Science Grade 04 Unit 03 Exemplar Lesson 01: Forms of Energy

This lesson is one approach to teaching the State Standards associated with this unit. Districts are encouraged to customize this lesson by supplementing with district-approved resources, materials, and activities to best meet the needs of learners. The duration for this lesson is only a recommendation, and districts may modify the time frame to meet students’ needs. To better understand how your district may be implementing CSCOPE lessons, please contact your child’s teacher. (For your convenience, please find linked the TEA Commissioner’s List of State Board of Education Approved Instructional Resources and Midcycle State Adopted Instructional Materials.)

Lesson Synopsis

Students will differentiate among forms of energy, including mechanical, sound, electrical, light, and heat/thermal. In addition, they will differentiate between conductors and insulators.

TEKS

The Texas Essential Knowledge and Skills (TEKS) listed below are the standards adopted by the State Board of Education, which are required by Texas law. Any standard that has a strike-through (e.g. sample phrase) indicates that portion of the standard is taught in a previous or subsequent unit. The TEKS are available on the Texas Education Agency website at http://www.tea.state.tx.us/index2.aspx?id=6148.

4.6 Force, motion, and energy. The student knows that energy exists in many forms and can be observed in cycles, patterns, and systems. The student is expected to:

4.6A Differentiate among forms of energy, including mechanical, sound, electrical, light, and heat/thermal.

4.6B Differentiate between conductors and insulators.

Scientific Process TEKS

4.1 Scientific investigation and reasoning. The student conducts classroom and outdoor investigations, following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:

4.1A Demonstrate safe practices and the use of safety equipment as described in the Texas Safety Standards during classroom and outdoor investigations.

4.2 Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:

4.2A Plan and implement descriptive investigations, including asking well-defined questions, making inferences, and selecting and using appropriate equipment or technology to answer his/her questions.

4.2B Collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps.

4.2C Construct simple tables, charts, bar graphs, and maps using tools and current technology to organize, examine, and evaluate data.

4.2E Perform repeated investigations to increase the reliability of results.

4.2F Communicate valid, oral, and written results supported by data.

4.3 Scientific investigation and reasoning. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

4.3B Draw inferences and evaluate accuracy of services and product claims found in advertisements and labels such as for toys, food, and sunscreen.

4.4 Scientific investigation and reasoning. The student knows how to use a variety of tools, materials, equipment, and models to conduct science inquiry. The student is expected to:

4.4B Use safety equipment as appropriate, including safety goggles and gloves.
Performance Indicators

**Grade 04 Science Unit 03 PI 01**

Choose one form of energy to represent. Prepare a debate to convince classmates that the form of energy represented is the most useful. Explain the advantages that it has over all other forms of energy.

**Standard(s):** 4.2F, 4.6A

**ELPS** ELPS.c.1G, ELPS.c.2G, ELPS.c.3G

**Key Understandings**

- Energy comes in many forms, and each form has unique characteristics which allow it to be distinguished from the others.
  
  — In what ways is one form of energy different from another?

**Vocabulary of Instruction**

- energy
- electrical energy
- heat/thermal energy
- light energy
- mechanical energy
- sound energy
- vibration
- conductor
- insulator
- differentiate

**Materials**

- aluminum foil (about an 8 X 10 sheet, 1 per group)
- aluminum pie pan (4 in. (11 cm), 1 per group)
- balloon (2–4 per teacher)
- books (about 1 inch thick, 6 per group)
- bowl (plastic, large enough to hold another container with 8 ounce capacity, 1 per group)
- bowl of water (clear, filled half way with water, 1 per teacher)
- can (metal, soup-type, 8 ounce, 1 per class)
- chocolate chips (10–15 per group)
- clothespin (1 per group)
- cup (clear, plastic, 6–8 ounce, 1 per group)
- cup (hot beverage, paper, 8 ounce, 1 per class)
- cup (plastic, 8 ounce, 1 per class)
- cup (Styrofoam™, 8 ounce, 1 per class)
- ice water (enough for 1 cup per group)
- jar (heat resistant, 8 ounce, 1 per class)
- matches (for teacher use only)
- meter stick (1 per group)
- mirrors (about 3x3 inches, 1 per group)
- paper (colored, at least four different colors per group)
- paper (lined notebook, 1–2 sheets per student)
- paper (white, 1 sheet per group)
- pepper (coarse ground, 1 pinch per group)
- plastic wrap (6 inch piece, 1 per group)
- stopwatch or clock with second hand (1 per group)
- tea light candle (1 per group)
- tennis ball (1 per group)
- tuning fork (1 per group)
- water (hot - 120°F, enough for 4 ounces per group)

**Attachments**

All attachments associated with this lesson are referenced in the body of the lesson. Due to considerations for grading or student assessment, attachments that are connected with Performance Indicators or serve as answer keys are available in the district site and are not accessible on the public website.

