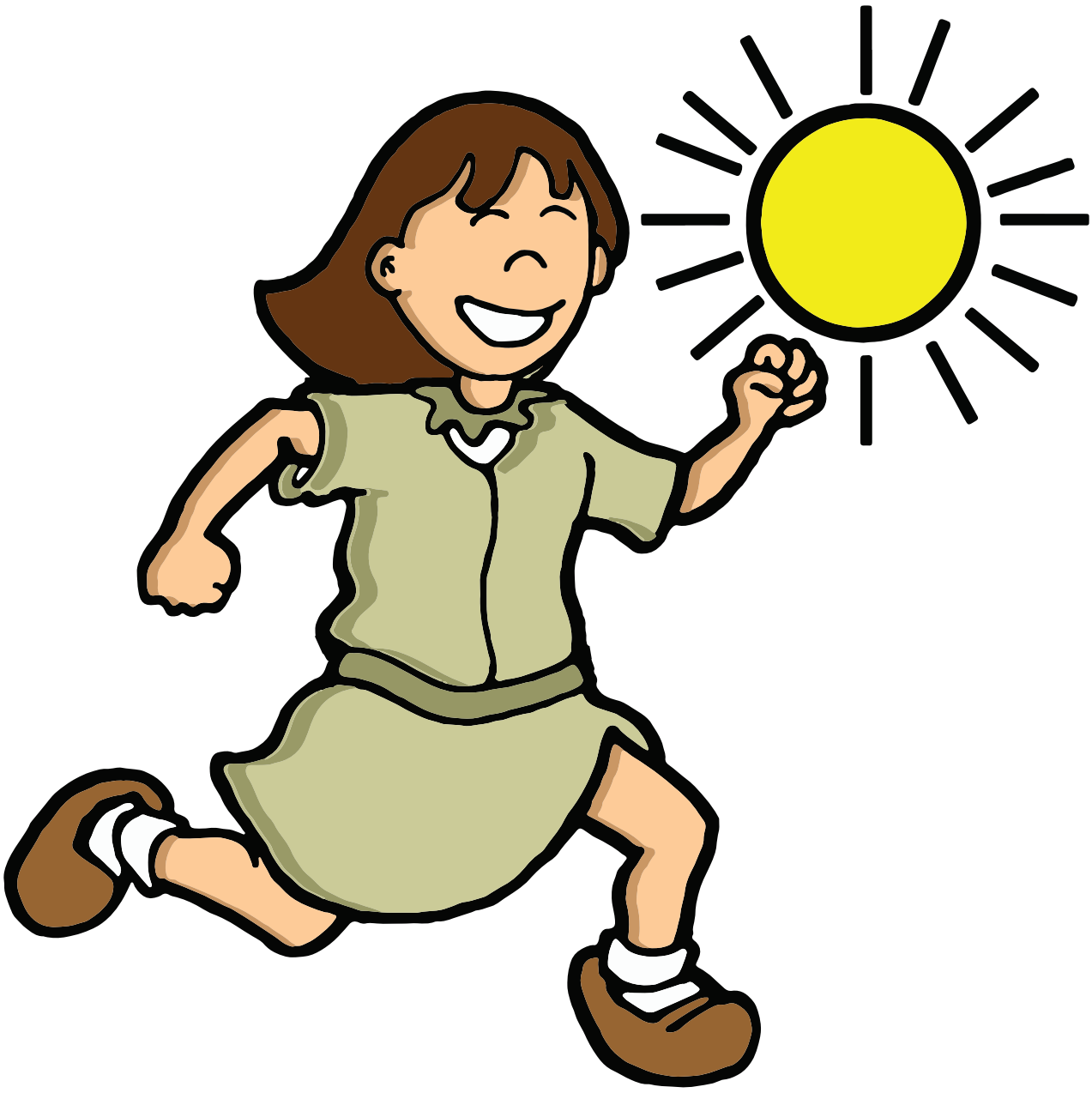
mosaic

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

Grade 1

Energy All Around Us: Light, Heat, and Sound



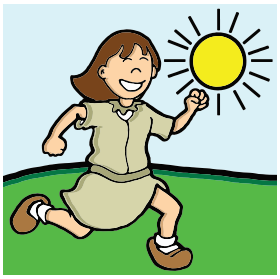
Acknowledgments

The MOSAIC Program was made possible through a grant from the Sid W. Richardson Foundation of Fort Worth, Texas. Since 1947, the Foundation has generously supported education, healthcare, human services, and culture in Texas.

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.

SEDL
4700 Mueller Blvd.
Austin, TX 78723
800-476-6861
www.sedl.org

Contents



Energy All Around Us: Light, Heat, and Sound

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 students' attention and make connections between students' prior knowledge and the new concept they will be learning.

In this module: Students experience the sound vibrations made by their own voices, the light reflection in a mirror, and the expansion of heated water.

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 or in writing. ELs at the advanced and advanced high levels will require practice with the appropriate expression of the content's mastery (oral or written).

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 shadows, water at different temperatures, and vibrations of a rubber band on a tissue box guitar.

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 help ELs 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 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 of the importance of energy in everyday life.

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: The teacher leads students through a prereading think-pair-share strategy about ways in which they use energy. Next, the teacher reads *Energy Makes Things Happen* (2002), by Kimberly Brubaker Bradley. The students then brainstorm to develop a class list of ways they use energy every day.

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 *Energy Makes Things Happen,* 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 illustrating how energy changes things and is important in everyday life. 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 each students' level of English language proficiency. For example, assessments 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 first grade students. To help them grasp the concept of energy, access their prior knowledge and provide concrete experiences that allow the students to connect light, heat, and sound to their 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 first grade 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 experience and interact with different forms of energy, including light, heat, and sound. Then at the end of the unit, revisit the concept of energy to refine students' operational definition.

Light

The concept of light is also abstract for young children. When light is present, people can see objects. 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 through space as waves of energy. The waves we can detect with our eyes are called visible light. 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 or bounce off objects. Additionally, different materials can block or absorb light. If an object blocks light, a shadow of the object forms. If the intensity or direction of the light source changes, the appearance of an object's shadow can change in size, shape, or darkness. Absorbing light energy can cause changes in matter. A common example includes the color of paper or fabric fading as the matter absorbs light over time.

Heat

Temperature and heat are not the same thing! Temperature is a measurement of how hot or cold a substance is; heat is the amount of energy contained in a substance or material. This heat energy can be passed or transferred to a cooler substance or material, which can cause changes in matter. For example, a frozen solid ice cube melts in our warm hands and becomes a liquid. In first grade, students should have experiences that help them understand that more heat energy causes the colored fluid in a thermometer to expand and rise, while less heat energy causes the colored fluid to contract and fall.

Sound

Vibrations cause sounds. We can hear when sound waves travel through the air to our ears and cause our eardrums to vibrate. Sound can also travel through other forms of matter, such as liquids and solids.

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 important in everyday life and may cause changes in objects around us.
- Mathematics is used every day to measure and make comparisons.

Concepts

By the end of this lesson, Grade 1 students will understand the following concepts:

- Energy is important in everyday life.
- Light, sound, and heat are forms of energy.
- Energy can move from one object or material to another object or material.
- Sounds are vibrations that we can hear and sometimes see and feel.
- Light must reflect off objects for us to see them.
- Shadows form when solid or opaque objects block light.
- Heated materials expand and rise, whereas removing heat causes materials to contract or shrink, as seen in a thermometer.
- The size of a nonstandard unit is related to the number of that unit needed to measure a given length (the larger the unit, the fewer units needed to measure a given distance; the smaller the unit, the more units needed to measure the same distance)
- Two or more objects can be ordered according to relative temperature (from hottest to coldest or from coldest to hottest).
- Patterns can be observed to make predictions.
- The temperatures of different objects can be identified using whole numbers up to 99, and temperatures of objects can be compared to that of other objects (e.g., 90 degrees is hotter than 60 degrees).
- A thermometer is a tool that can collect data to identify properties and patterns.
- Descriptive investigations should be planned and conducted safely.
- Student-generated data from simple descriptive investigations can be used to communicate observations and justify explanations.

