use the think-pair-share strategy (e.g., "Tell your partner what you saw . . .").

ELABORATE

Rainbows

Time: Approximately 30 minutes

1. Distribute the Rainbow Peepholes™ or rainbow glasses to students. Ask students to look toward an indoor light source and describe what they see to their elbow partner.
   - Have you ever seen these colors before? *Most will say in a rainbow in the sky or in a picture of a rainbow.*
   - Why did you have to look toward light to see the colors? *You need light to see a rainbow.*
2. Distribute the What Colors Make a Rainbow? Data Sheet and crayons (rainbow colors) to each student. Place the demonstration data sheet where all the students can see you model the color pattern of the rainbow.
3. Ask students to listen carefully as you read the story *What Makes a Rainbow?* (2000) by Betty Ann Schwartz.
4. Instruct students to color each band of color on the data sheet as that color is revealed in the book.

Materials

For the class

- ☐ *What Makes a Rainbow?* by Betty Ann Schwartz
- ☐ What Colors Make a Rainbow? Data Sheet (see Resources section)
- ☐ Markers (rainbow colors)

For each student

- ☐ Rainbow Peephole™ or rainbow glasses
- ☐ What Colors Make a Rainbow? Data Sheet
- ☐ Crayons (rainbow colors)

Capacity

Time: Approximately 30 minutes

1. Explain to students that they have been using their five senses to observe different types of energy, such as light, heat, and sound. Now, students are going to use their sense of sight to explore capacity. When it rains, we use rain gauges to measure how much rain fell from the sky. Sometimes it rains so much, we say the rain gauge was filled to capacity.
2. Ask students what "filled to capacity" means and accept all answers. Then do the following:
   a. Show the students a container (such as a beaker or measuring cup) that is partially filled with water.
   b. Ask them if the container is full. *No.*

Materials

For the class

- ☐ 2 containers with the same capacity, but distinctly different shapes (such as tall and thin, short and wide)
- ☐ Colored water or liquid to fill one container
- ☐ Clear pitcher
- ☐ Water

c. Can the container hold more liquid? *Yes.*

d. What happens when the container is full? *You cannot put any more in it.*

e. Explain to students that the term *capacity* means the total amount that something can hold or contain (or at this grade level, you could say the amount something contains when it is full).

3. Show students two containers that have the same capacity but different shapes. (Do not tell students the containers have the same capacity.) In front of the class, pour into a clear pitcher the amount of colored liquid that would fill one of the two containers to capacity (to the top).
4. Poll the class to see which of the different-shaped containers students think has the greater capacity.
5. Then ask students to observe as you empty the colored liquid in the pitcher into the container that more students thought had the greater capacity.
6. Ask students what will happen if you pour the liquid from that container into the other one.
7. Accept all answers and then pour the liquid from the container into the other one. The liquid should fill the second container to capacity as well.
8. Ask students for their opinions or conclusions about the capacity of each of the containers. *Students should conclude that the capacity is the same for each one and that containers with different shapes can still have the same capacity.*
9. Note that the amount of liquid remained constant and that liquid, such as water, takes on the shape of its container.
10. Also, note that when a container is filled to a specific line measuring the amount of liquid, the line is measuring the volume of liquid in the container. *Capacity* is how much can be put in a container, and *volume* is a measured amount of liquid.
11. So when we say it rained 3 inches, we are talking about the volume of water in the rain gauge (i.e., how much water the rain gauge contains).

English Language Support

- Provide a word bank with examples for the words *sound, light,* and *heat.* Illustrated English-Spanish vocabulary cards for these terms are provided in the Resources section.
- While reading *What Makes a Rainbow?*, check for student understanding.
- Show realia (real examples), such as pictures of rainbows.
- Explicitly share the *What Colors Make a Rainbow?* Data Sheet (rainbow-*arco iris*).
- For beginning ELs, provide the chart terms in Spanish and English (sound-*sonido,* light-*luz,* and heat-*calor).*
- Support ELs as they are entering data into the data sheet.

EVALUATE

A group project for assessing student understanding is provided below. Teachers also may elect to have each student complete the provided multiple-choice assessment.

Group Project

Time: Approximately 1 hour (30 minutes to develop; 30 minutes to present)

Materials

For each group

- ☐ Project materials (see Materials List and Details in the Resources section)
- ☐ Computer with Internet access
- ☐ Storytelling website such as **http://www.storybird.com**

1. Ask students to work in groups to create a collage or an oral report that presents the five senses and explains how they are used to detect different types of energy. The project should also include one or more examples of when our senses detect something is filled to capacity.
2. To integrate technology into the assessment, use a storytelling website such as **http://www.storybird.com** to lead students in creating a digital story illustrating the five senses and how they are used to identify sources of energy and capacity.
   a. Prior to the assessment, review the website. Preselect art on the site that you want students to use.
   b. In class, model the process for students by going to the website, selecting story art from the images you preselected, and adding your own text.
   c. Student groups should use the art preselected by the teacher for their stories.
3. Read the following rubric aloud to students row by row. After each row, check that students understand what is expected.
4. Monitor the groups while they work to check their progress, provide feedback, review expectations, and offer assistance or guidance.
5. Have each group present its project to the class.

	1-Needs Improvement	2-Satisfactory	3-Excellent
Five Senses/ Energy	Two or fewer senses and how they detect energy are included.	Three to four senses and how they detect energy are included.	All five senses and how they detect energy are included.
Measurement/ Capacity	No measurement or example of capacity is included.	A form of measurement or example of capacity is included, but it is inappropriate (e.g., length for volume) or inaccurate.	The unit of measurement or example of capacity included is appropriate and accurate.
Technology	Technology is not used correctly to tell the digital story.	Technology is limited to word processing.	The digital story used the technology and software correctly.

Individual Assessment

Time: 30 minutes

Have each student complete the Energy Assessment, which is similar to STAAR™. See the Resources section for the assessment, instructions, and answer key.

Materials

For each student

- ☐ Energy Assessment (see Resources section)
- ☐ 2 pencils

Assessment Support for English Learners

While developing assessments for English learners, take into consideration each student's English language proficiency level (from TELPAS and teacher observation). Differentiate evaluations by levels of English proficiency. Methods of assessing ELs might include the following:

Beginning and Intermediate:

- Physical demonstrations (repeating the experiment while a teacher checks for understanding)
- Pictorial products (drawings related to what students learned in the centers)

Advanced:

- Oral presentations of what students learned while a teacher provides linguistic support
- Spanish-English word bank with content-specific vocabulary for ELs to use during assessments
- Linguistic support provided by monitoring ELs while they are taking the assessment
- Clarification of test questions if needed to ensure understanding of what is being asked (e.g., arrange the pictures in order from coldest to hottest).

Advanced High:

- Limited linguistic support with comprehension of test questions as needed
- Consistent monitoring of ELs while they are engaged in the assessment and clarification of concepts as needed

Materials List and Details

ENGAGE

Temperature

For the class

- ☐ 3 clear water pitchers
- ☐ Warm, cold, and room-temperature water
- ☐ Green, red, and blue food coloring

For each group

- ☐ Water Pitchers card
- ☐ Green, red, and blue crayons

Our Five Senses

Teacher Preparation: Make a copy of the My Five Senses Data Sheet for each student. Next, create a large version of the chart on chart paper or a whiteboard. You will need to be able to tape pictures to the chart. Copy and laminate one pack of Sense cards for yourself and put double-sided tape on the back of each card. Then create a pack of Sense cards for each student and place each pack in a resealable bag. Do not place tape on the backs of these cards. In addition, prepare a Secret Sock for each group (see instructions below).

For the class

- ☐ Prepared five-column chart (shown at right)
- ☐ Markers
- ☐ Pack of Sense cards (laminate and put double-sided tape on the back)
- ☐ Double-sided tape
- ☐ Timer
- ☐ *My Five Senses by Aliki* (English version: ISBN 0-06-445083-X; Spanish version: ISBN 0-06-445138-0)

Observing the Secret Sock				

For each group

- ☐ Secret Sock (see instructions below)
- ☐ Glue stick
- ☐ Safety scissors

For each student

- ☐ Pack of Sense cards (copy each set in color, laminate, cut apart, and put in a resealable bag)
- ☐ Resealable bag (per pack of Sense cards)
- ☐ My Five Senses Data Sheet
- ☐ Student journal

PREPARE IN ADVANCE
Sense Cards

Secret Sock preparation

Place a plastic cup containing a small sealed package of cinnamon-flavored graham crackers in the toe of a new large athletic sock. Make sure students cannot see what is inside the sock.

- ☐ Large sock (new)
- ☐ Large plastic cup
- ☐ Individual pack of cinnamon-flavored graham crackers (sealed)

EXPLORE

Light Center: Jar Lens

Teacher Preparation: Copy and laminate the Light Center Instructions, Rabbit card, and Alphabet Letter cards. Fill the jug/jar with room-temperature water.

For each center

- ☐ Light Center Instructions (laminate for repeated use)
- ☐ Clear 2-liter plastic jug or glass jar with straight sides
- ☐ Water to fill jug/jar
- ☐ Flashlight or laser pen
- ☐ 2 Rabbit cards (laminate for repeated use)
- ☐ Alphabet Letter cards (laminate for repeated use)

Heat Center: Melting Ice Alphabetically

Teacher Preparation: Copy and laminate the Heat Center Instructions and Heat card. Prior to class, fill a hot water bottle with very hot water and seal tightly. (A waterproof heating pad may be used instead.) Tape the Heat card to the upper surface of the sealed hot water bottle. Then place a clear rectangular dish over the Heat card. Place several ice cubes in an ice chest.

For each center

- ☐ Heat Center Instructions (laminate for repeated use)
- ☐ Heat card (laminate for repeated use)
- ☐ Hot water bottle (filled with hot water) or waterproof heating pad
- ☐ Tape
- ☐ Clear rectangular plastic dish
- ☐ Ice cubes
- ☐ Small ice chest (to hold ice cubes)

Sound Center: Sound Tube

Teacher Preparation: Copy and laminate the Sound Center Instructions. In advance, create a sound tube for each center (see instructions below).