- Teacher Resource: What Kind of Energy KEY
- Handout: Forms of Energy Advance Organizer (1 per student)
- Teacher Resource: Forms of Energy Advance Organizer KEY
Resources

None Identified

Advance Preparation

1. Print the Handout: **Forms of Energy Advance Organizer** as a back-to-back (2-sided) document to save time and paper. If this is not possible then students will need to cut out both pages and glue them together to create a two-sided document.
2. Print the Handout: **Evaluating Toy Labels**. Cut apart so each group will receive only one label to evaluate.
3. Prepare the attachment(s) as necessary.

Background Information

This lesson bundles student expectations in which students will be investigating various forms of energy: heat/thermal, light, sound, electrical, and mechanical. Students will differentiate among forms of energy and investigate conductors and insulators of heat and sound. This lesson will be the first introduction to conductors and insulators of heat and sound. Students will be expected to differentiate between a conductor and an insulator.

**INSTRUCTIONAL PROCEDURES**

<table>
<thead>
<tr>
<th>Instructional Procedures</th>
<th>Notes for Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGAGE – What Kind of Energy?</td>
<td>NOTE: 1 Day = 50 minutes Suggested Day 1</td>
</tr>
<tr>
<td>1. Show the PowerPoint: <strong>What Kind of Energy?</strong> Each slide has a question for students to answer. The Teacher Resource: <strong>What Kind of Energy KEY</strong> has additional questions to use during this activity.</td>
<td>Attachments:</td>
</tr>
</tbody>
</table>
| 2. Distribute the Handout: **Forms of Energy Advance Organizer**. Inform students that over the next several days, they will be learning to differentiate between the five forms of energy on the handout. In addition, they will learn to differentiate between conductors and insulators. | • Teacher Resource: PowerPoint: **What Kind of Energy?**  
• Teacher Resource: **What Kind of Energy KEY**  
• Handout: **Forms of Energy Advance Organizer** (1 per student)  
• Teacher Resource: **Forms of Energy Advance Organizer KEY** |
| 3. Instruct students to cut out the two pages of their handout. The pages should be glued so it makes a two-sided organizer. See Advance Preparation for alternative suggestions for this handout. The Teacher Resource: **Forms of Energy Advance Organizer KEY** is one way the teacher may want to assist students with organization of the information as they go through each form of energy. | Instructional Note: Students explored forms of energy in Grade 3 (3.6A): Explore different forms of energy, including mechanical, light, sound,
4. Students may want to write down information on their handout that they remember about the various forms of energy (learned in previous years). and heat/thermal, in everyday life. Only electrical energy will be new to them.

**Misconceptions:**
- Students may think that energy can be made, used, and lost.
- Students may think that energy is an object or something that is tangible.
- Students may think that objects use up energy instead of transforming energy.
- Students may think that energy sources are the same as the energy.

**EXPLORE/EXPLAIN – Light Energy**

**Suggested Day 2**

1. **Say:**
   - Today, we will be learning more about light energy.
   - Ask:
     - What are some sources of light energy? (*The Sun, a lamp, a headlight, etc.*)
     - Where is the light energy in this room coming from? (*The light bulb*)
     - Where does the light bulb get its energy? (*From electricity*)
     - Where does the electricity come from? (*A power plant*)

2. **Say:**
   - I’m sure many of you have seen a rainbow before.
   - Ask:
     - What colors appear in a rainbow? (*From the top of the arc to the inside: red, orange, yellow, green, blue, indigo, and violet*)
   - Say:
     - With your partner, discuss how a rainbow forms.

3. Allow students the opportunity to share their thinking. (*The spectrum of light appears when the Sun shines on the water droplets in the atmosphere. A rainbow will appear in the sky directly opposite the Sun. Red will be on the outermost part of the arc and violet on the inside. There are not distinct bands of colors.*)

4. Show the Teacher Resource: PowerPoint: *Light*. As each slide is shown, read the sentences for the students, and point out the illustration that supports it. Allow time during the slide show for students to write or draw some of the information on the advanced organizer or in their science notebooks.

5. Show students paper in a variety of colors.
   - Ask:
     - What do you think will happen when this paper interacts with sunlight? Answers may vary.

6. Take students outside. Follow the directions on Teacher Resource: *To Reflect or Not to Reflect*. (Explain how to do the experiment, and model the procedure with two pieces of white paper so students do not see results before completing the investigation themselves.)