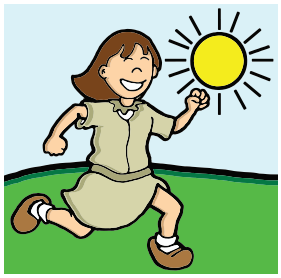
Language Support for English Learners

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

- First grade 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 the target language (English).
- Consider the language demands of instruction. Find ways to contextualize abstract concepts. For example, to explain the concept of energy, show pictures or video clips of machines or people using energy, or use graphic organizers with content-specific vocabulary.
- For beginning ELs, 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).
- In general, be cognizant of the amount of wait time you give ELs to allow them enough time to process their 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
bell	campana
cloud	nube
cold	frio
cold water	agua fría
dropper	cuentagotas
energy	energía
flashlight	linterna
guitar	guitarra
hand lens (magnifying glass)	lupa
heat	calor
hot	caliente
hot water	agua caliente

English Vocabulary	Spanish Vocabulary
light	luz
mirror	espejo
shade	sombra
shadow	sombra
sound	sonido
straight	recto o derecho
sun	sol
sunlight	luz solar
temperature	temperatura
thermometer	termómetro
vibrate	vibrar
water	agua



Lesson Procedures

ENGAGE

Sound

Time: Approximately 30 minutes

Materials

For the class

☐ Bell

1. Ring a bell behind your desk so that students cannot see what is making the noise. Ask:
   - What object might be making this sound? *Students may name several objects, but should ultimately conclude that a bell made the sound.*
2. Name the objects that students suggest and confirm the right answer. When students identify that a bell made the sound, explain how the bell produced the sound. Show students the clapper in the bell and how it strikes the metal bell casing. Allow several students to feel the metal casing immediately after the bell is rung and to describe the shaking movement of the metal.
   - What are some other objects that make sounds? *Answers may vary but may include drums, guitars, horns, and people.*
3. Ask students to gently place their fingers on their throat and hum softly. Then ask students to hum very loudly.
   - What do you feel when you are humming softly? *a tiny shaking or back-and-forth movement in my throat*
   - What do you feel when you are humming loudly? *stronger and faster back-and-forth movements in my throat*
   - Based on these two examples, what might cause noises or sounds? *small back-and-forth movements*

4. Ask students to think of other (appropriate) sounds they can make, such as whistling, clapping, and snapping fingers.
   - What do all these sounds have in common? *Something is moving before or during the sound.*

English Language Support

- During the building background phase, provide opportunities for ELs to engage actively in the discussion and hands-on activities.
- Encourage ELs to participate and share their experiences.
- Show a picture of a bell and then an actual bell to the class, while repeating the name slowly.
- When asking questions, institute wait time by pausing 5–7 seconds between asking a question and soliciting an answer. This pause allows ELs time to process information.
- Use hand gestures to explicitly model academic vocabulary. For example, point your finger to your forehead and say, "Think of other sounds and noises you can make."
- Provide language frames to shelter student responses (e.g., "When I was humming softly, I felt _____.").

Light

Time: Approximately 30 minutes

Materials

For each pair

☐ Small mirror

1. Group students in pairs and give each pair a mirror. Ask partners to face each other with the mirror between them. One student should be facing the shiny side of the mirror; the other student should be facing the non-reflective side.
2. Ask students to raise their hands if they can see themselves in the mirror. Draw everyone's attention to the fact that only one student in each pair can see his or her reflection in the mirror. Ask:
   - If you can see yourself in the mirror, describe the mirror properties you observe. *shiny, silver, very smooth*
   - If you cannot see yourself in the mirror, describe the mirror properties you observe. *dull, gray, slightly textured (Answers may vary depending on the mirrors used.)*
   - Can you always see yourself if you are facing the shiny side of the mirror? *Answers may vary.*
   - Could you see yourself in the mirror if it were very dark, such as if it were night or if you were in a closet? *Answers may vary.*

3. Dim the lights in the room, if possible, and ask students to look in their mirrors. After a few seconds, turn the lights back on.
   - Can you see yourself in the mirror? *Students should say that they can see themselves better in the mirror with the lights on.*
   - In addition to looking at the shiny side of a mirror, what else is needed to see your reflection in a mirror? *Light!*
   - What are some sources of light? *the sun, lamps, flashlights*
   - Why do we turn a light on at night? *So we can see objects and not bump into or trip over them.*

English Language Support

- Before students engage in the paired activity, model steps 1 and 2 explicitly, indicating the shiny side and non-reflective side of a mirror. (ELs may not understand some of the terms, such as *dull, shiny,* or *smooth,* that are used to describe different parts of a mirror. As you are modeling the activity, allow ELs to feel the related part of a mirror as you share each term.)
- Model and provide opportunities for students to engage in hands-on activities to experience a mirror's various features: shiny, silver, very smooth, dull, and slightly textured.
- Highlight related academic language, such as *observed, properties,* and *reflection,* by using a mirror to explicitly model these terms.
- Provide pictures for vocabulary like *mirror.* (An illustrated English-Spanish vocabulary card for the term *mirror* is provided in the Resources section.)

Heat

Time: Approximately 30 minutes

1. Gather the class around a demonstration table.
   a. Fill one cup with hot water and add red food coloring.
   b. Fill the other cup with ice-cold water.
   c. Fill the dropper with the hot, colored water.
   d. Set the dropper in the cup of cold water with the pointed end of the dropper resting on the inside bottom of the cup.
   e. Gently squeeze the bulb of the dropper to slowly expel some of the hot water at the bottom of the cup of cold water.

Materials

For the class

- ☐ 2 clear cups
- ☐ Red food coloring
- ☐ Hot water
- ☐ Ice-cold water
- ☐ Dropper

2. Ask students to observe what happens. Ask:
   - What happened to the hot water? *It rose to the top of the cold water.*
   - If hot water rises to the top of cold water, what might happen if we put cold water at the bottom of a cup of hot water? *The cold water might stay at the bottom of the cup.*
3. Demonstrate this second scenario for students.
   a. Fill the dropper with cold water.
   b. Set the dropper in the cup of hot water with the pointed end of the dropper resting on the inside bottom of the cup.
   c. Gently squeeze the bulb of the dropper to expel some of the cold water at the bottom of the cup.
      - What happened to the cold water? *It stayed at the bottom of the cup.*
   d. Then raise the pointed end of the dropper to the top of the cup of hot water and very gently squeeze the bulb of the dropper to expel some more cold water.
      - What happened to this cold water? *It sank to the bottom of the cup.*
      - What happens when cold water is gently put into hot water? *The cold water goes to the bottom of the hot water.*
      - What would happen if we quickly put cold water into hot water? Let's try it. What happened? *The water mixed together.*

English Language Support

- For beginning and intermediate ELs, provide visual support of the materials by pointing to each item and stating its name in English (e.g., "This is a dropper.") or by providing students with a sheet with illustrated and labeled terms.
- Show the class a picture of a dropper with the name written in English and Spanish on it (see the Resources section). Say the name in both English and Spanish. Then show a real dropper while repeating the name *dropper* slowly.
- Monitor your rate, tone, and enunciation of speech.
- Watch for student understanding during demonstrations. Pace yourself accordingly and make intentional efforts to ask ELs questions while modeling a demonstration.
- Check for understanding as students engage in discussion.
- Using the think-pair-share strategy, have students predict what they think will happen to the hot and cold water.
- Provide language stems to support student responses (e.g., "The hot, colored water will _____ when _____.").

General Instructions for Explore Centers

Time: Approximately 1 hour, including 10–15 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 allows 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 and ask if students have any questions. Emphasize that in addition to each center's specific task, students should look for ways that energy is changing things.
5. While students are at each center, move about the room to monitor their activities. After about 10–15 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: Shadow Squares

Students place different materials between a light source and the wall to cast a shadow on the wall. Students observe the extent to which each material blocks light, recording whether the material casts a dark shadow, a faint shadow, or no shadow.

Materials

For each center

- ☐ Light Center Instructions (see Resources section)
- ☐ Flashlight
- ☐ Small square mirror
- ☐ Square of index card
- ☐ Square of wax paper
- ☐ Square of clear freezer bag
- ☐ black, blue, yellow crayons

For each student

- ☐ Light Center Data Sheet (see Resources section)

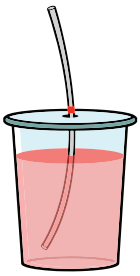
Heat Center: Plastic Cup Thermometer

Students use a plastic cup thermometer, prepared by the teacher in advance, to make approximate temperature measurements of warm water and ice water. Students then conduct investigations using magic animal growing capsules, which are small sponge shapes that are compressed in a capsule that dissolves in warm water. The teacher may want to wait to give out the growing capsules to each group until after students have completed Part I of the data sheet.

PREPARE IN ADVANCE
Plastic Cup Thermometer

Warm water should not be warmer than 54°C for safety.

Safety goggles required



Materials

For each center

- ☐ Heat Center Instructions (see Resources section)
- ☐ Plastic cup thermometer (see Materials List and Details in Resources Section)
- ☐ Plastic red bowl of warm water
- ☐ Plastic blue bowl of ice water
- ☐ Tape
- ☐ Timer
- ☐ Red crayon
- ☐ 2 magic animal growing capsules (per group)
- ☐ Paper towels
- ☐ 5 safety goggles

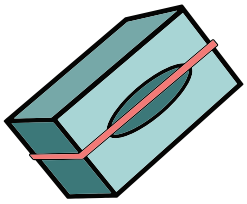
For each student

- ☐ Heat Center Data Sheet (see Resources section)

Sound Center: Tissue Box Guitar

Students pluck a rubber band stretched over the opening of a tissue box guitar, while other students use a hand lens to observe the vibrations of the rubber band and how they relate to the sound made.