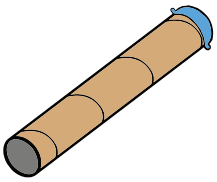
For each center

- ☐ Sound Center Instructions (laminate for repeated use)
- ☐ Sound tube (see instructions below)

PREPARE IN ADVANCE
Sound Tube

Sound Tube preparation

Reinforce the ends of an empty paper towel tube (or something similar) with clear mailing tape. Cut the neck off a balloon. Stretch the remaining piece of balloon tightly across the end of the tube and then place a rubber band close to the end of the tube to hold the stretched balloon in place. Other types of tubes that may be used include the following: short postal tubes, plastic tubes, or Pringle cans with one end removed. Do not use any type of metal tube or tubes with cut metal ends for safety reasons—rough edges could cut students.



- ☐ Paper or plastic tube
- ☐ Clear mailing tape
- ☐ Balloon (not inflated)
- ☐ Rubber band

EXPLAIN

Heat Center: Ice

Teacher Preparation: Just before class, fill a clear 2-liter jug or jar with ice.

For the class

- ☐ Clear 2-liter jug/jar full of ice

Light Center: Jar Lens

Teacher Preparation: Fill a clear 2-liter jug or jar with water. Then stuff a second clear 2-liter jug or jar with paper.

For the class

- ☐ Clear 2-liter jug/jar filled with water
- ☐ Clear 2-liter jug/jar stuffed with paper
- ☐ 2 Rabbit cards (made previously)
- ☐ Flashlight or laser pen
- ☐ 5 hand lenses
- ☐ Several objects to view (e.g., feathers, rocks, coins)

Sound Center: Sound Tube

For the class

- ☐ Hand-held fan
- ☐ Wooden ruler
- ☐ Large balloon (not inflated)
- ☐ Sound tube (made previously)
- ☐ Chart paper/whiteboard
- ☐ Markers

ELABORATE

Rainbows

Teacher Preparation: Make a copy of the What Colors Make a Rainbow? Data Sheet for each student and the teacher. Ensure that you have markers and crayons for each color of the rainbow.

For the class

- ☐ *What Makes a Rainbow?* by Betty Ann Schwartz (ISBN 158117076-9)
- ☐ What Colors Make a Rainbow? Data Sheet
- ☐ Markers (rainbow colors)

For each student

- ☐ Rainbow Peephole™ or rainbow glasses (diffraction grating lenses; available online)
- ☐ What Colors Make a Rainbow? Data Sheet
- ☐ Crayons (rainbow colors)

Capacity

For the class

- ☐ 2 containers with the same capacity, but distinctly different shapes (e.g., tall and thin, short and wide)
- ☐ Colored water or liquid to fill one container
- ☐ Clear pitcher
- ☐ Water

EVALUATE

Group Project

For each group

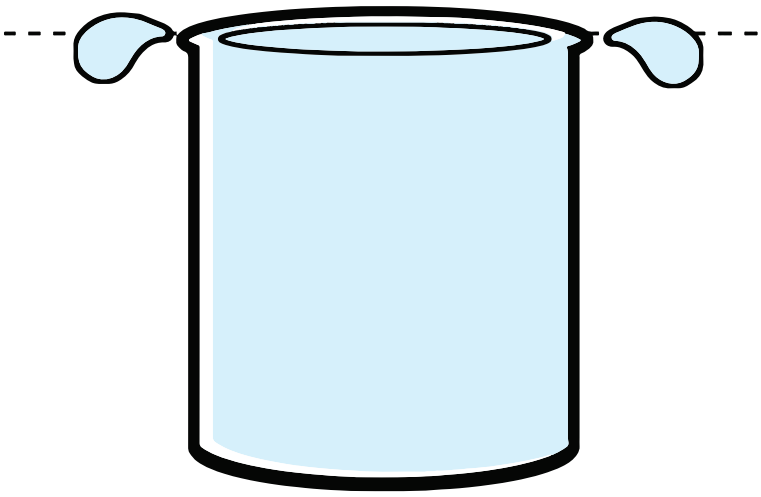
- ☐ Books and websites with age-appropriate information about heat, light, and sound
- ☐ Magazines and newspapers that can be used for collages
- ☐ Computer with Internet access
- ☐ Collaborative storytelling website such as **http://www.storybird.com**
- ☐ Paper or poster board
- ☐ Pencils and markers
- ☐ Safety scissors
- ☐ Glue sticks