7. **Ask:**
   - If the light energy came from the Sun, what caused it to be reflected on the white paper? (*The light energy interacted with the colored paper, and it changed directions to reflect on to the white paper.*)

**Materials:**
- mirrors (about 3x3 inches, 1 per group)
- aluminum foil (about an 8x10 sheet, 1 per group)
- paper (colored, at least four different colors per group)
- paper (white, 1 sheet per group)

**Attachments:**
- Teacher Resource: PowerPoint: *Light*
- Teacher Resource: *To Reflect or Not to Reflect*

**Instructional Notes:**
The reflection of the colored sheets of paper is muted. In addition, if this investigation is conducted on an extremely bright day, then the color is difficult to see.

If there is inclement weather, then this investigation will need to be completed with the aid of a lamp that has an incandescent light bulb.

Students are introduced to the concepts of refraction and reflection, but are not expected to master the concepts since it is a Grade 5 TEKS: 5.6C.

Listen for the misunderstanding where students may think that in order to reflect light, an object must be light and shiny.

**Science Notebooks:**
Students should write what they know about light energy in the appropriate section of their Advanced Organizer. It should include a working definition, sources, uses, and (possibly) what makes it unique.

Create an illustration of how the Sun’s light reflected off the aluminum foil and colored paper.
8. Instruct students to draw, in their science notebook, a diagram of how the light energy from the Sun reflected onto the white paper. Arrows should be included to show how the light is travelling.

9. Inform students that smooth surfaces on matter will make the light bounce back, but that all objects reflect some light, which is why we are able to see them and perceive color.

10. Say:
   - Look at the floor or whiteboard (if whiteboard is available).
   - Ask:
   - Can you see a reflection of yourself there? (The floor and whiteboard show a blurry reflection.)
   - Why can’t you see your reflection as well as you can when looking into a mirror? (The floor and whiteboard are not as smooth as the mirror.)
   - What caused the light to change direction? (It interacted with the floor and whiteboard, and they caused it to change direction.)

11. Explain to students that light is an energy that moves in a straight line and only changes direction when it interacts with matter. Students should have the opportunity to complete their Handout: Forms of Energy Advance Organizer for the section on light energy. Additional reflections may be completed in the science notebook.

EXPLORE/EXPLAIN – Mechanical Energy

Suggested Day 3

1. Divide class into groups of four students. Assign roles according to the procedures used in your classroom.

2. Distribute the Handout: Mechanical Energy and materials needed to complete activity as outlined in the handout.

3. Review the instructions on the handout.


5. Review the directions with students, and have them complete the activity, recording their results after each test. Students will need to conduct repeated trials and record the results in meters and centimeters.

6. Inform students that once they have the data for the investigation, they will need to create a graph to represent their data.

7. Ask the following questions, and have students respond either on the reverse side of the Handout: Mechanical Energy Recording Sheet or in their science notebook:
   - Which of the ramps allowed the ball to travel the farthest? Answers may vary, but will most likely be the one with the greatest number of books.
   - What do you think made the difference? The height of the ramp

8. After students have completed their Handout: Mechanical Energy Recording Sheet, provide the following explanation:
   Say:
   - The balls all had stored energy while on the ramp.
   - The higher the ramp, the greater the amount of stored energy the ball had.
   - Each ramp placed the ball in a different position.
   - The stored energy became energy of motion once the ball was set free and was moving.
   - When the ball was at the top of the ramp, it had stored energy, and when it began to roll, it had energy of motion.

9. Ask:

Materials:
- meter stick (1 per group)
- books (about 1 inch thick, 6 per group)
- tennis ball (1 per group)

Attachments:
- Handout: Mechanical Energy (1 per group)
- Handout: Mechanical Energy Recording Sheet (1 per student)
- Teacher Resource: Forms of Energy Advance Organizer KEY (from previous activity)

Instructional Notes:
Potential energy is the amount of stored energy an object has due to its position. Kinetic energy is the energy an object has when it is in motion. This is a Grade 6 concept but is mentioned here as teacher background information.

Science Notebooks:
Respond to the questions, either in the science notebook or on the reverse side of the Handout: Mechanical Energy Recording Sheet:
- Which of the ramps allowed the ball to travel the farthest?
- What do you think made the difference?
In what ways is mechanical energy different from light energy?

0. Use the Teacher Resource: *Forms of Energy Advance Organizer KEY* to guide students with the completion of the section on mechanical energy.