PREPARE IN ADVANCE
Tissue Box Guitar



Materials

For each center

- ☐ Tissue box guitar (see Materials List and Details in Resources section)
- ☐ Hand lens magnifier

For each student

- ☐ Sound Center Instructions and Data Sheet (see Resources section)

English Language Support

- Shelter vocabulary by providing labeled illustrations and pictures of the items used at each center, such as a hand lens, a flashlight, a mirror, an index card, and wax paper. (Some illustrated Spanish-English vocabulary cards are available in the Resources section.)
- Provide illustrations or model procedures for relevant academic terms, such as *observations, recording,* and *detailed information.*
- Pace your demonstrations to ensure that ELs have enough time to process the information. Make intentional efforts to ask ELs questions to check for understanding.
- Monitor and consistently check for student understanding of the content being learned and of the center expectations as students engage in activities and discussions. If a student does not understand, clarify before he or she moves on to the next center.

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. This portion of the lesson also provides an opportunity to introduce new vocabulary.

Materials

For the class

- ☐ Light, heat, and sound center materials
- ☐ Chart paper/whiteboard
- ☐ Markers

Light Center: Shadow Squares

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

- What was the source of light? *flashlight*
- Which materials at the center made the darkest shadows? *mirror and index card*
- Why is that? *They are both solid materials that block or do not let light pass through.*
- What is another word for materials that do not let light pass through? *opaque*
- What is needed for a shadow to form? *light and an object to block the light*
- What are other materials or objects that can block light and form a dark shadow? *Answers may include buildings, trees, people, and animals.*
- What are some things you have noticed about shadows? *Shadows have a shape similar to the object blocking the light, and shadows are always on the other side of the object from the light.*
- Have you ever looked at your shadow outdoors during lunch recess? Is your shadow at noon smaller or larger than the shadow you see of yourself in the morning or late afternoon? *smaller, because the sun is directly overhead at noon*
- What do we call an area outdoors where direct sunlight from the sun is blocked? *shade*
- Where can we find shade outdoors? *under a tree, near a tall building*
- Why might we prefer a shady area on a hot day? *It is cooler out of direct sunlight.*
- Why might we prefer to stay in sunny areas on a cold day? *The sunny areas would be warmer.*
- Which material at the light center forms faint shadows? *wax paper*
- Why is that? *The wax paper allows some light to pass through it.*
- What is another word for materials that let some light pass through? *translucent*
- What are other materials or objects that allow some light to pass through and form a faint shadow? *Answers might include plastic milk jugs, tissue paper, screens, and loose weave fabrics.*
- Which material at the light center forms no shadow? *plastic bag*
- Why is that? *It is clear and does not block the light.*

- What is another word for materials that let light pass through? *transparent*
- What are other materials or objects that allow light to pass through without forming a shadow? *Answers may include windows, eyeglass lenses, and hand lenses.*
- What changed with the different things the light passed through? *the size, darkness, and shape of the shadows*

Heat Center: Plastic Cup Thermometer

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

- What did you observe when the thermometer was placed in the bowl of warm water? *The red liquid rose in the tube.*
- What else do you think would make the red liquid rise in the tube? *Students should mention things that are hot: hot chocolate, soup, boiling water, or a sunny hot day.*
- What did you observe when the thermometer was placed in the bowl of cold water? *The red liquid sank in the tube.*
- What else do you think would make the red liquid sink or go lower in the tube? *Students should mention things that are cold: ice cream, a cold soda, or a snowy day.*
- What changed because of the heat in the water? *The red liquid rose higher in the tube.*
- How many squares did each animal growing capsule cover or touch before you put it in the water? *Answers will vary.*
- What happened to the capsule that was placed in the warm water? *It grew really fast and became a foam animal.*
- How many squares did the foam animal cover or touch after you put it in the warm water? *Answers will vary.*
- What happened to the capsule that was placed in the cold water? *Students may answer that nothing happened or that the capsule grew really slowly.*
- How many squares did the animal capsule cover or touch after you put it in the cold water? *Answers will vary, but should be less than the numbers reported for the capsule put in warm water.*
- Why do you think the warm water and the cold water affected the capsule in different ways? *The warm water had more heat energy, which was needed to change the capsule into a foam animal. The cold water did not have enough heat energy to change the capsule in the same way.*

Sound Center: Tissue Box Guitar

Show the tissue box guitar to the students and ask the following questions about their observations at the sound center:

- What happened when you gently pulled the rubber band on the box guitar and let it go? *Students may say that the rubber band made a noise and moved.*
- What did you hear when the rubber band was pulled and let go? *a twang or noise*
- Was the sound different when the rubber band was pulled tighter? *The rubber band vibrated faster and sounded different (higher pitched).*
- What did you see when you looked at the rubber band as it was making a noise? *The rubber band moved back and forth really fast.*
- We call this kind of fast motion a vibration. How many of you have heard of that word before? *Answers will vary.*
- What was the change you observed? *A sound was made when the rubber band moved back and forth (vibrations were turned into sound), and the box vibrated too.*

Sound and Measurement

1. Ask students to think of something noisy like construction equipment or a siren.
   - What happens as you get farther and farther away from the source of a sound? *The sound gets quieter or softer.*
   - What will eventually happen if you keep moving away from the source of the sound? *Students should figure out that they eventually would no longer hear the sound.*
2. Explain that we use different ways to measure how loud a sound is or the distance a sound can travel and still be heard. Tell students they are going to use their classroom to help them measure the distance at which a sound can be heard.
3. Make a T-chart labeled "Tall Student" and "Short Student," as shown, for the class to see. Select the tallest and the shortest students in the class. Ask each student, in turn, to walk the length of the classroom using normal steps and to count the number of steps he or she takes. Record the number of steps in the appropriate column on the T-chart.

Tall Student	Short Student

4. Organize students into groups of two to three and ask the groups to examine and discuss the results in the T-chart.
5. Ask students from one or more groups to report the pattern that group members discovered when discussing the results recorded in the T-chart. *Students should notice that the numbers are different: the taller student took fewer steps to walk the length of the room, and the shorter student took more steps.*

6. The objective is for students to realize that the larger the size of the unit (steps), the fewer units are needed to measure a certain distance (and vice versa). If students do not reach this conclusion, ask guiding questions to lead them to this observation.
7. Then use the tissue box guitar to measure how far away in steps different students can be and still hear the sound the guitar makes when the rubber band is gently pulled.
8. Record and discuss the results for different distances and why we would want to use one kind of measuring system for this experiment.

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:

- During the series of questions, explicitly model content and discussion by using objects, body gestures, and demonstrations. For example, for beginning and intermediate ELs, you might use explicit gestures as you say, "Show me who the tallest student in the room is." For advanced ELs, you might say, "Explain the T-chart results to me."
- Watch your pacing (use a slower rate of delivery) as you ask students questions and guide discussion.
- Provide ELs with opportunities to speak and get engaged by asking recall questions and using language frames.
- Intermediate ELs may need the same support as beginners as both groups are learning new concepts.
- During question and discussion sessions, pair ELs at different English proficiency levels and have the pairs engage in think-pair-share activities (e.g., "Tell your partner what you saw when. . .").
- Use language frames to support responses from students (e.g., "If I move farther away from the sound, the sound will _____.").

ELABORATE

Uses of Energy

Time: Approximately 30 minutes

1. Begin with a think-pair-share activity:
   a. *Think:* Ask students to think of ways that energy is important in their everyday lives and to record their responses in words or pictures in their journals.
   b. *Pair:* Ask each student to discuss with a partner ways in which they use energy.
   c. *Share:* Ask students to share with the class some ways in which we use energy in our daily lives.
2. Create a chart with three equal columns, as shown at right, but do not add the Sound, Light, and Heat labels. You will add these category headings later.
3. Record the students' shared ideas about energy use in the appropriate columns on the chart, organizing the ideas by the category headings you will add later.
4. Read *Energy Makes Things Happen* (2002) by Kimberly Brubaker Bradley.
5. Ask students to add to the list of the ways energy is used in our lives every day and how energy changes things. Record students' answers in the appropriate columns on the chart.
6. After the list is complete, ask students what kind of energy all of the entries in the first column have in common. After students have responded, label the first column "Sound."
7. Do the same thing for the light and heat columns.

Materials

For the class

- ☐ *Energy Makes Things Happen* by Kimberly Brubaker Bradley
- ☐ Chart paper/whiteboard
- ☐ Markers

For each student

- ☐ Journal

Sound	Light	Heat

English Language Support

- While reading *Energy Makes Things Happen* to the class, pace yourself and explicitly share pictures and ask questions to engage ELs.
- For beginning ELs, provide the chart terms in Spanish. (See the illustrated English-Spanish vocabulary cards provided in the Resources section.)
- Allow enough room on the chart for beginning and intermediate ELs to illustrate their ideas.
- Tap into ELs' prior knowledge by asking how they use energy (Spanish-*energía*) at home.