Individual Assessment

For each student

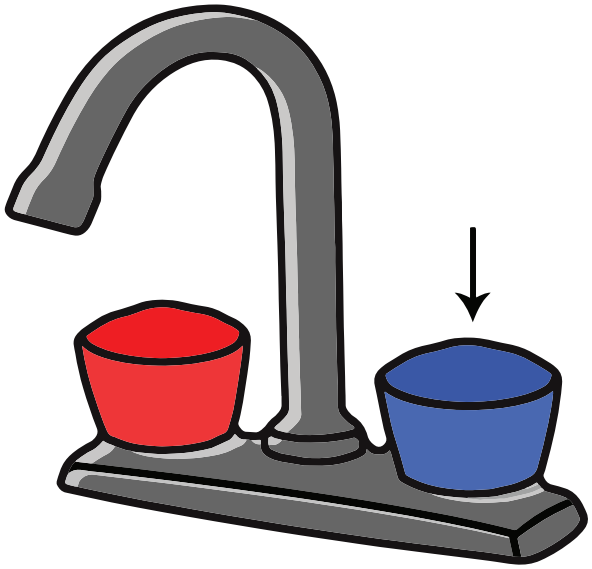
- ☐ Energy Assessment
- ☐ 2 pencils

Frequent English/Spanish Vocabulary Words



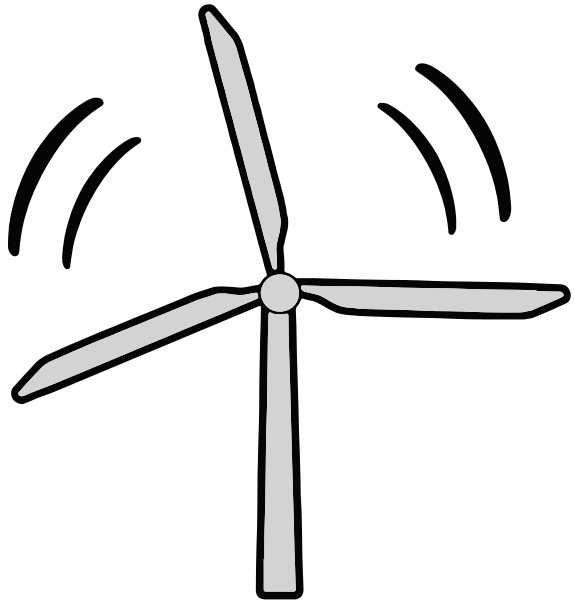
capacity / capacidad

cold / frio

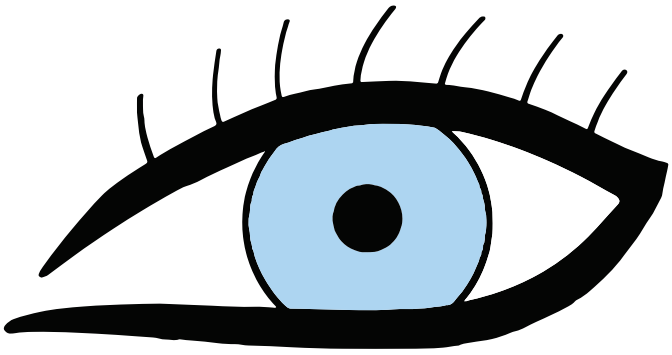


cold water / agua fría

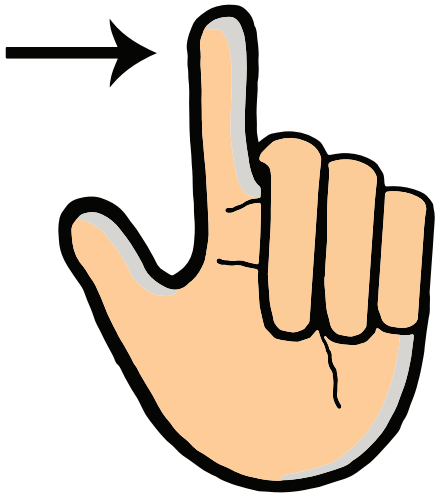
ear / oido



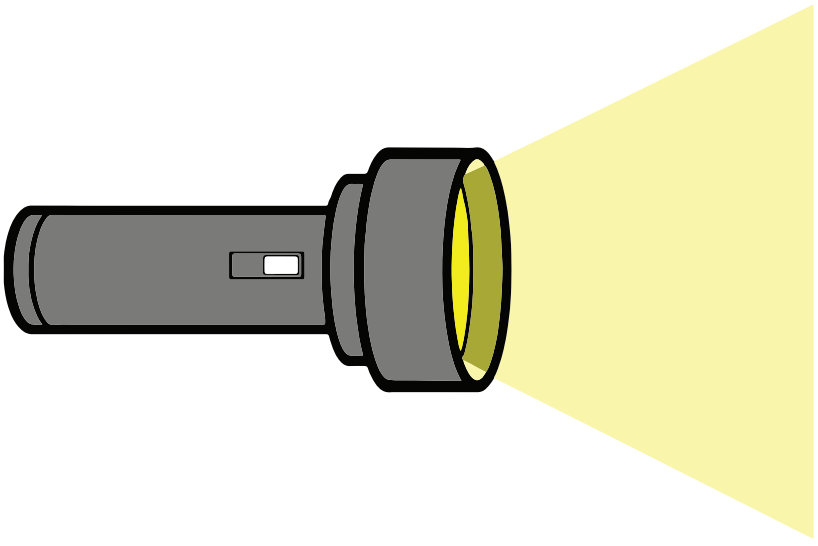
energy / energía



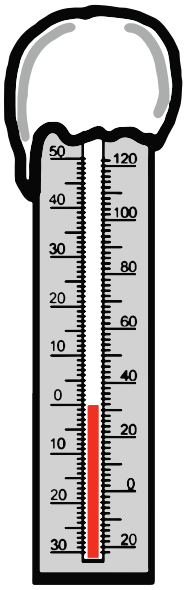
eye / ojo



finger / dedo



flashlight / linterna



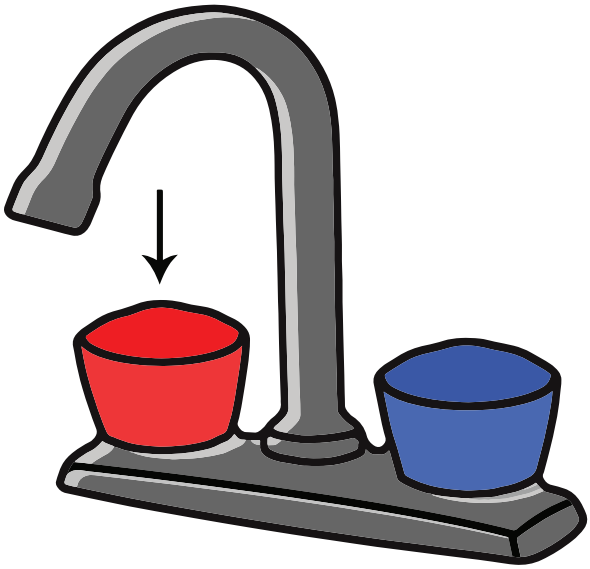
freeze / congelar

hand lens (magnifying glass) / lupa

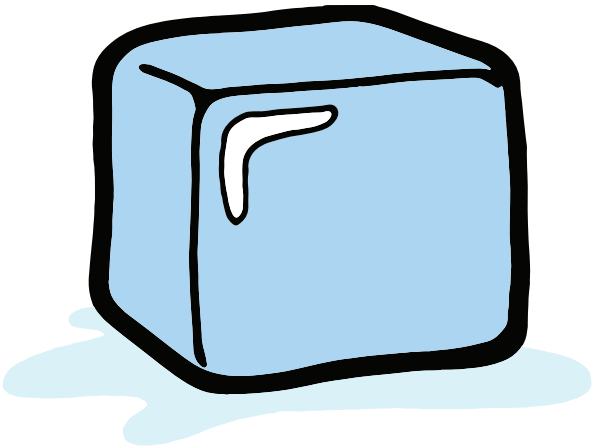
hearing / audición

heat / calor

hot / caliente

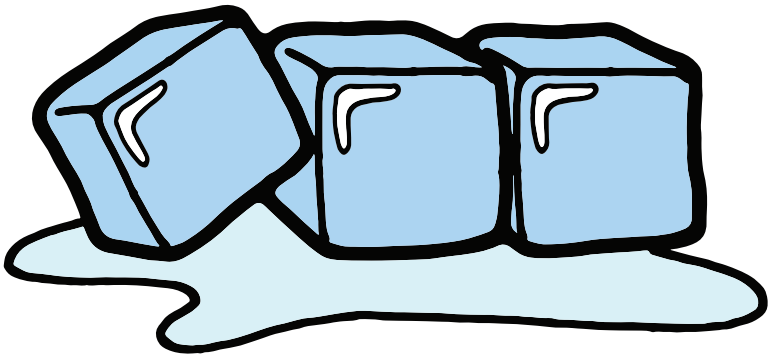


hot water / agua caliente

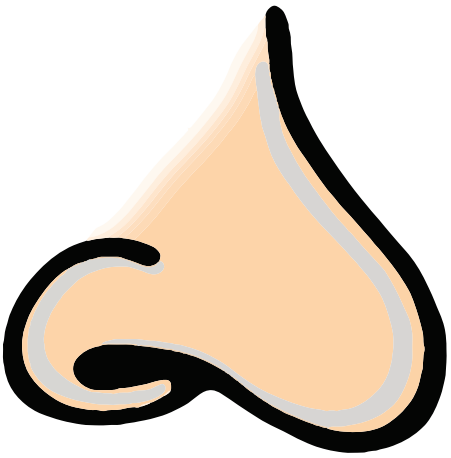


ice cube / cubo de hielo