<table>
<thead>
<tr>
<th>EXPLORE/EXPLAIN – Sound</th>
<th>Suggested Day 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Divide the class into groups of four students, and assign roles.</td>
<td><strong>Materials:</strong></td>
</tr>
<tr>
<td>2. Address safety guidelines before starting.</td>
<td>- cup (clear, plastic, 6–8 ounce, 1 per group)</td>
</tr>
<tr>
<td>3. Provide each group with a copy of the Handout: <em>Dancing Pepper</em> and materials they will need to complete the investigation (plastic cup, plastic wrap, pepper, and tuning fork). Instruct groups to work on the activity and follow directions on the handout.</td>
<td>- plastic wrap (6 inch piece, 1 per group)</td>
</tr>
<tr>
<td>4. When the groups complete the activity, provide them with a copy of the Handout: <em>Dancing Pepper</em>. Each student will complete a handout.</td>
<td>- pepper (coarse ground, 1 pinch per group)</td>
</tr>
<tr>
<td>5. When the groups complete the Handout: <em>Dancing Pepper</em>, conduct the demonstration with the tuning fork and bowl of water.</td>
<td>- tuning fork (1 per group)</td>
</tr>
<tr>
<td>6. (Teacher Demonstration) Place a clear bowl, filled about half way with water, where students can see it.</td>
<td>- bowl of water (clear, filled half way with water, 1 per teacher)</td>
</tr>
<tr>
<td>7. Strike the tuning fork on a soft surface. Touch the tuning fork on the side of the bowl. Allow students to make observations.</td>
<td><strong>Attachments:</strong></td>
</tr>
<tr>
<td>8. Strike the tuning fork on a soft surface. Touch the tuning fork on the surface of the water. Allow students to make observations.</td>
<td>- Handout: <em>Dancing Pepper Instructions</em> (1 per group)</td>
</tr>
<tr>
<td>9. After the teacher demonstration, facilitate a discussion about the investigation and demonstration using the Teacher Resource: <em>Questions to Guide the Facilitated Discussion KEY</em>.</td>
<td>- Handout: <em>Dancing Pepper</em> (1 per student)</td>
</tr>
<tr>
<td>10. Distribute the Handout: <em>Sound</em>, and instruct students how to fold it to create a booklet. Read the booklet with partners.</td>
<td>- Teacher Resource: <em>Dancing Pepper KEY</em></td>
</tr>
<tr>
<td>11. After students have finished reading the booklet, they should have the opportunity to complete their Handout: <em>Forms of Energy Advance Organizer</em> for the section on sound energy. Additional reflections may be recorded in the science notebook.</td>
<td>- Teacher Resource: <em>Questions to Guide a Facilitated Discussion KEY</em></td>
</tr>
<tr>
<td></td>
<td>- Handout: <em>Sound</em> (1 per student)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPLORE/EXPLAIN – Electrical Energy</th>
<th>Suggested Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inflate a small balloon, and tie it off. Rub it several times across a piece of fabric, such as a shirt or pant leg. “Stick” the balloon to a wall.</td>
<td><strong>Materials:</strong></td>
</tr>
<tr>
<td>2. Inflate a second balloon, and tie it off. Rub it several times across a piece of fabric, such as a shirt or pant leg. Hold the balloon 1–2 inches above a student’s head (works best on 4–8 inch length hair that has no hair product applied).</td>
<td>- balloon (2–4 per teacher)</td>
</tr>
<tr>
<td>3. Ask:</td>
<td><strong>Attachments:</strong></td>
</tr>
<tr>
<td>• What happened with each of the balloons in this demonstration? (The first balloon appeared to “stick” to the wall. The second balloon was able to “lift” strands of the student’s hair.)</td>
<td>- Teacher Resource: <em>Evaluating a Product</em> (1 for projection)</td>
</tr>
<tr>
<td>• What caused these two events to happen? Answers may vary. It is static electricity that causes these events to happen.</td>
<td>- Teacher Resource: <em>Toy Labels</em> (1 per class)</td>
</tr>
<tr>
<td>• Have you had other experiences with static electricity? What were they? Answers may vary, but might include getting a shock from a door handle, a shock when shaking someone’s hand, or clothes sticking together when taking them from the clothes dryer.</td>
<td>- Handout: <em>Evaluating Toy Labels</em> (1 per student)</td>
</tr>
<tr>
<td>4. Say:</td>
<td><strong>Instructional Notes:</strong></td>
</tr>
</tbody>
</table>

- Electrical energy is the movement of charged particles (+, -). It
\begin{itemize}
\item Static electricity is the simplest form of electrical energy. When the balloon was rubbed against the fabric, it became charged. Positively charged objects attract negatively charged objects (similar to how magnets react). Lightning is a powerful form of static electricity.
\end{itemize}

5. Ask:

\begin{itemize}
\item What are some other sources of electrical energy? (Batteries, the burning of fossil fuels, nuclear energy, and solar energy)
\end{itemize}

6. Say:

\begin{itemize}
\item We will be conducting an investigation to evaluate the accuracy of toy labels. Many of the toys found in stores today use either electrical or mechanical energy to work. Other toys produce heat, light, or sound.
\item Have you ever received a toy that did not live up to the promises shown in the advertisement? Allow a few students to share their experiences.
\item You will work in groups to draw inferences and evaluate accuracy of product claims found in labels for toys.
\end{itemize}

7. Project the Teacher Resource: Evaluating a Product. Facilitate a discussion about the advertisements and techniques used to promote the sale of the product.