EVALUATE

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

Group Project

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

Materials

For each group

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

1. Ask students to work in groups to create a collage or an oral report of two examples of changes caused by heat, light, or sound. The project may include examples of when there is too much or not enough heat, light, or sound.
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 showing how one type of energy is important to everyday life.
   a. Prior to the assessment, review the website. Preselect art on the site that you want the students to use.
   b. In class, model the process for students by going to the website, choosing 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. Provide each group with a copy of the rubric on the next page (also provided in the Resources section), which will be used to grade the project. Read the rubric aloud to students row by row. After you read 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	1-Satisfactory	2-Excellent
Energy	A way that energy causes change is not included.	One way that energy causes change is correctly provided.	Two ways that energy causes change are correctly provided.
Measurement	A measurement is not included, and no explanation is provided.	The form of measurement included is inappropriate (e.g., time for distance).	The unit of measurement included is used appropriately, or an explanation is provided why measurement is not relevant.
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, as illustrated in the chart below for four hypothetical students. 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

Sound

For the class

- ☐ Bell

Light

For each pair

- ☐ Small mirror

Heat

For the class

- ☐ 2 clear cups
- ☐ Red food coloring
- ☐ Hot water
- ☐ Ice-cold water
- ☐ Dropper

EXPLORE

Light Center: Shadow Squares

Teacher Preparation: Copy and laminate the Light Center Instructions and make a copy of the Light Center Data Sheet for each student. Cut the material squares (index card, wax paper, clear plastic freezer bag) the same size as the mirror so that all the items will be roughly the same size and shape for a fair test.

For each center

- ☐ Light Center Instructions (laminate for repeated use)
- ☐ Flashlight
- ☐ Small square mirror
- ☐ Square of index card
- ☐ Square of wax paper
- ☐ Square of clear plastic freezer bag
- ☐ black, blue, yellow crayons

For each student

- ☐ Light Center Data Sheet

Heat Center: Plastic Cup Thermometer

Teacher Preparation: Copy and laminate the Heat Center Instructions and make a copy of the Heat Center Data Sheet for each student. In advance, prepare the plastic cup thermometers (see instructions below). Immediately before class, prepare the bowls of water so they remain at the correct temperature. You may need to refresh the bowls of water to maintain their temperature.

For each center

- ☐ Heat Station Instructions (laminate for repeated use)
- ☐ Plastic cup thermometer (see instructions below)
- ☐ Plastic red bowl of warm water (deep bowl)
- ☐ Plastic blue bowl of ice water (deep bowl)
- ☐ Tape
- ☐ Timer
- ☐ Red crayon
- ☐ 2 magic animal growing capsules (per group; available for purchase online)
- ☐ Paper towels
- ☐ 5 safety goggles

- **Warm water should not be warmer than 54°C for safety.**
- **Students must use safety goggles at this center. If goggles are not available, prepare the thermometers without alcohol. They will still work, but the change in the level of the liquid will not be as rapid or dramatic.**

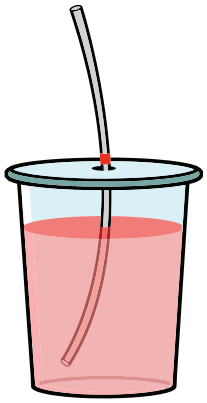
For each student

- ☐ Heat Center Data Sheet

Plastic cup thermometer preparation

PREPARE IN ADVANCE
Plastic Cup Thermometer

Use a hot nail to make a hole in the lid of a small plastic cup. Insert a piece of aquarium tubing into the lid until the tubing almost touches the bottom of the cup. Remove the lid and tubing and set aside. Fill the cup with equal parts of water and alcohol; then add 4 drops of red food coloring. Put the lid back on the cup, insert the tubing, and mark in red the place on the tubing where it meets the lid to indicate the starting temperature. Before class, place the plastic cups in a dish of ice and water to "prime" them so the red liquid will rise dramatically when placed in warm water.



- ☐ Clear or white plastic cup with plastic lid (small enough to sit in plastic bowls)
- ☐ Nail
- ☐ Aquarium tubing (25–30 cm piece per cup)
- ☐ Red food coloring
- ☐ Rubbing alcohol
- ☐ Water
- ☐ Medium bowl or dish of ice water

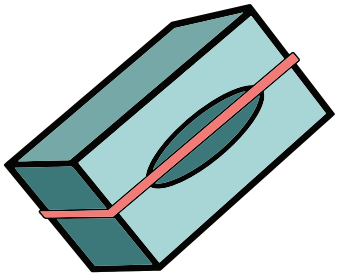
PREPARE IN ADVANCE
Tissue Box Guitar

Sound Center: Tissue Box Guitar

Teacher Preparation: Copy the Sound Center Instructions and Data Sheet (laminate one copy for each center; make a copy for each student). In advance, prepare the tissue box guitars (see instructions below).

For each center

- ☐ Tissue box guitar (see instructions below)
- ☐ Hand lens magnifier



For each student

- ☐ Sound Center Instructions and Data Sheet

Tissue box guitar preparation

Stretch a large rubber band lengthwise over the opening of an empty rectangular tissue box.

- ☐ Large rubber band
- ☐ Empty rectangular tissue box

EXPLAIN

For the class

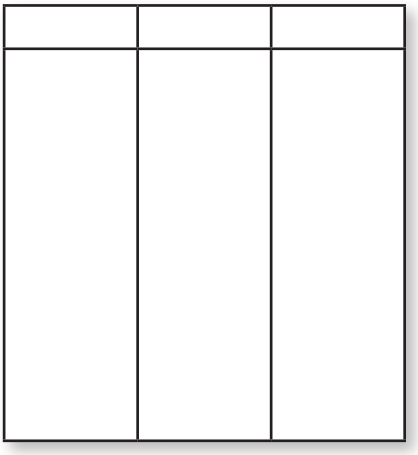
- ☐ Light, heat, and sound center materials
- ☐ Chart paper or whiteboard
- ☐ Markers

ELABORATE

Uses of Energy

For the class

- ☐ *Energy Makes Things Happen* by Kimberly Brubaker Bradley (ISBN 978-0064452137)
- ☐ Chart paper or whiteboard
- ☐ Markers
- ☐ Three-column chart as shown



EVALUATE

Group Project

For each group

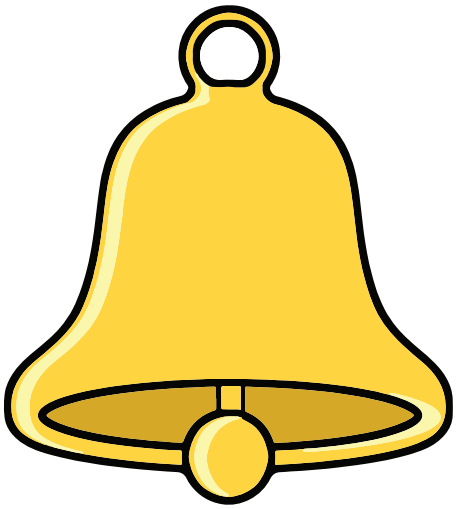
- ☐ Group Project Rubric
- ☐ Books and websites with age-appropriate information about heat, light, and sound
- ☐ Magazines and newspapers that can be used for collages
- ☐ Computer with Internet access
- ☐ Collaborative storytelling website such as **http://www.storybird.com**
- ☐ Pencils and markers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

Individual Assessment

For each student

- ☐ Energy Assessment
- ☐ 2 pencils

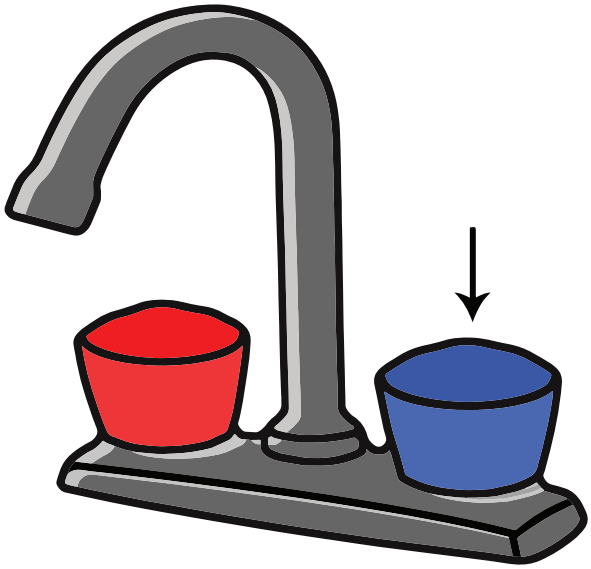
Frequent English/Spanish Vocabulary Words