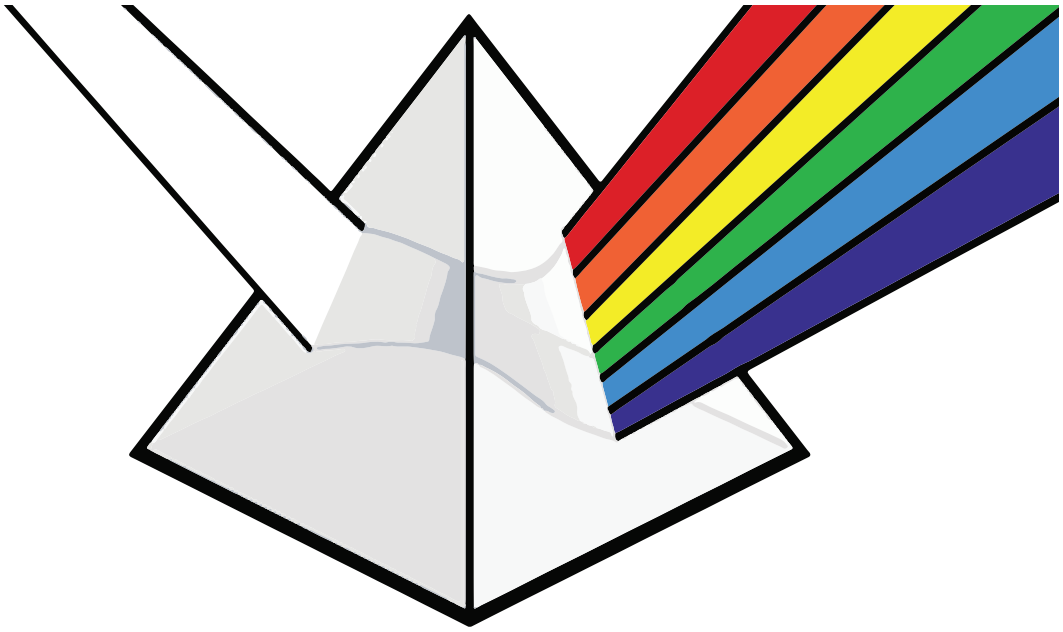
light / luz



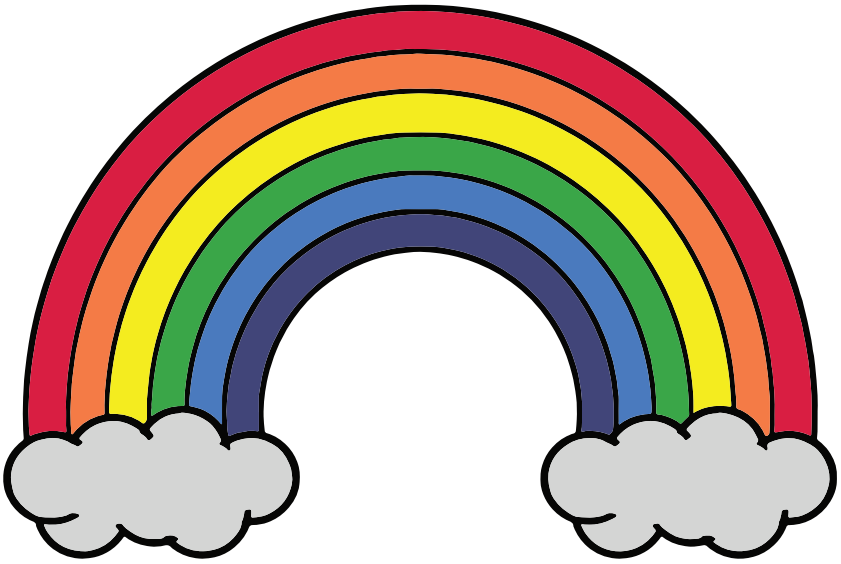
melt / derretir



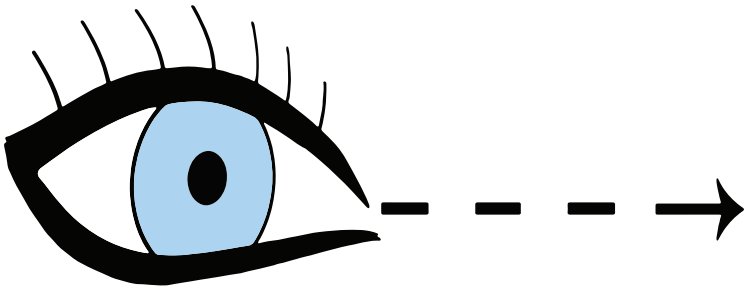
nose / nariz



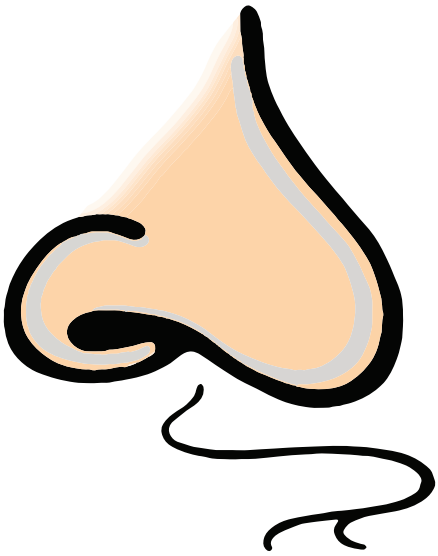
prism / prisma



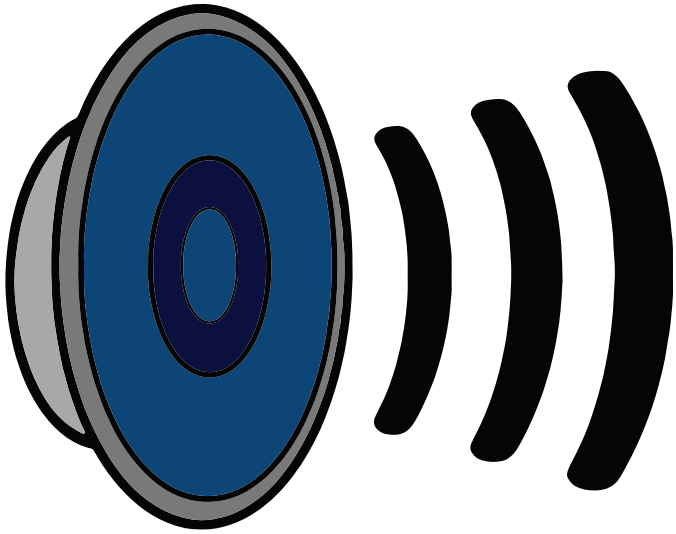
rainbow / arco iris



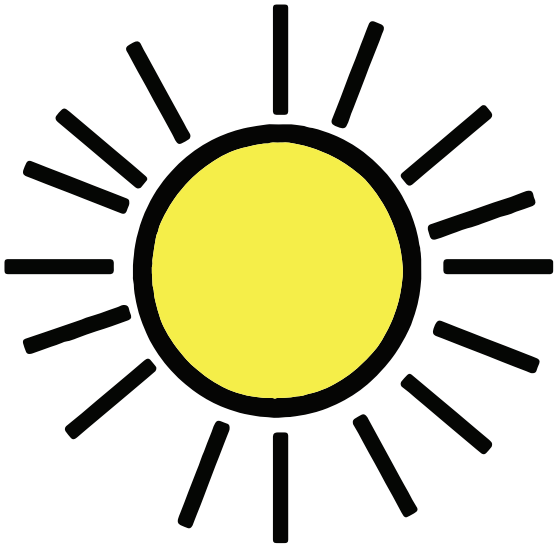
sight / vista



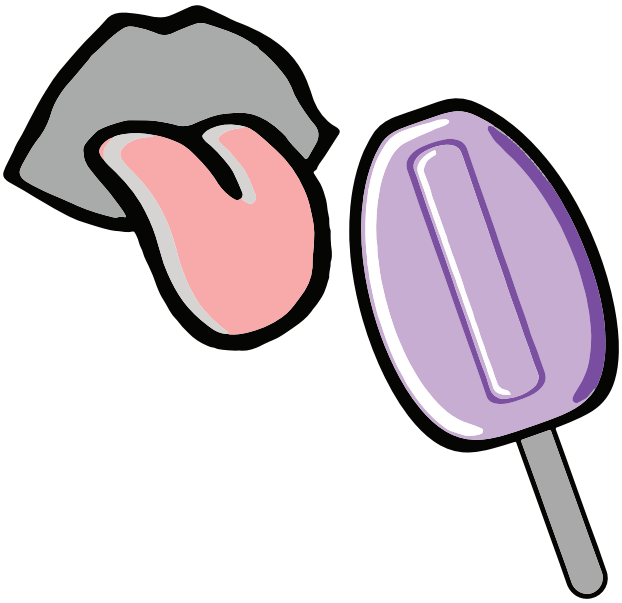
smell / oler



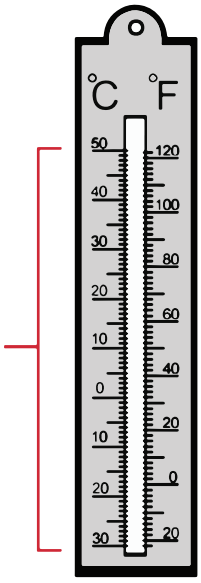
sound / sonido



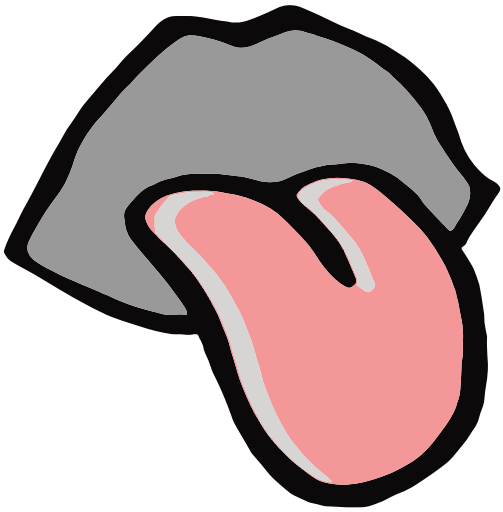
sun / sol



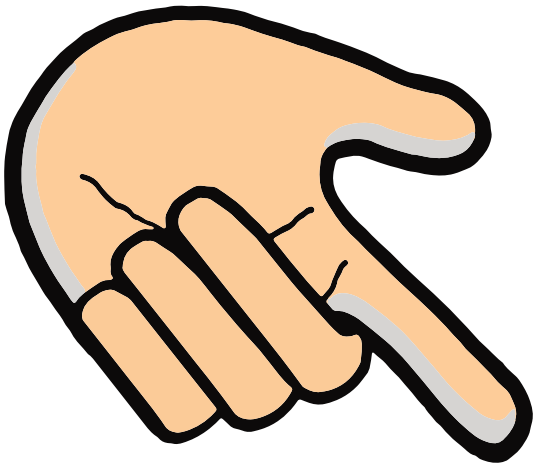
taste / sabor



temperature / temperatura

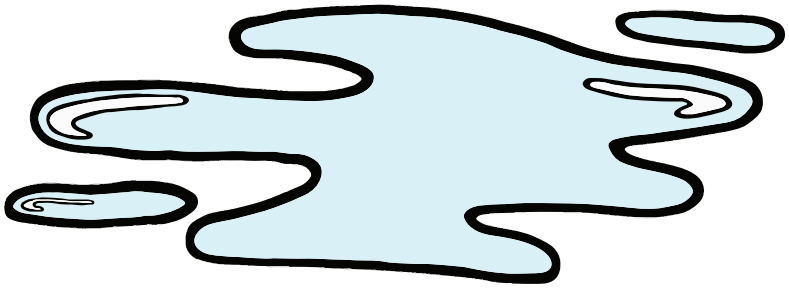


tongue / lengua



touch / toque

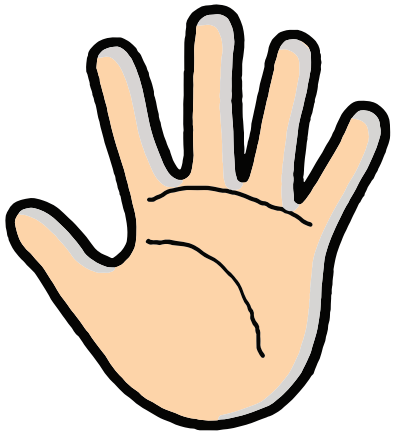
vibrate / vibrar

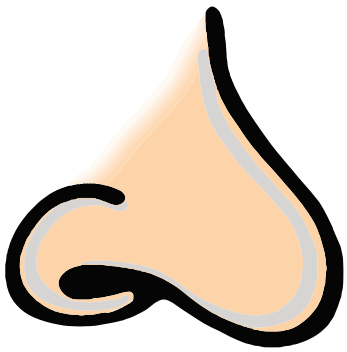


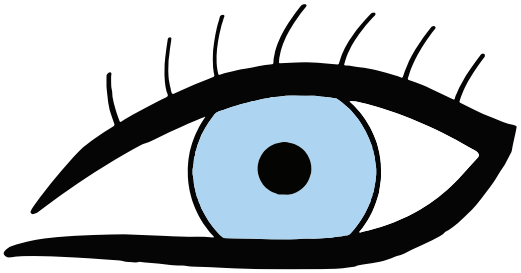