8. Distribute a label for a toy to each group.

9. Instruct groups to look at the product label they are reviewing and then evaluate the product according to the criteria on the Handout: Evaluating Toy Labels.

10. Groups should have the opportunity to share their findings with the rest of the class. This promotes communicating valid results based on data.

11. Students will also need the opportunity to evaluate a food and sunscreen label. It is suggested that students evaluate a cereal box label since this item is easily found. To assist with evaluating the cereal and sunscreen, consider the following questions:

\begin{itemize}
\item \textbf{Cereal}
\item What does it mean if a cereal is ‘enriched’?
\item Who determines if the cereal is a “good source” of a specific nutrient?
\item If the cereal claims to be “low in” a specific ingredient, low compared to what?
\item If the advertisement claims that the cereal is “part of a healthy breakfast”, what is the other part of the healthy breakfast?
\end{itemize}

\begin{itemize}
\item \textbf{Sunscreen}
\item What do the letters SPF represent?
\item Are any sunscreens “waterproof” or “sweat proof”? (See Instructional Notes)
\item What do the abbreviations UVA and UVB represent?
\item Is there a difference between “sunscreen” and “sunblock”?
\end{itemize}
1. Divide the class into groups of four students.

2. Review safety guidelines with students before starting activity. (Some guidelines might include: All hair should be tied back. Loose clothing should not be permitted. Dangling jewelry needs to be removed. Shoes that cover the foot should be worn.)

3. Provide each group with a copy of the Handout: The Heat is On Instructions and materials they will need (pie pan, clothespin, chocolate chips, and tea light candle).

4. Instruct groups to read the directions from the handout.

5. Following instructions on the Handout: The Heat is On Instructions, groups should complete the investigation. When all groups have completed the investigation and the candles have been extinguished, provide students with the Handout: The Heat is On. Students will complete the handout on their own.

6. Once students have completed the handout, have them share their writing with one person. This is an ELPS strategy that allows students to write and speak and listen.

7. Ask:
   - What form of energy was applied to the pan and the chocolate chips? (The form of energy was heat/thermal.)
   - What was used to light the candle? (A match)
   - Why did the chocolate chips start to melt at different rates? (The front side of the row had more direct heat/thermal energy applied to it.)
   - How did the chips that were not over the fire melt? (The heat/thermal energy moved from one end of the aluminum pan to the other.)
   - If the chips were not directly over the fire, what caused them to melt? (The heat/thermal energy was transferred from the fire to the aluminum pan and from the pan to the chocolate chips.)

8. Say:
   - Heat is a form of energy. Heat was transferred through matter: the aluminum pie pan and chocolate chips.
     - Ask:
       - Do metals transfer heat well? Explain your thinking. (Metals are good conductors of heat, and they allow heat/thermal energy to transfer well; explanations may vary.)
       - What must heat do in order to flow? (It must interact with matter.)
       - In what direction do you think heat/thermal energy travels? Allow students to answer this, and then provide the following two scenarios.

9. Say:
   - Imagine you have a glass of iced tea.
     - You set the glass down, and 15 minutes later, you notice the ice cubes are gone.
     - In your science notebook, write or draw an explanation for the disappearance of the ice cubes.

10. Say:
    - Imagine you are attending a football game in January.
      - You have dressed warmly; you are wearing a jacket, hat, and mittens or gloves.
      - You take your seat on the metal bleachers.
      - In 10 minutes, you are shivering because you are cold.
      - In your science notebook, write or draw an explanation about why your body became cold so quickly.

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**Materials:**
- aluminum pie pan (4 in. (11 cm), 1 per group)
- clothespin (1 per group)
- chocolate chips (10–15 per group)
- tea light candle (1 per group)
- matches (for teacher use only)

**Attachments:**
- Handout: The Heat is On Instructions (1 per group)
- Handout: The Heat is On (1 per student)
- Teacher Resource: The Heat is On KEY

**Safety Notes:**
Instruct students to be careful of the candle flame. They should pin hair back and keep clothing away from the flame of the candle.

Make sure to light the candle for the students and talk to them about their safety and about fire. Look at Step 3 from the Handout: The Heat is On Instructions.

**Instructional Notes:**
The candle flame needs to be positioned so that the first chocolate chip in the row receives the most direct heat. Heat should transfer slowly down each row as the metal transfers the heat energy to the other chips.

Make sure not to confuse students with the terms transfer and transformation. Transfer means that heat is transferring from one medium to another.

Transformation means that the energy transforms into another form of energy. You may use the example of the movie “Transformers”; in this movie, the cars totally transform into another robotic object.