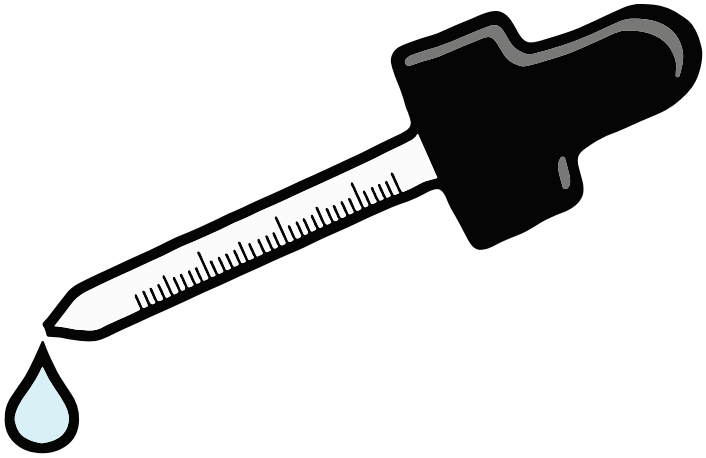
bell / campana

cloud / nube

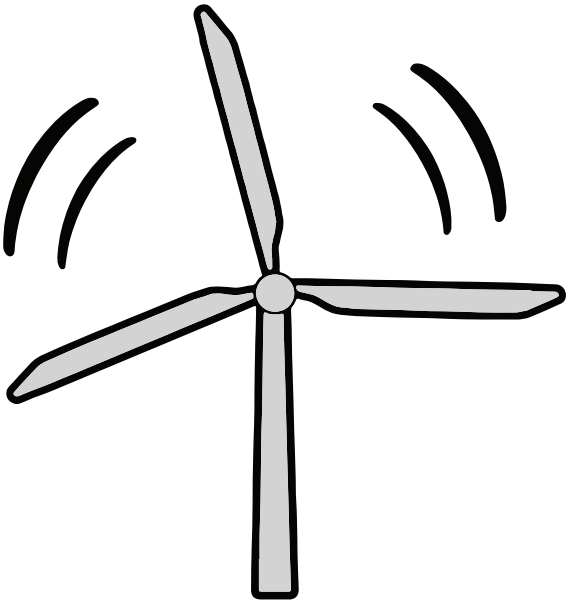
cold / frio



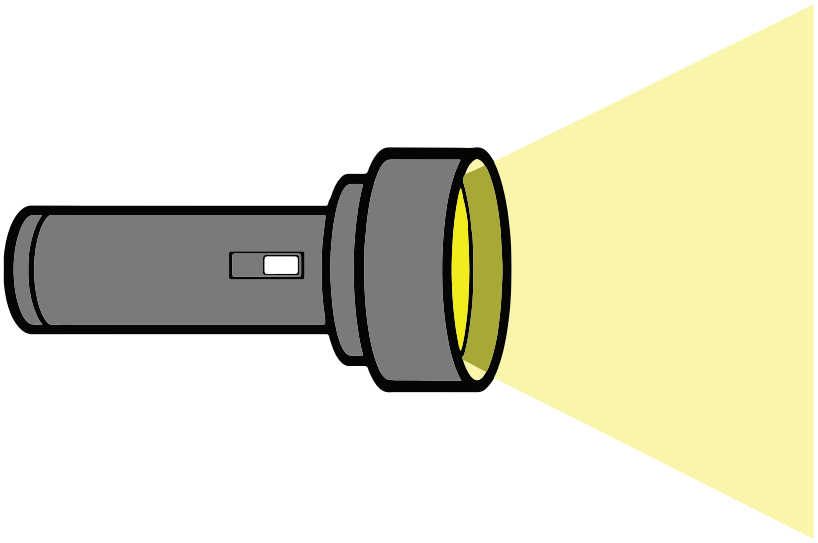
cold water / agua fría



dropper / cuentagotas



energy / energía



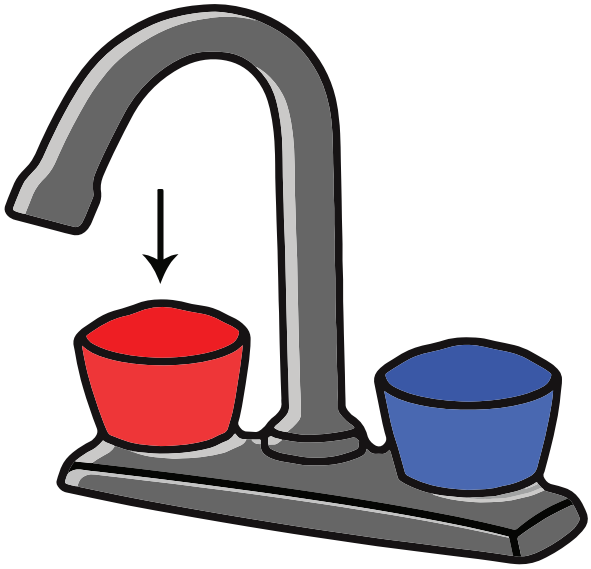
flashlight / linterna

guitar / guitarra

hand lens (magnifying glass) / lupa

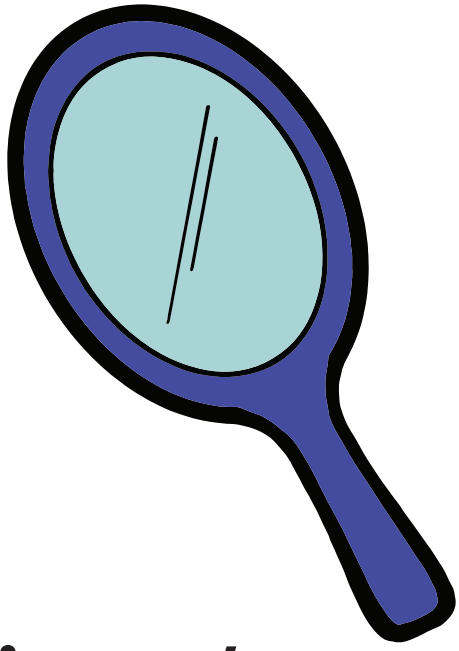
heat / calor

hot / caliente

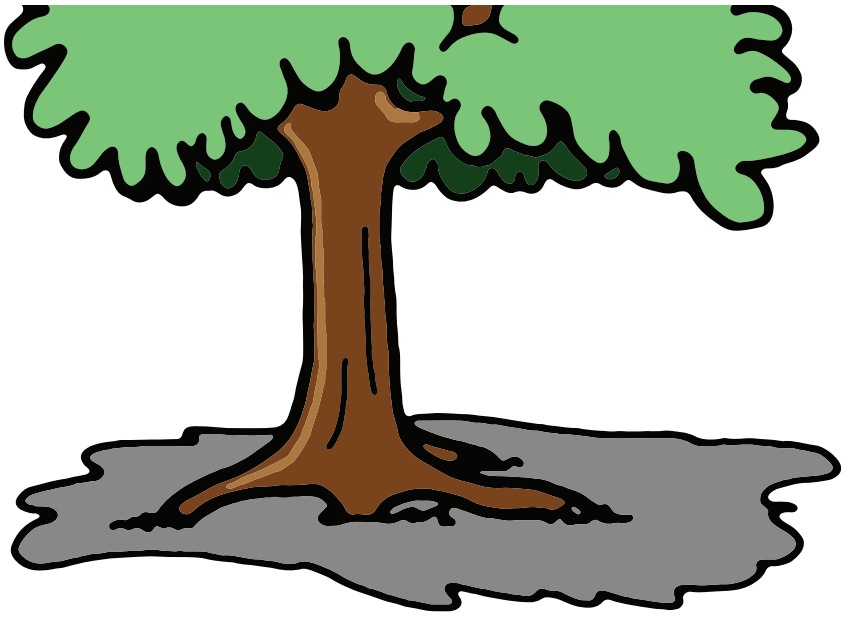


hot water / agua caliente

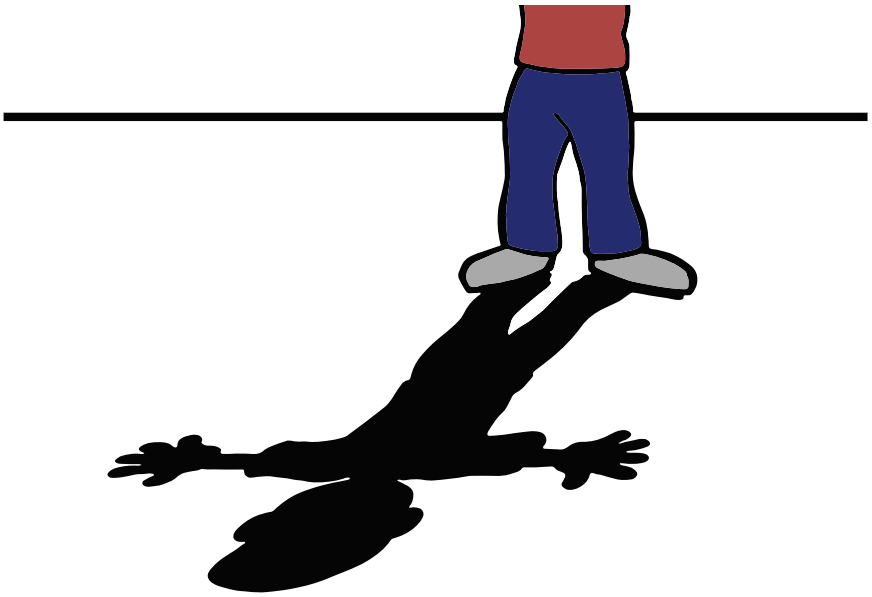
light / luz



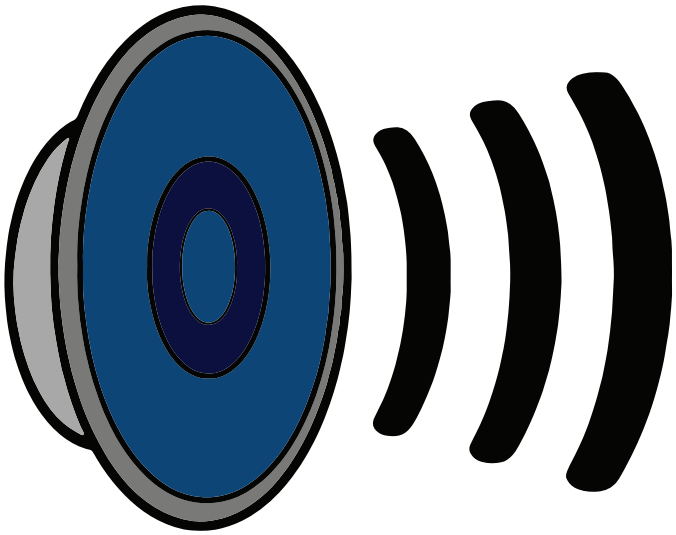
mirror / espejo



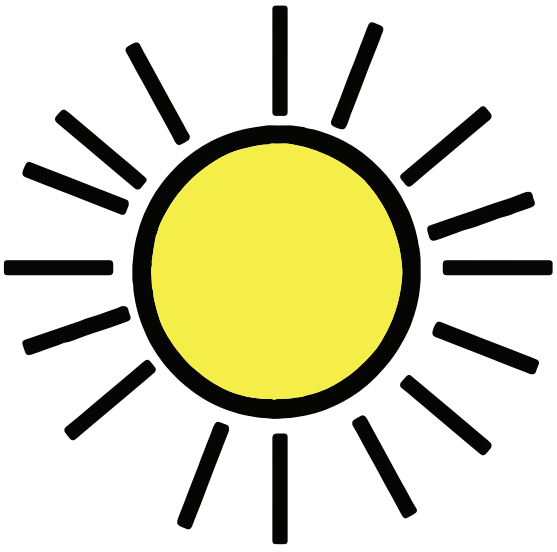
shade / sombra



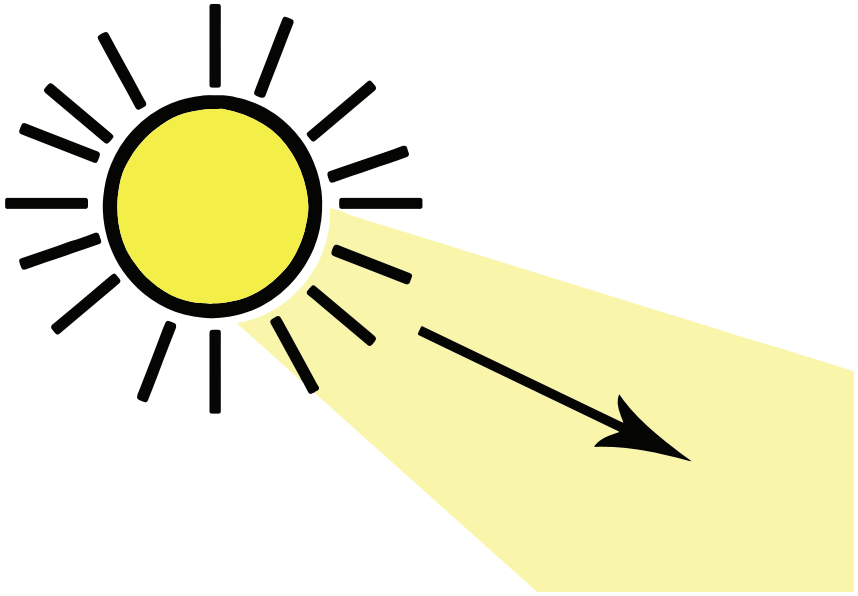
shadow / sombra



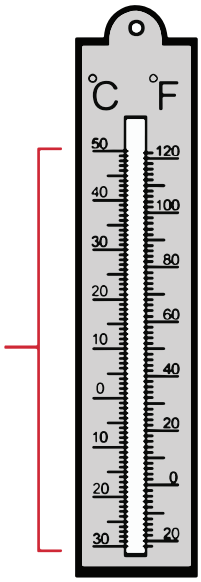
sound / sonido



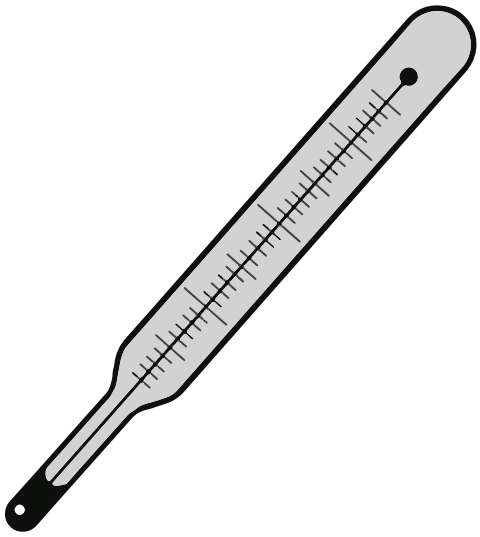
sun / sol



sunlight / luz solar

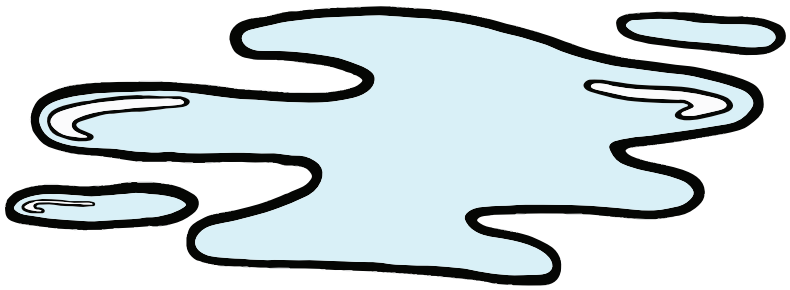


temperature / temperatura



thermometer / termómetro

vibrate / vibrar



water / agua

Light Center Instructions

Shadow Squares

Read the following instructions to the students as needed.

1. Work with your group to test what type of shadow each material makes when held before a flashlight.

2. Point the flashlight at the wall. Hold one of the squares of material between the flashlight and the wall.

3. Hold the flashlight and the materials in the same position for all tests.

4. Test each square of material, beginning with the mirror.

5. Talk about the shadow formed by each material with your group. Does it form a dark shadow, a faint shadow, or no shadow at all?

6. Record your observation on the data sheet by coloring the correct square in the chart next to each material.

Black = Dark shadow

Blue = Faint shadow

Yellow = No shadow

Light Center Data Sheet

Name _____ **Date**_____

Shadow Squares

Color the boxes next to each material to show the type of shadow formed.

Black = Dark shadow

Blue = Faint shadow

Yellow = No shadow

Material	Dark Shadow	Faint Shadow	No Shadow
Mirror			
Index card			
Wax paper			
Clear bag			