water / agua

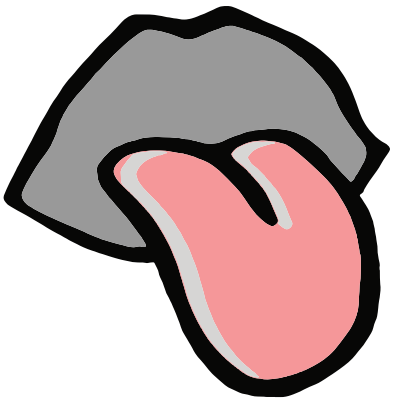
Water Pitchers Card

Sense Cards



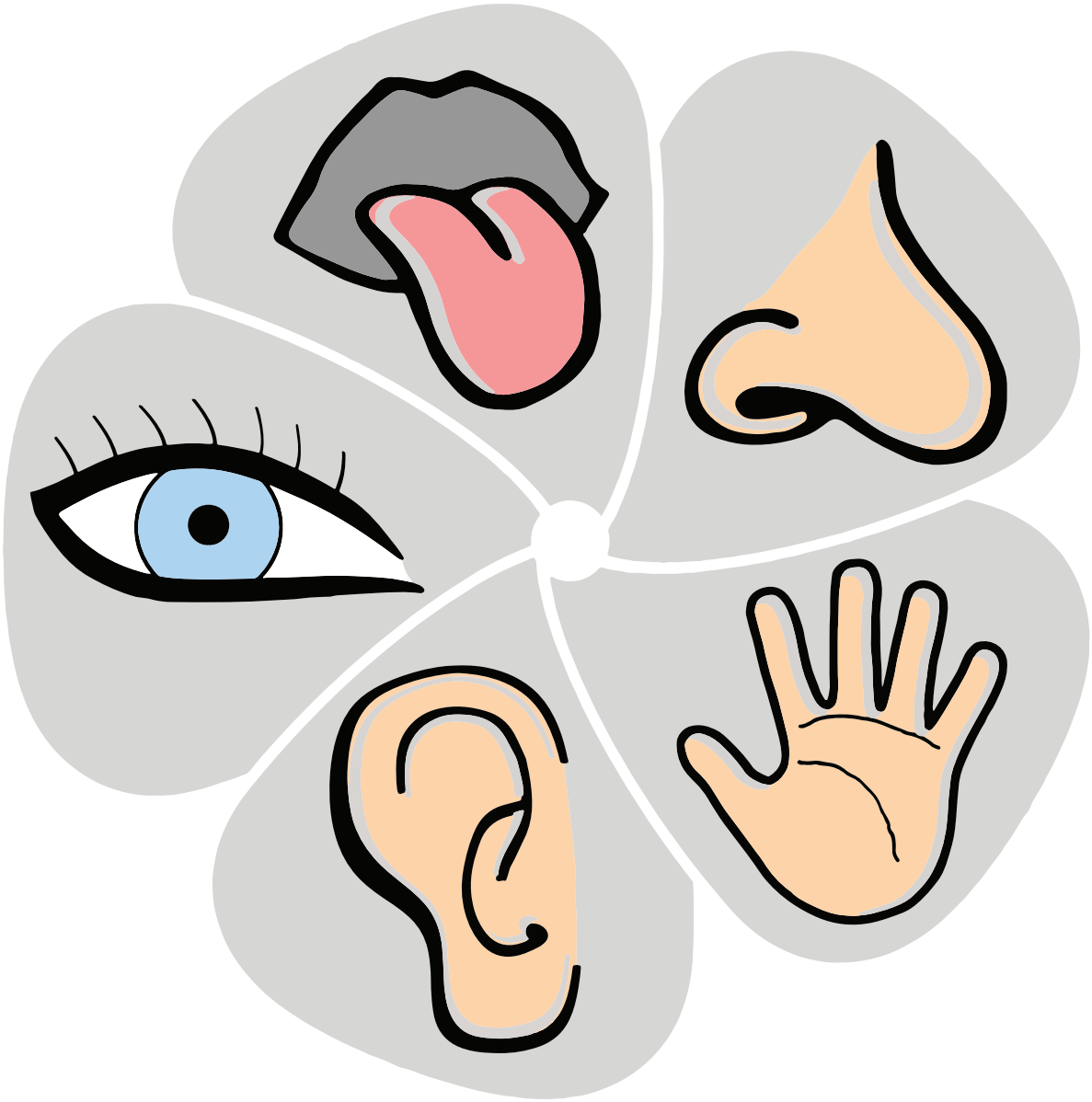


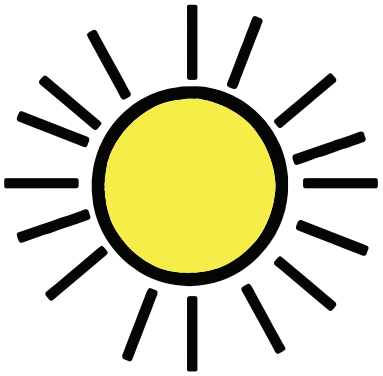


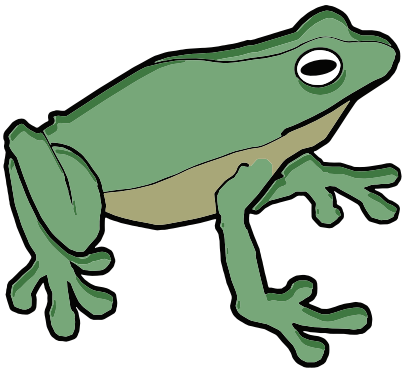


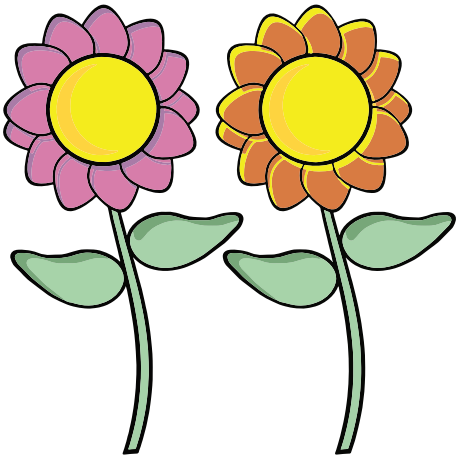
My Five Senses Data Sheet

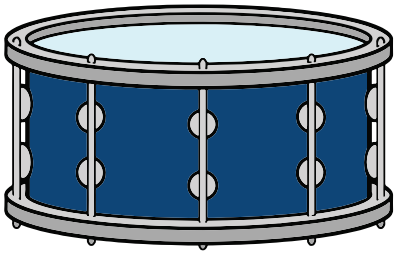
Name _____ **Date**_____

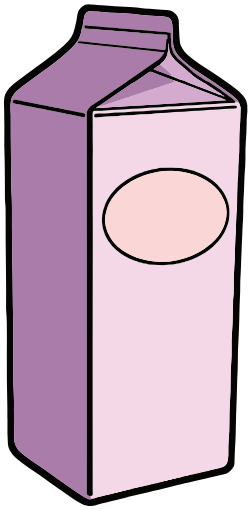


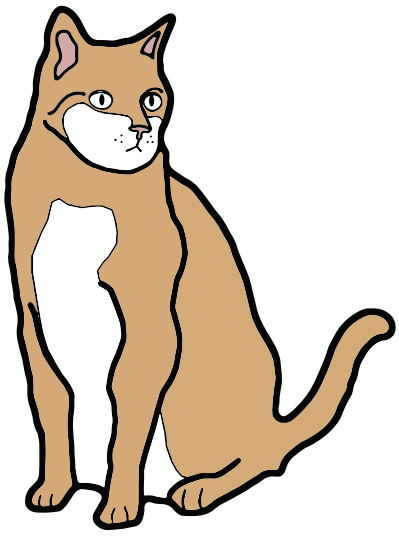


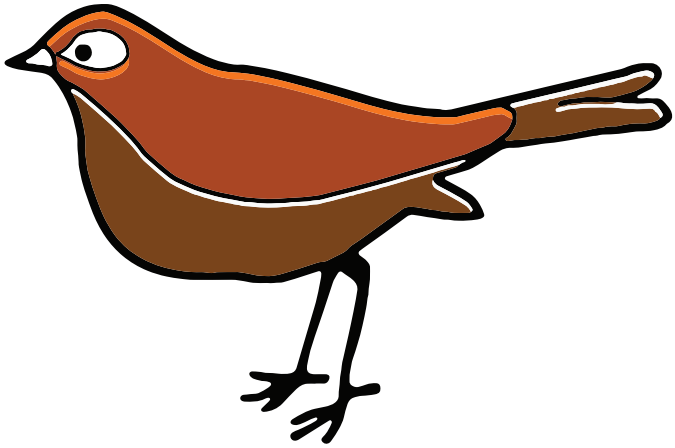


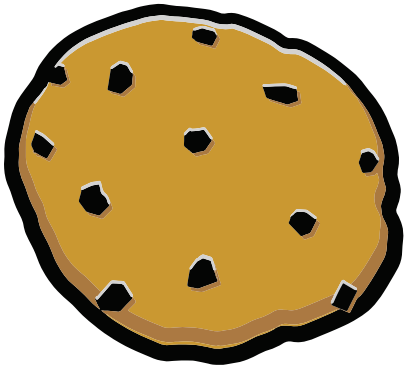


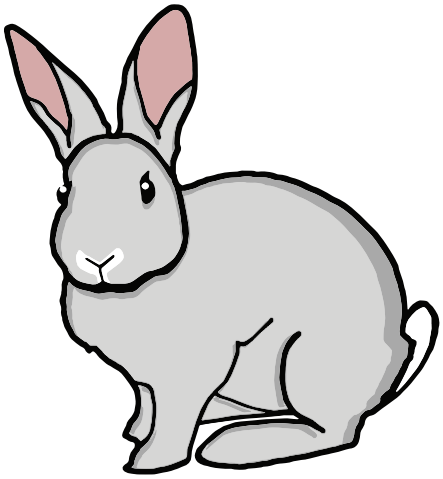








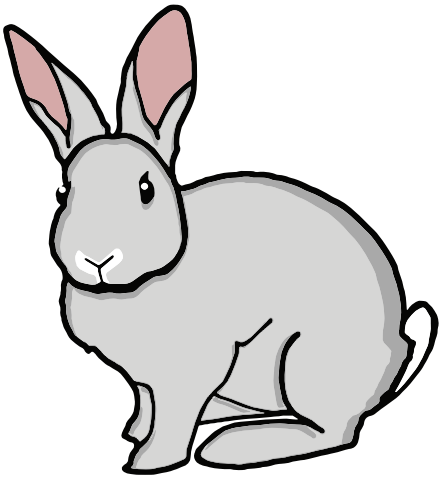


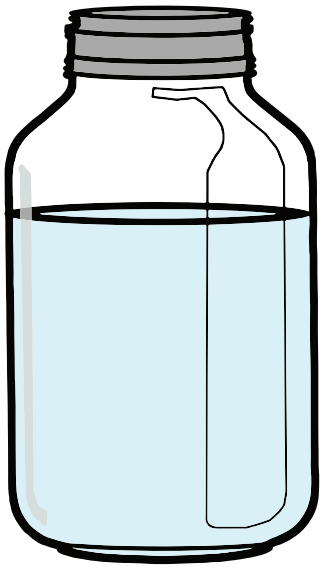


Light Center Instructions

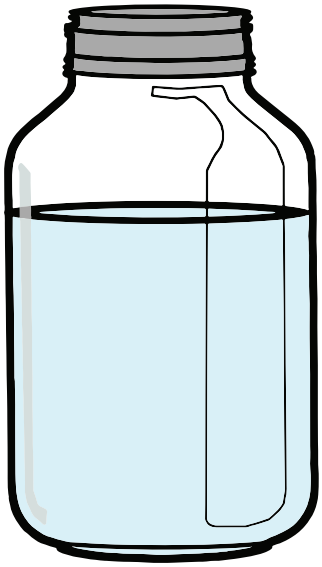
Jar Lens

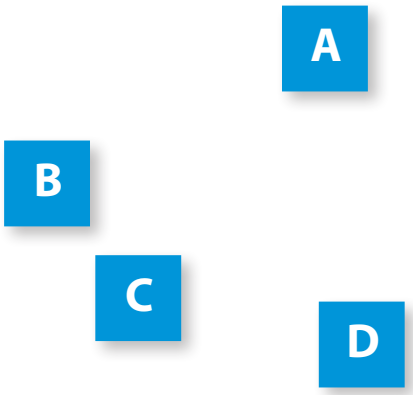
Draw how the rabbit picture looks behind the jar of water.