**Science Notebooks:**
Students should have the opportunity to complete their Handout: Forms of Energy Advance Organizer for the section on heat/thermal energy. Additional reflections may be recorded in the science notebook.
11. Choose several students to share their explanations.
   Say:
   - Thermal energy is related to the temperature of an object or a substance. “Therm” means heat.
   - Thermal energy transfers from the warmer substance to the cooler substance.
   - Review your explanations and make adjustments based on how you now know heat/thermal energy transfer.

12. Say:
   - With your group, write down as many sources of heat/thermal energy you can think of.
   - We have already observed a candle and match as a source of heat/thermal energy.

13. After students have had a few minutes to write down their ideas, allow each group to share their sources of heat/thermal energy. Capture student responses on a chart, overhead, whiteboard, or chalkboard. A sample chart is shown below.

<table>
<thead>
<tr>
<th>Sources</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td></td>
</tr>
<tr>
<td>Stove/ oven</td>
<td></td>
</tr>
<tr>
<td>Candle</td>
<td></td>
</tr>
<tr>
<td>Match</td>
<td></td>
</tr>
<tr>
<td>Earth (magma)</td>
<td></td>
</tr>
<tr>
<td>Light bulb</td>
<td></td>
</tr>
</tbody>
</table>

14. Say:
   - For each of the sources, write down at least one use of the heat/thermal energy.

15. After students have had a few minutes to write down their ideas, allow each group to share their uses of heat/thermal energy. Capture student responses on a chart, overhead, whiteboard, or chalkboard. (See sample chart on next page.)

<table>
<thead>
<tr>
<th>Sources</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>Plants make food, keep us warm, heat the ocean</td>
</tr>
<tr>
<td>Stove/ oven</td>
<td>Cook food, warm food</td>
</tr>
<tr>
<td>Candle</td>
<td>Light a room, birthday cake (celebrate)</td>
</tr>
<tr>
<td>Match</td>
<td>Light a candle or fire</td>
</tr>
<tr>
<td>Earth (magma)</td>
<td>Creates new rocks or landforms when it cools</td>
</tr>
<tr>
<td>Light bulb</td>
<td>Lights a room, cooks food in Easy Bake™ oven</td>
</tr>
</tbody>
</table>

16. Instruct students to observe the chart.
   Ask:
   - What conclusions about heat/thermal energy could you make by observing the chart? Answers will vary, but may include that some sources of heat/thermal energy affect the entire Earth [the Sun], and some
are sources specific to a need [the match].

7. Students should have the opportunity to complete their Handout: **Forms of Energy Advance Organizer** for the section on heat/thermal energy. Additional reflections may be recorded in the science notebook.

EXPLORE/EXPLAIN – Conductors and Insulators - Heat

1. **Ask:**
   - If you had a cup of hot chocolate, what would you want the cup to be made of? Why? Insulated cups would keep the hot chocolate at a higher temperature for a longer period of time. Metal cups would transfer the heat from the hot chocolate to your hands. Ceramic cups would also transfer the heat to your hands.

2. **Show students the five different containers**, including a plastic cup, Styrofoam™ cup, hot beverage paper cup, metal soup-type can, and heat resistant glass jar.
   **Say:**
   - Each group will investigate how well the following materials conduct or insulate heat.

3. **Distribute the Handout: **Conduction and Insulation of Heat Energy** to each student. Review the procedure, and answer any questions or concerns students may have about the procedures. Review safety rules regarding the handling of hot issues.

4. **Divide the class into five groups.** Each group will test one of the types of materials, including a plastic cup, Styrofoam™ cup, hot beverage paper cup, metal soup-type can, and heat resistant glass jar.

5. **Instruct students to follow the directions on the Handout: **Conduction and Insulation of Heat Energy**. The group members may complete the handout cooperatively. Each student should complete a handout.

6. **Instruct each group to select a member to record the four times on chart paper, an interactive whiteboard, or overhead transparency.**

   **Sample Chart**

<table>
<thead>
<tr>
<th>Material</th>
<th>Initial reading</th>
<th>After 1 minute</th>
<th>After 2 minutes</th>
<th>After 3 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Styrofoam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. **After groups have conducted the investigation and completed the Handout: **Conduction and Insulation of Heat Energy**.
   **Ask:**
   - In which container did the water stay the hottest? It will most likely be the Styrofoam™ container.
   - What do you think this means about this material? (Styrofoam™ is a good insulator of heat.)
   - In which container did the water become the coolest? Answers may vary.
   - What do you think this means about this material? It is a good conductor of heat.
   - Why do you think cooking materials such as pots, pans and teapots are made of metal? (Metal is a good conductor of heat. Foods might...
If you were stirring a pot of spaghetti, would you rather stir it with a plastic spoon, or a metal spoon? Why? A plastic or wood spoon. They are poor conductors of heat.

8. Provide students the opportunity to complete the section on heat conductors and insulators on their Advance Organizer. Vocabulary should be added to the organizer as needed.