Which materials form the darkest shadows? Why?

What are other materials or objects that can block light and form a dark shadow?

Which material forms faint shadows? Why?

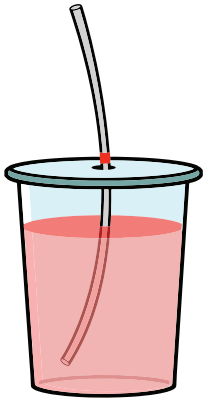
What are other materials or objects that can block light and form a faint shadow?

Which material forms no shadow? Why?

What are other materials or objects that allow light to pass through without forming a shadow?

Heat Center Instructions

Plastic Cup Thermometer



1. Put on safety goggles. All members of the group must wear goggles.
2. Observe the plastic cup thermometer and the starting-line mark on the tube.
3. Place the plastic cup thermometer in the bowl of warm water.
4. Observe the direction of the movement of the red liquid in the tube. Put a small piece of tape where the red liquid stops.
5. Record your observations on the data sheet by coloring a red line on the tubing of the thermometer labeled warm water.
6. Place the plastic cup thermometer in the bowl of ice water.
7. Observe the direction of the movement of the red liquid in the tube. Put a small piece of tape where the red liquid stops.
8. Record your observations on the data sheet by coloring a red line on the tubing of the thermometer labeled cold water.
9. Ask your teacher for two capsules. Trace, count, and record how many squares each capsule covers or touches on the grid on the data sheet.
10. Place a capsule in each bowl of water. Set the timer for 3 minutes.
11. Observe and record on your data sheet any changes in the capsules.
12. Remove the capsules at the end of 3 minutes and place them on paper towels. Again, place each capsule on the grid on the data. Count and record how many squares each shape covers or touches.
13. Give the wet capsules to your teacher.
14. Leave your station clean, neat, and dry.

Heat Center Data Sheet

Name _____ **Date**_____

Plastic Cup Thermometer

Part I:

Question: What will happen to the red liquid in a plastic cup thermometer when it is placed in warm or cold water?

Prediction: Circle the word to complete your prediction.