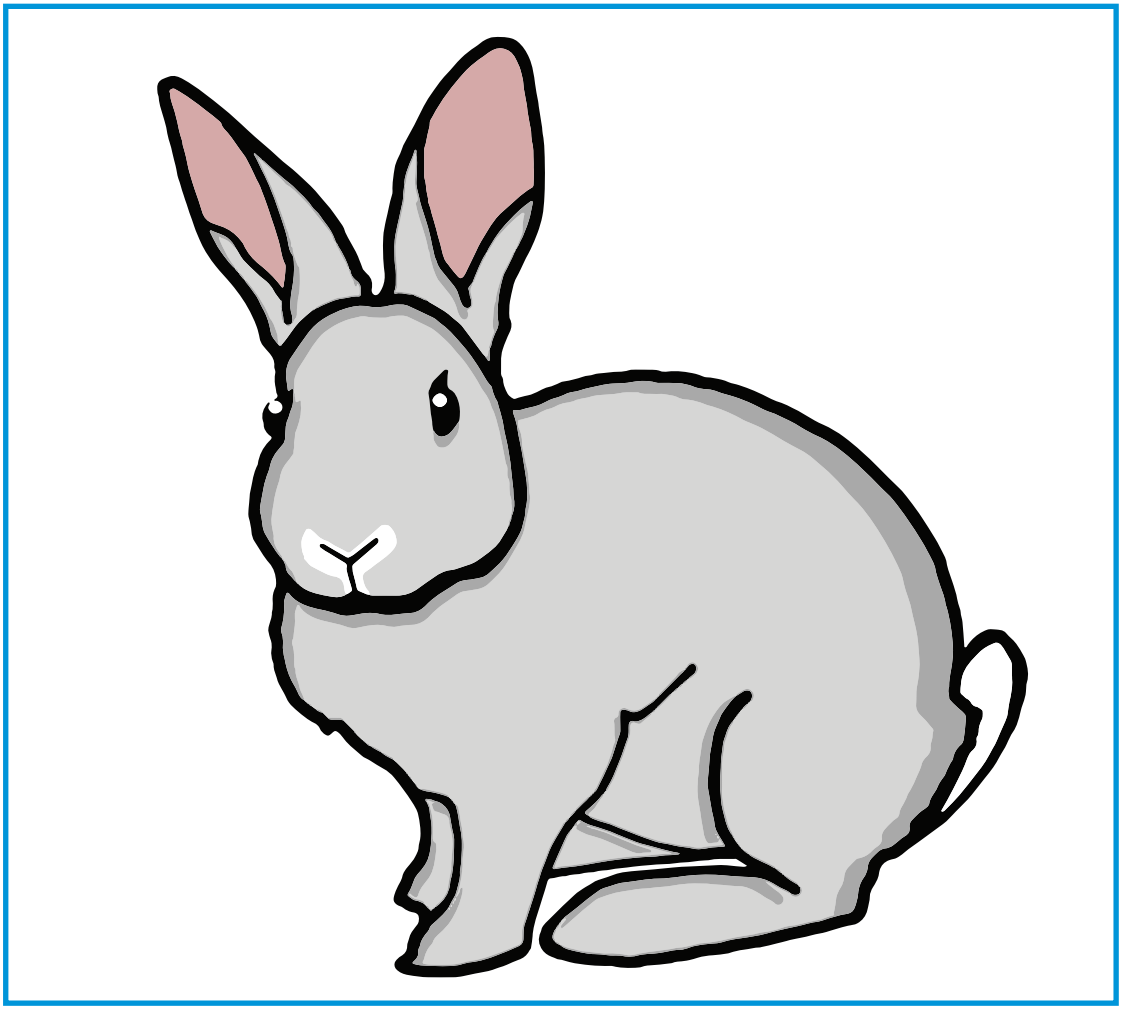


Draw how the letters look behind the jar of water.





Rabbit Card and Alphabet Letter Cards

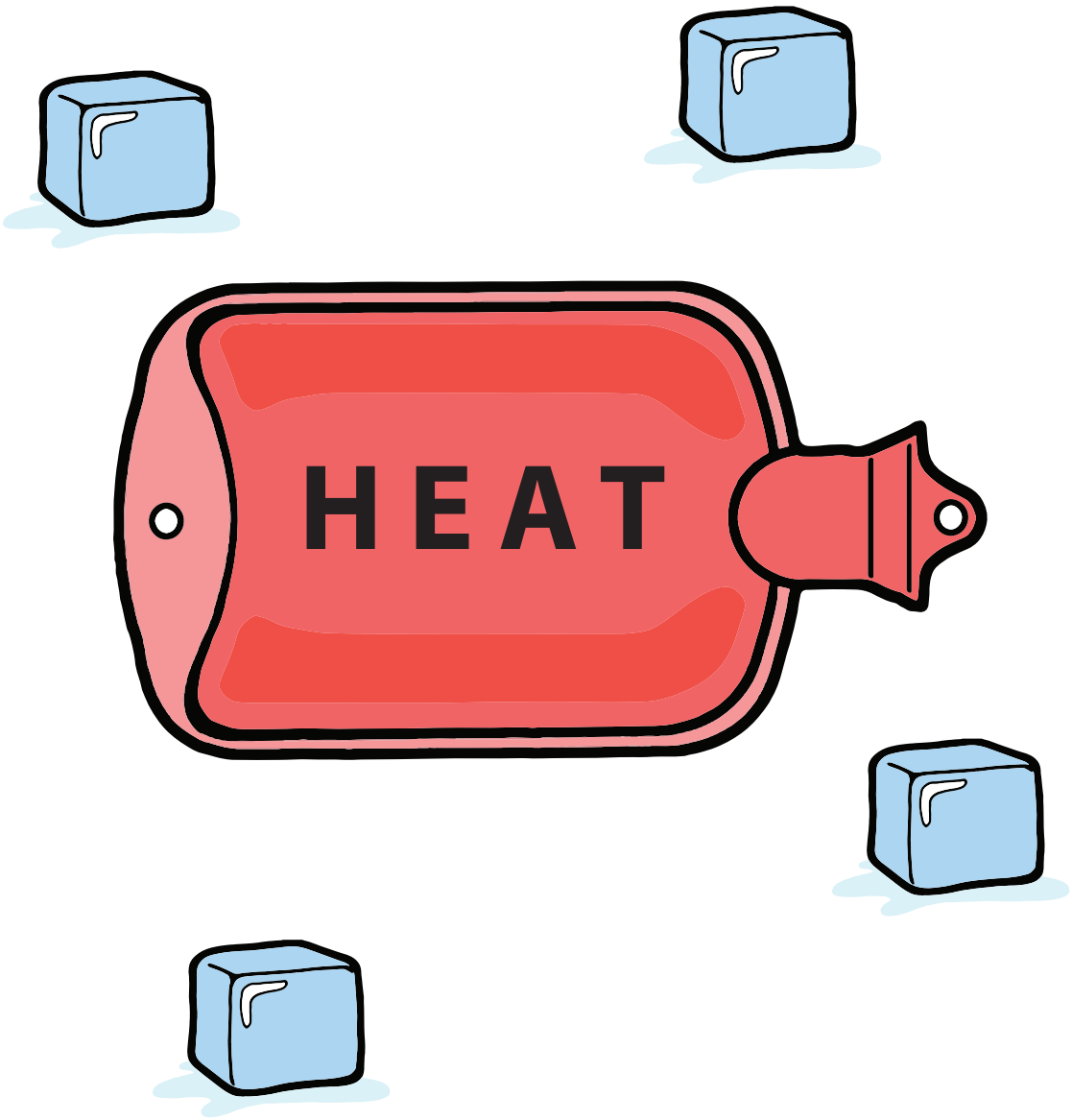


A B C D

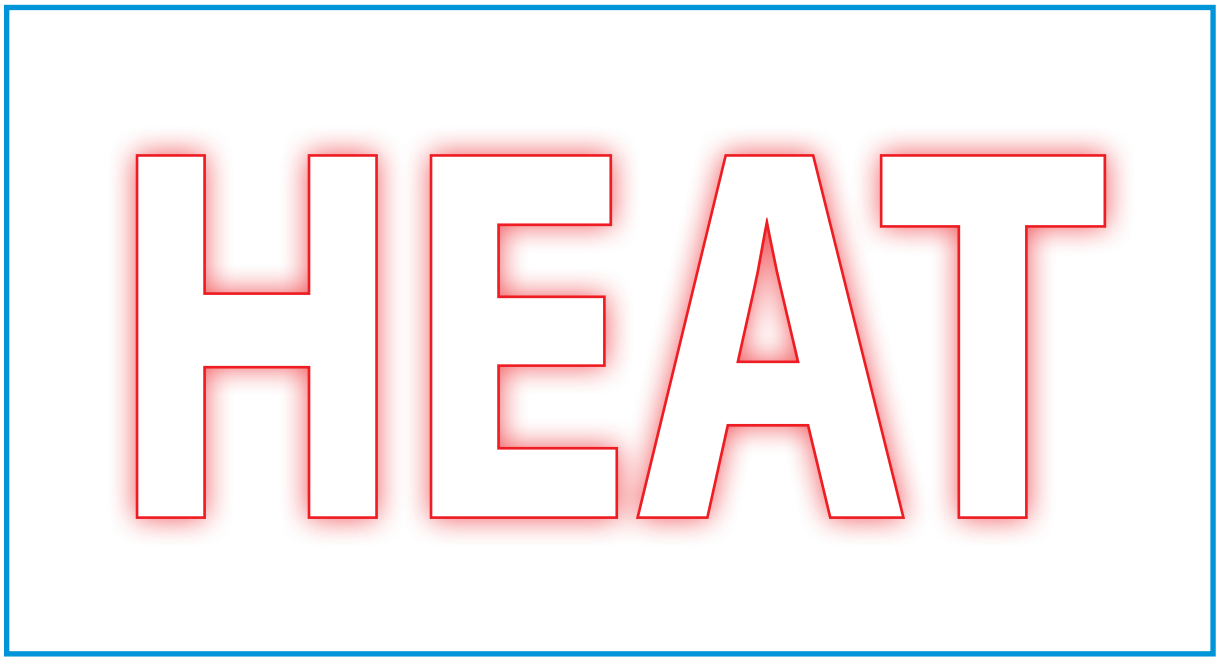
Heat Center Instructions

Melting Ice Alphabetically

Trace over each letter in the word HEAT with an ice cube and draw what happens.