<table>
<thead>
<tr>
<th>EXPLORE/EXPLAIN – Conductors and Insulators - Sound</th>
<th>Suggested Days 7 (continued) and 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ask:</td>
<td></td>
</tr>
<tr>
<td>- <strong>What is the purpose of a conductor of heat?</strong></td>
<td><strong>Attachments:</strong></td>
</tr>
<tr>
<td>Answers may vary, but students should be</td>
<td>- Teacher Resource: Power Point:</td>
</tr>
<tr>
<td>gaining the understanding that a conductor of</td>
<td>Conductor and Insulator</td>
</tr>
<tr>
<td>heat is a property of matter that allows heat</td>
<td></td>
</tr>
<tr>
<td>to be transmitted and transferred easily.</td>
<td><strong>Instructional Note:</strong></td>
</tr>
<tr>
<td>- <strong>What is the purpose of an insulator of heat?</strong></td>
<td>If time permits, the teacher could</td>
</tr>
<tr>
<td>Answers may vary, but students should be</td>
<td>provide the students the</td>
</tr>
<tr>
<td>gaining the understanding that an insulator</td>
<td>opportunity to conduct the</td>
</tr>
<tr>
<td>of heat is a property of matter that allows</td>
<td>investigations they planned</td>
</tr>
<tr>
<td>heat to be retained. Students may also say</td>
<td>during this day’s lesson.</td>
</tr>
<tr>
<td>the material prevents the movement or</td>
<td></td>
</tr>
<tr>
<td>conduction of heat.</td>
<td></td>
</tr>
<tr>
<td>2. Ask:</td>
<td></td>
</tr>
<tr>
<td>- <strong>What is the purpose of a conductor of sound?</strong></td>
<td></td>
</tr>
<tr>
<td>Answers may vary.</td>
<td></td>
</tr>
<tr>
<td>- <strong>What is the purpose of an insulator of sound?</strong></td>
<td></td>
</tr>
<tr>
<td>Answers may vary.</td>
<td></td>
</tr>
<tr>
<td>3. Say:</td>
<td></td>
</tr>
<tr>
<td>- You have learned about sound energy; now, I</td>
<td></td>
</tr>
<tr>
<td>want you to think of materials that would be</td>
<td></td>
</tr>
<tr>
<td>conductors or insulators of sound. In your</td>
<td></td>
</tr>
<tr>
<td>science notebook, write down materials that</td>
<td></td>
</tr>
<tr>
<td>might be good conductors of sound and</td>
<td></td>
</tr>
<tr>
<td>materials that might be good insulators of</td>
<td></td>
</tr>
<tr>
<td>sound. Use a T-chart to record your thinking.</td>
<td></td>
</tr>
<tr>
<td>4. After students have had the opportunity to</td>
<td></td>
</tr>
<tr>
<td>record their ideas, ask for volunteers to</td>
<td></td>
</tr>
<tr>
<td>share their thinking. You may wish to record</td>
<td></td>
</tr>
<tr>
<td>all the ideas on one chart so all ideas are</td>
<td></td>
</tr>
<tr>
<td>shared by the class.</td>
<td></td>
</tr>
<tr>
<td>5. Divide class into groups of four students.</td>
<td></td>
</tr>
<tr>
<td>6. Ask:</td>
<td></td>
</tr>
<tr>
<td>- <strong>How might we design an investigation to test</strong></td>
<td></td>
</tr>
<tr>
<td>whether or not a material is a good sound</td>
<td></td>
</tr>
<tr>
<td>insulator? Say:</td>
<td></td>
</tr>
<tr>
<td>- **With your group members, come up with at</td>
<td></td>
</tr>
<tr>
<td>least two ways an investigation could be</td>
<td></td>
</tr>
<tr>
<td>completed to test your ideas.</td>
<td></td>
</tr>
<tr>
<td>7. Allow at least ten minutes for students to</td>
<td></td>
</tr>
<tr>
<td>come up with a plan. Provide students with</td>
<td></td>
</tr>
<tr>
<td>the opportunity to share their plans with the</td>
<td></td>
</tr>
<tr>
<td>class. (This discussion may take about five</td>
<td></td>
</tr>
<tr>
<td>minutes per group.)</td>
<td></td>
</tr>
<tr>
<td>8. Show the Teacher Resource: Power Point:</td>
<td></td>
</tr>
<tr>
<td>Conductor and Insulator. At each slide, ask</td>
<td></td>
</tr>
<tr>
<td>students which picture shows the better</td>
<td></td>
</tr>
<tr>
<td>material for conduction of sound and which</td>
<td></td>
</tr>
<tr>
<td>shows the material with better insulation of</td>
<td></td>
</tr>
<tr>
<td>sound. There are notes to assist on each slide.</td>
<td></td>
</tr>
<tr>
<td>9. Allow time for students to complete the portion</td>
<td></td>
</tr>
<tr>
<td>on sound conductors and insulators on the</td>
<td></td>
</tr>
<tr>
<td>Advance Organizer.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELABORATE – Forms of Energy</th>
<th>Suggested Day 8 (continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Provide students with</td>
<td></td>
</tr>
<tr>
<td>the opportunity to</td>
<td></td>
</tr>
<tr>
<td>complete their Advanced</td>
<td></td>
</tr>
<tr>
<td>Organizer. Review any</td>
<td></td>
</tr>
<tr>
<td>vocabulary that students</td>
<td></td>
</tr>
<tr>
<td>have not fully understood.</td>
<td></td>
</tr>
<tr>
<td>2. As a review for the</td>
<td></td>
</tr>
<tr>
<td>Performance Indicator,</td>
<td></td>
</tr>
<tr>
<td>Ask:</td>
<td></td>
</tr>
</tbody>
</table>
- In what ways is one form of energy different from another?