The red liquid will

rise **fall** **stay the same**

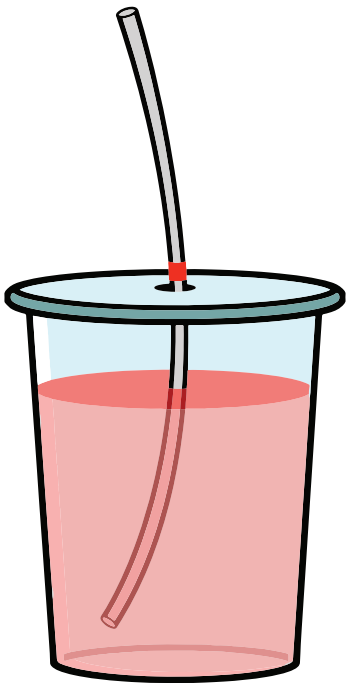
in warm water.

The red liquid will

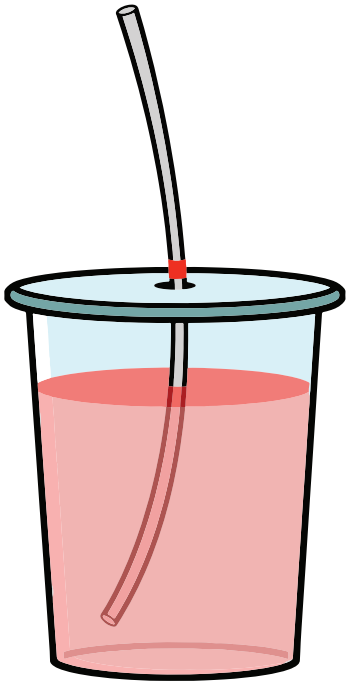
rise **fall** **stay the same**

in cold water.

Follow steps 1–8 at the heat center. Color the tubing on the pictures red to show how far the red liquid moved in each thermometer.



Warm water



Cold water

1. Which direction did the red liquid move when the thermometer was placed in the bowl of warm water?

2. Which direction did the red liquid move when the thermometer was placed in the bowl of ice water?

Part II:

Question: What will happen to the capsules when they are placed in warm or cold water?

Prediction: Circle the word to complete your prediction.

The capsule in the warm water will

grow faster **grow slower** **grow at the same rate**

as the capsule in the cold water.

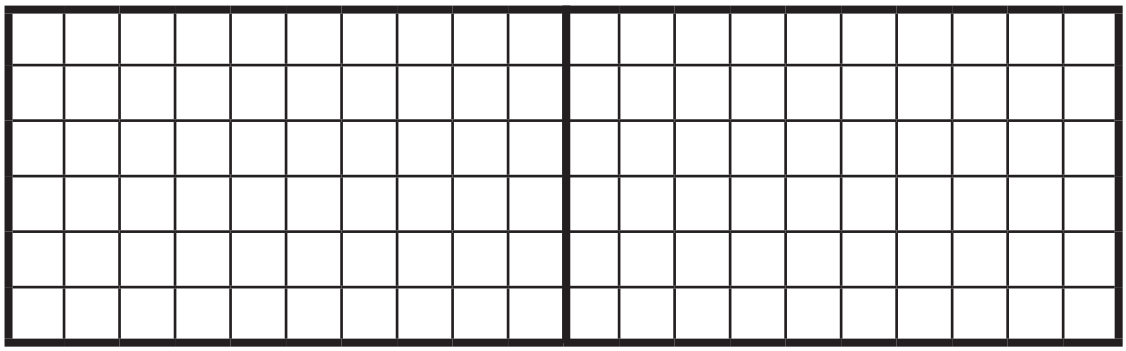
The capsule in the cold water will

grow faster **grow slower** **grow at the same rate**

as the capsule in the warm water.

Follow steps 9–14 at the heat center.

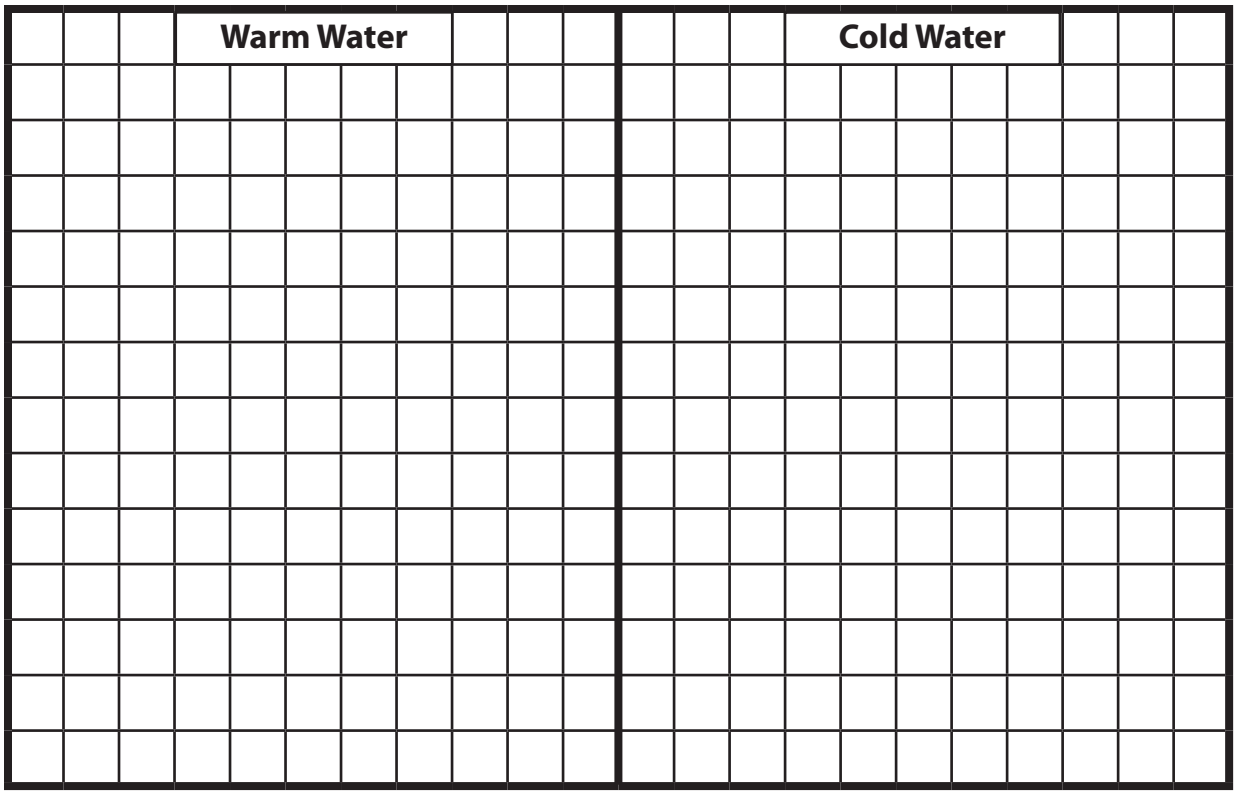
1. Place one capsule on each side of the grid below. Trace the capsules. Count and record how many squares each capsule covers or touches.



_____ _____

2. Place one capsule in warm water. Place the other capsule in cold water. After 3 minutes, observe and record below any changes in the capsules.

3. Place the capsules on the grids below. Trace each capsule. How many squares does each shape cover or touch after it was in the water for 3 minutes?



Warm _____ **Cold** _____

4. Discuss and record in the space below why there was or was not a difference in how quickly the capsules grew in the warm and cold water.

5. Leave your station clean, neat, and dry.

Sound Center Instructions and Data Sheet

Name _____ **Date**_____

Tissue Box Guitar

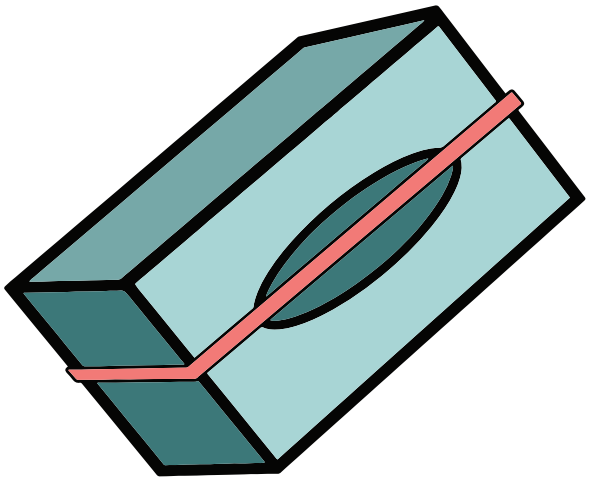
1. Gently pull the rubber band tight across the box and then release it.
2. What do you hear?

3. What happens to the rubber band when you hear the sound?

4. Pluck the rubber band again. A second student should use the hand lens magnifier to observe the rubber band.
5. With your fingers, pull the rubber band tighter across the box and pluck it again. Is the sound higher or lower?

6. Use a hand lens to observe the rubber band again. Do you notice whether it is moving back and forth faster when the sound is higher?