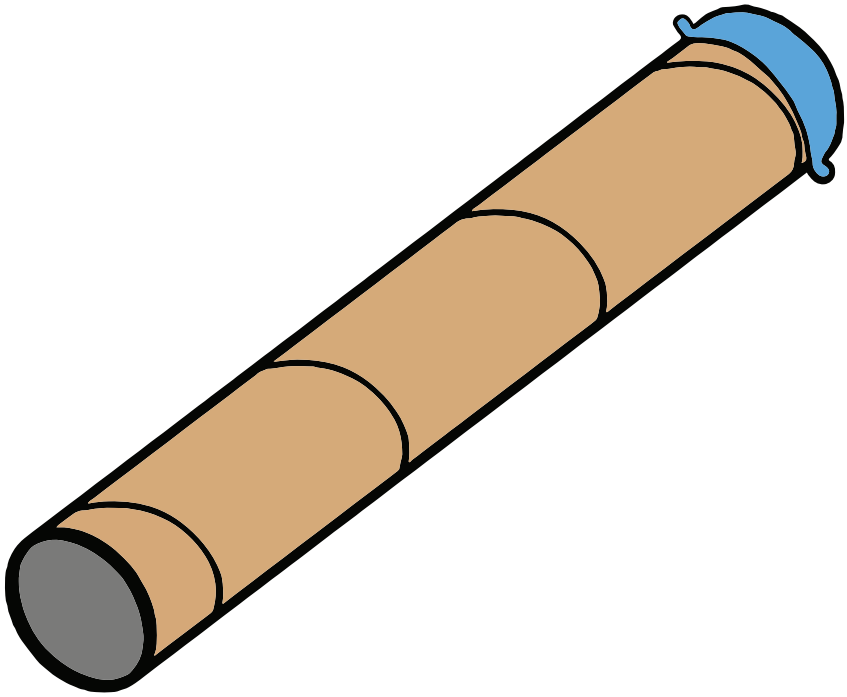


Heat Card



Sound Center Instructions

Sound Tube



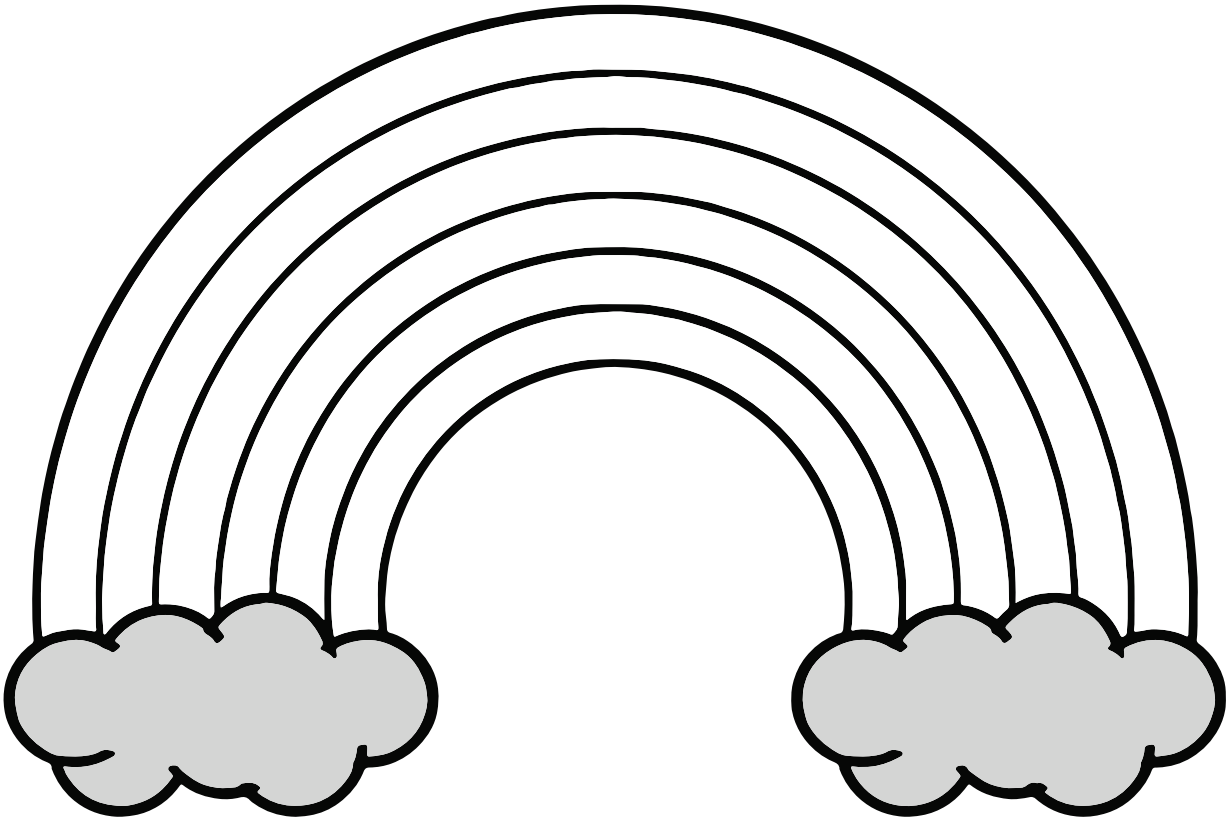
1. Place your hand on the end of the tube covered with the balloon.

2. Ask your partner to say the letters of the alphabet into the uncovered end of the tube.

3. What happens to the stretched balloon when you hear each letter?

What Colors Make a Rainbow? Data Sheet

Name _____ **Date**_____



Which color of ribbon did you see first in the story?
Color it above the other colors at the top of the rainbow.

Which color of ribbon came next? Color it under the first band of color.

Which color of ribbon came next? Color it under the second band of color.

Which color of ribbon came next? Color it under the third band of color.

Which color of ribbon came next? Color it under the fourth band of color.

Which color is below, or under, all of the others?

Energy Assessment Teacher Instructions

1. Duplicate the assessment and distribute to each student.

2. Read the following instructions aloud to the class:

> **"Listen carefully as I read each question and the possible answers. When I have finished, circle the letter next to the best answer to the question."**

3. Read the assessment questions and possible answers aloud to students. The answers are listed below.

Answer Key

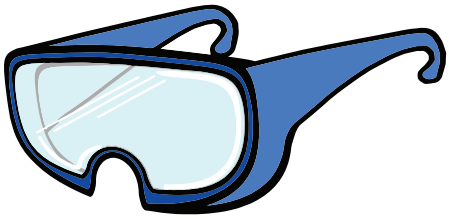
1. **B**
2. **B**
3. **C**
4. **C**

Name _____ Date_____

Energy Assessment

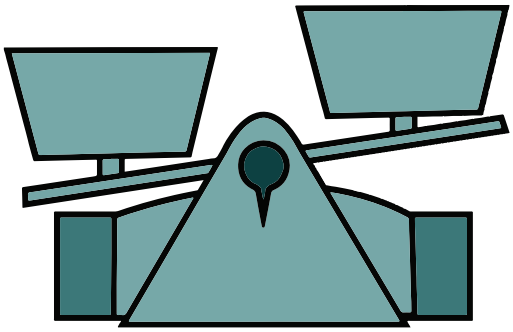
1. Which is the best science tool to observe an ant?

A



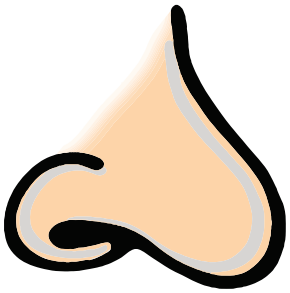
B

C

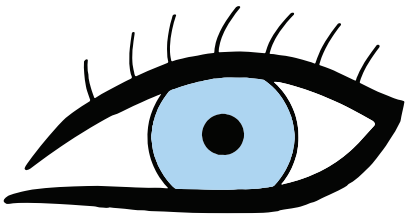


2. Which sense is used to observe the colors in a rainbow?

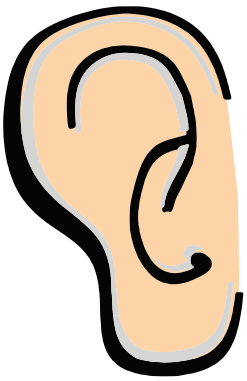
A



B



C



3. On a hot day, the objects in the circle will _____.

A **freeze**

B **vibrate**

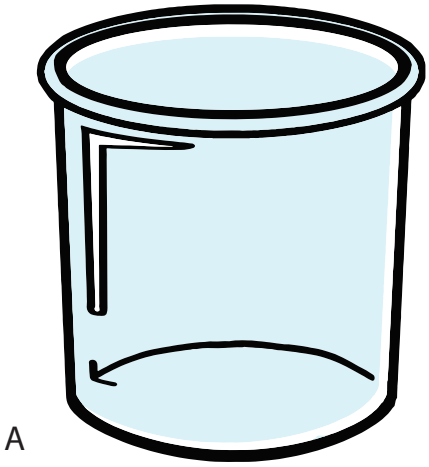
C **melt**

4. Which of these two cups has the greater capacity?

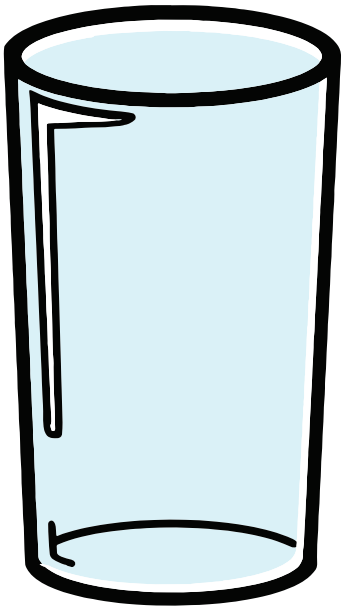
A **The one on the left (A)**

B **The one on the right (B)**

C **You cannot tell just by looking**



A



B

Reading Connections

The following books are recommended as literary resources to enhance the study of light, heat, and sound energy for kindergarten students.

The Five Senses

Aliki. (1989). *My five senses* (Let's-Read-and-Find-Out Science 1). New York, NY: HarperCollins Publishers. (Available in English and Spanish)

Cole, J. (1994). *You can't smell a flower with your ear: All about your 5 senses.* New York, NY: Grosset & Dunlap.

Light and Rainbows

Cobb, V. (2002). *I see myself* (Vicki Cobb Science Play). New York, NY: HarperCollins Publishers.

Dr. Seuss [LeSieg, T.]. (1999). *The eye book* (Bright and Early Books for Beginning Beginners). New York, NY: Random House, Inc.

Fowler, A. (1998). *All the colors of the rainbow* (Rookie Read-About Science). New York, NY: Children's Press.

Freeman, D. (1966). *A rainbow of my own.* New York, NY: Puffin Books.

Kirkpatrick, R. K. (1985). *Look at rainbow colors.* Milwaukee, WI: Raintree Children's Books.

Krupp, E. C. (2000). *The rainbow and you.* Singapore: HarperCollins Publishers.

Lee, S. (2010). *Shadow.* San Francisco, CA: Chronicle Books.

Schwartz, B. A. (2000). *What makes a rainbow?* (A Magic Ribbon Book). Santa Monica, CA: Piggy Toes Press.

Wyler, R. (1989). *Raindrops and rainbows* (An Outdoor Science Book). Englewood Cliffs, NJ: Julian Messner Publishers.

Heat

Greathouse, L. (2010). *Melting and freezing* (Science Readers: A Closer Look). Huntington Beach, CA: Teacher Created Materials. (Available in English and Spanish)

Manolis, K. (2008). *Temperature* (Blastoff! Readers: First Science). Minneapolis, MN: Bellwether Media.

Sound

Manolis, K. (2008). *Sound* (Blastoff! Readers: First Science). Minneapolis, MN: Bellwether Media.

Pfeffer, W. (1999). *Sounds all around* (Let's-Read-and-Find-Out Science 1). New York, NY: HarperCollins Publishers.

Wright, L. (2000). *The science of noise* (Science World). Austin, TX: Raintree Steck-Vaughn Company.

Texas Essential Knowledge and Skills (TEKS) Focus

§112.11. Science, Kindergarten, Beginning with School Year 2010–2011.

(b) Knowledge and skills.

(1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following home and school safety procedures and uses environmentally appropriate and responsible practices. The student is expected to:

(A) identify and demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including wearing safety goggles, washing hands, and using materials appropriately;

(B) discuss the importance of safe practices to keep self and others safe and healthy.

(2) Scientific investigation and reasoning. The student develops abilities to ask questions and seek answers in classroom and outdoor investigations. The student is expected to:

(A) ask questions about organisms, objects, and events observed in the natural world;

(B) plan and conduct simple descriptive investigations such as ways objects move;

(C) collect data and make observations using simple equipment such as hand lenses, primary balances, and non-standard measurement tools;

(D) record and organize data and observations using pictures, numbers, and words; and

(E) communicate observations with others about simple descriptive investigations.

(3) Scientific investigation and reasoning. The student knows that information and critical thinking are used in scientific problem solving. The student is expected to:

(B) make predictions based on observable patterns in nature such as the shapes of leaves.

(4) Scientific investigation and reasoning. The student uses age-appropriate tools and models to investigate the natural world. The student is expected to:

(A) collect information using tools, including computers, hand lenses, primary balances, cups, bowls, magnets, collecting nets, and notebooks; timing devices, including clocks and timers; non-standard measuring items such as paper clips and clothespins; weather instruments such as demonstration thermometers and wind socks; and materials to support observations of habitats of organisms such as terrariums and aquariums; and

(B) use senses as a tool of observation to identify properties and patterns of organisms, objects, and events in the environment.

(5) Matter and energy. The student knows that objects have properties and patterns. The student is expected to:

(A) observe and record properties of objects, including relative size and mass, such as bigger or smaller and heavier or lighter, shape, color, and texture; and

(B) observe, record, and discuss how materials can be changed by heating or cooling.

(6) Force, motion, and energy. The student knows that energy, force, and motion are related and are a part of their everyday life. The student is expected to:

(A) use the five senses to explore different forms of energy such as light, heat, and sound.

§111.12. Mathematics, Kindergarten.

(b) Knowledge and skills.

(6) Patterns, relationships, and algebraic thinking. The student uses patterns to make predictions. The student is expected to:

(A) use patterns to predict what comes next, including cause-and-effect relationships.

(10) Measurement. The student directly compares the attributes of length, area, weight/mass, capacity, and/or relative temperature. The student uses comparative language to solve problems and answer questions. The student is expected to:

(C) compare two containers according to capacity (holds more, holds less, or holds the same);

(E) compare situations or objects according to relative temperature (hotter/colder than, or the same as).

(13) Underlying processes and mathematical tools. The student applies Kindergarten mathematics to solve problems connected to everyday experiences and activities in and outside of school. The student is expected to:

(A) identify mathematics in everyday situations;

(C) select or develop an appropriate problem-solving strategy including drawing a picture, looking for a pattern, systematic guessing and checking, or acting it out in order to solve a problem.

(14) Underlying processes and mathematical tools. The student communicates about Kindergarten mathematics using informal language. The student is expected to:

(A) communicate mathematical ideas using objects, words, pictures, numbers, and technology.

§126.2. Technology Applications, Kindergarten–Grade 2.

(b) Knowledge and skills.

(7) Solving problems. The student uses appropriate computer-based productivity tools to create and modify solutions to problems. The student is expected to:

(A) use software programs with audio, video, and graphics to enhance learning experiences; and

(B) use appropriate software, including the use of word processing and multimedia, to express ideas and solve problems.

(8) Solving problems. The student uses research skills and electronic communication, with appropriate supervision, to create new knowledge. The student is expected to:

(A) use communication tools to participate in group projects; and

(B) use electronic tools and research skills to build a knowledge base regarding a topic, task, or assignment.

§74.4. English Language Proficiency Standards.

(b) School district responsibilities. In fulfilling the requirements of this section, school districts shall:

(1) Identify the student's English language proficiency levels in the domains of listening, speaking, reading, and writing in accordance with the proficiency level descriptors for the beginning, intermediate, advanced, and advanced high levels delineated in subsection (d) of this section;

(2) Provide instruction in the knowledge and skills of the foundation and enrichment curriculum in a manner that is linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's levels of English language proficiency to ensure that the student learns the knowledge and skills in the required curriculum;

(3) Provide content-based instruction including the cross-curricular second language acquisition essential knowledge and skills in subsection (c) of this section in a manner that is linguistically accommodated to help the student acquire English language proficiency.

(c) Cross-curricular second language acquisition essential knowledge and skills.

(1) Cross-curricular second language acquisition/learning strategies. The ELL uses language-learning strategies to develop an awareness of his or her own learning processes in all content areas. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. The student is expected to:

(A) Use prior knowledge and experiences to understand meanings in English;

(B) Monitor oral and written language production and employ self-corrective techniques or other resources;

(C) Use strategic learning techniques such as concept mapping, drawing, memorizing, comparing, contrasting, and reviewing to acquire basic and grade-level vocabulary;

(D) Speak using learning strategies such as requesting assistance, employing non-verbal cues, and using synonyms and circumlocution (conveying ideas by defining or describing when exact English words are not known);

(E) Internalize new basic and academic language by using and reusing it in meaningful ways in speaking and writing activities that build concept and language attainment;

(F) Use accessible language and learn new and essential language in the process;

(G) Demonstrate an increasing ability to distinguish between formal and informal English and an increasing knowledge of when to use each one commensurate with grade-level learning expectations; and

(H) Develop and expand repertoire of learning strategies such as reasoning inductively or deductively, looking for patterns in language, and analyzing sayings and expressions commensurate with grade-level learning expectations.

References

National Research Council: Committee on Conceptual Framework for the New K–12 Science Education Standards. (2011). *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: National Academies Press. Available from **http://www.nap.edu/catalog.php?record_id=13165**

National Research Council: National Committee on Science Education Standards and Assessment. (1996). *The national science education standards* (p. 23). Washington, DC: National Academies Press. Available from **http://books.nap.edu/catalog.php?record_id=4962**

Texas Education Agency, Student Assessment Division. (2011). *Educator Guide to TELPAS: Grades K–12* (pp. 15, 22, 30, 40, 78, 84). Austin, TX: Author. Available from **http://www.tea.state.tx.us/student.assessment/ell/telpas**

Texas Essential Knowledge and Skills, 19 Tex. Admin. Code § 74.4, 111, 112, 126 (2010). Available from **http://www.tea.state.tx.us/index2.aspx?id=6148**