7. What changed when the tissue box guitar was making a sound?



Group Project Rubric

	1-Needs Improvement	1-Satisfactory	2-Excellent
Energy	A way that energy causes change is not included.	One way that energy causes change is correctly provided.	Two ways that energy causes change are correctly provided.
Measurement	A measurement is not included, and no explanation is provided.	The form of measurement included is inappropriate (e.g., time for distance).	The unit of measurement included is used appropriately, or an explanation is provided why measurement is not relevant.
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.

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. **D**
2. **B**
3. **B**
4. **C**
5. **A**
6. **B**

Name _____ Date _____

Energy Assessment

1. Trees provide shade for us when they _____ .

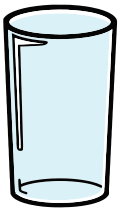
A bounce light

B need water

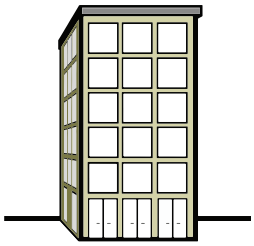
C are under a cloud

D block sunlight

2. Which of these will most likely form a dark shadow on a sunny day?

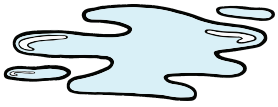


A clear glass



B a building

C clear cup



D water

3. Ice cream would cause the red liquid in a thermometer to _____ .

A rise

B fall

C stay the same

D disappear

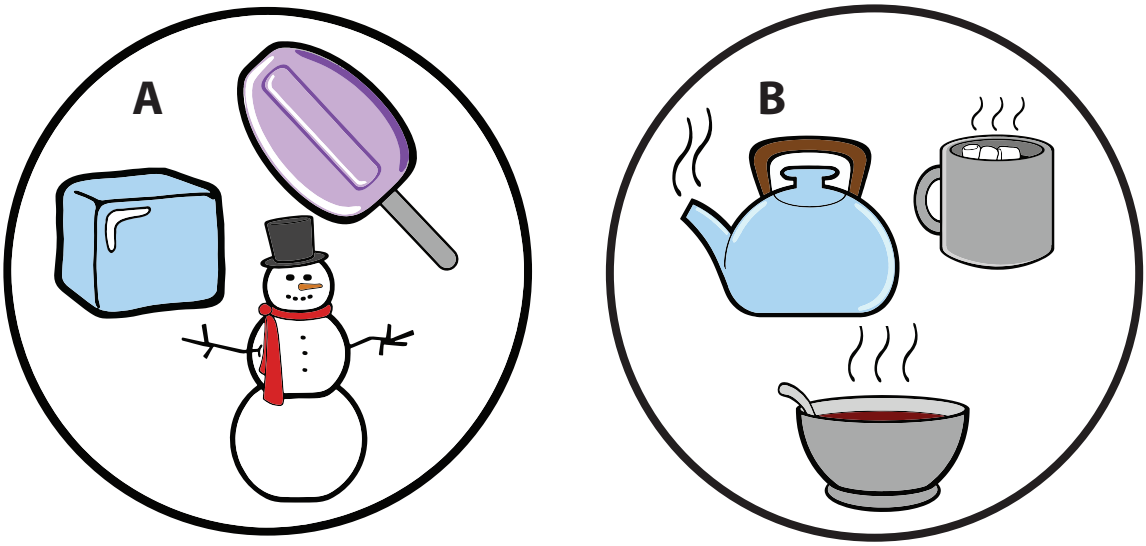
4. The strings on a guitar make noise because they _____ .

A stretch

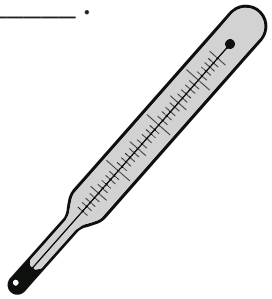
B break

C vibrate

D stay still



5. Look at the pictures above. Placing a thermometer into the materials in Circle B would cause the red liquid in the tube to _____ .



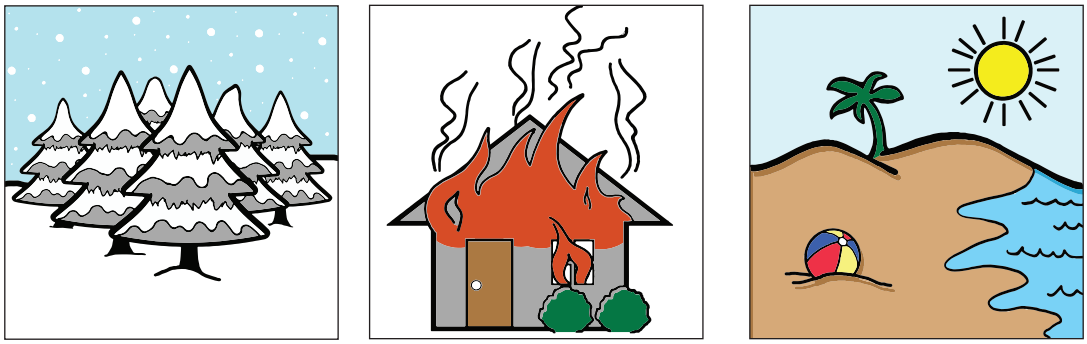
A rise

B fall

C stay the same

D disappear

6. Which series of numbers shows the pictures from coldest to hottest?



1 **2** **3**

A 2 3 1

B 1 3 2

C 1 2 3

D 3 1 2

Reading Connections

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

Energy

Bradley, K. B. (2002). *Energy Makes Things Happen* (Let's-Read-and-Find-Out Science 2). New York, NY: HarperCollins Publishers.

Light

Asch, F. (2000). *Moonbear's shadow.* New York, NY: Aladdin.

Berge, C. (2006). *Whose shadow is this? A Look at animal shapes—Round, long, and pointy.* North Mankato, MN: Picture Window Books.

Branley, F. M. (2005). *What makes day and night* (Let's-Read-and-Find-Out Science 2). New York, NY: HarperCollins Publishers.

Bulla, C. R. (1994). *What makes a shadow?* (Let's-Read-and-Find-Out Science 1). New York, NY: HarperCollins Publishers.

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

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

Swinburne, S. R. (1999). *Guess whose shadow?* Honesdale, PA: Boyds Mills Press.

Tompert, A. (1988). *Nothing sticks like a shadow.* New York, NY: Sandpiper Houghton Mifflin Company.

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

§112.12 Science, Grade 1, 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) recognize 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) recognize the importance of safe practices to keep self and others safe and healthy; and

(C) identify and learn how to use natural resources and materials, including conservation and reuse or recycling of paper, plastic, and metals.

(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 using pictures, numbers, and words; and

(E) communicate observations and provide reasons for explanations using student-generated data from 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:

(A) identify and explain a problem such as finding a home for a classroom pet and propose a solution in his/her own words;

(B) make predictions based on observable patterns; and

(C) describe what scientists do.

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

(B) measure and compare organisms and objects using non-standard units.

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

(A) classify objects by observable properties of the materials from which they are made such as larger and smaller, heavier and lighter, shape, color, and texture; and

(B) predict and identify changes in materials caused by heating and cooling such as ice melting, water freezing, and water evaporating.

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

(A) identify and discuss how different forms of energy such as light, heat, and sound are important to everyday life.

§111.13. Mathematics, Grade 1.

(b) Knowledge and skills.

(1) Number, operation, and quantitative reasoning. The student uses whole numbers to describe and compare quantities. The student is expected to:

(A) compare and order whole numbers up to 99 (less than, greater than, or equal to) using sets of concrete objects and pictorial models.

(7) Measurement. The student directly compares the attributes of length, area, weight/mass, capacity, and temperature. The student uses comparative language to solve problems and answer questions. The student selects and uses nonstandard units to describe length. The student is expected to:

(A) estimate and measure length using nonstandard units such as paper clips or sides of color tiles;

(B) compare and order two or more concrete objects according to length (from longest to shortest);

(C) describe the relationship between the size of the unit and the number of units needed to measure the length of an object;

(G) compare and order two or more objects according to relative temperature (from hottest to coldest).

(10) Probability and statistics. The student uses information from organized data. The student is expected to:

(A) Draw conclusions and answer questions using information organized in real-object graphs, picture graphs, and bar-type graphs.

(11) Underlying processes and mathematical tools. The student applies Grade 1 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.

(12) Underlying processes and mathematical tools. The student communicates about Grade 1 mathematics using informal language. The student is expected to:

(A) explain and record observations using objects, words, pictures, numbers, and technology.

§126.2. Technology Applications, Kindergarten–Grade 2.

(b) Knowledge and skills.

(2) Foundations. The student uses data input skills appropriate to the task. The student is expected to:

(B) use proper keyboarding techniques such as correct hand and body positions and smooth and rhythmic keystroke patterns as grade-level appropriate.

(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.

(11) Communication. The student delivers the product electronically in a variety of media, with appropriate supervision. The student is expected to:

(A) publish information in a variety of media including, but not limited to, printed copy or monitor display; and

(B) publish information in a variety of media including, but not limited to, stored files or video.

(12) Communication. The student uses technology applications to facilitate evaluation of communication, both process and product. The student is expected to:

(A) select representative products to be collected and stored in an electronic evaluation tool.

§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**