### EVALUATE – Performance Indicator - Power of Energy

**Grade 04 Science Unit 03 PI 01**

Choose one form of energy to represent. Prepare a debate to convince classmates that the form of energy represented is the most useful. Explain the advantages that it has over all other forms of energy.

**Standard(s):** 4.2F, 4.6A

**ELPS:** ELPS.c.1G, ELPS.c.2G, ELPS.c.3G

1. Refer to the Teacher Resource: *Instructions for Performance Indicator* for information on administering the performance assessment

### Materials:

- paper (lined notebook, 1–2 sheets per student)

### Attachments:

- Teacher Resource: *Instructions for Performance Indicator*
What Kind of Energy KEY

Ask at slide 1:
- What sources of energy are the pictures representing in this slide? *(The radiator represents heat/thermal energy; the push mower represents mechanical energy; the sound represents sound energy; and the Sun represents both light and heat/thermal energy.)*

Ask at slide 2:
- What type of energy is this object using? *[This object (the lamp) is using electrical energy.]*
- From where do you think this form of energy comes? *(The light energy was transformed from the electricity that comes from the wires out of the outlet. Energy is never made; it is only transformed or changed from one kind to another.)*

Ask at slide 3:
- What type of energy is represented by this object? *(Heat/thermal and light energy)*
- What is another object you are familiar with that represents more than one form of energy? Answers may vary.

Ask at slide 4:
- What kind of energy is cooking the soup? *(Heat/thermal energy is cooking the soup.)*
- What other kind of energy is the stovetop giving off? *(Light energy)*

Ask at slide 5:
- What type of energy is represented by the instrument? *(Sound energy)*
- What other form of energy is represented in this picture? *(Mechanical energy. The boys’ arm is moving the bow across the strings to make sounds.)*
Forms of Energy Advance Organizer

Light:

Heat/Thermal:

Mechanical:

Sound:

Electrical:
<table>
<thead>
<tr>
<th>Conductors</th>
<th>Insulators</th>
</tr>
</thead>
</table>

**VOCABULARY**

**VOCABULARY**
# Forms of Energy Advance Organizer KEY

**Light:** The energy carried by light. Visible light includes red, orange, yellow, green, blue, indigo, and violet. When all the light colors combine, we see white light.

**Sources:**
- Sun
- Fire - candles, campfires
- Lamps - flashlights

**Uses:**
- Plants grow (photosynthesis)
- To help us see
- As a warning (like exit signs or flashing lights)

**Sound:** The energy carried by sound waves. It’s caused by vibrations. It can travel through a solid, liquid, or gas.

**Sources:**
- People - talking, laughing
- Animals - barking, singing
- Instruments - drums, violin
- Sirens - police car, tornado warnings

**Uses:**
- Communication
- Celebration
- Warning

**Heat/Thermal:** It’s the energy related to the temperature of an object or a substance; “therm” means heat. Thermal energy transfers from the warmer substance to the cooler substance.

**Sources:**
- Sun
- Electricity - stove or oven
- Burning fuels - fire
- Earth (magma)

**Uses:**
- To keep us warm (like hand warmers)
- To cook our food
- To heat our homes

**Mechanical:** It’s the energy an object has because of its motion or position.

**Sources:**
- Water in motion; tides
- Windmills, wind turbines
- Bicycle

**Uses:**
- Any object with mechanical energy can do work.

**Electrical:** It’s the energy produced by electrical charges.

**Sources:**
- Static
- Lightning
- Batteries
- Fossil fuels

**Uses:**
- Power our appliances
- Power the electronics we use (computers, phones, games)

©2012, TESCCC 04/19/13
<table>
<thead>
<tr>
<th>Conductors</th>
<th>Insulators</th>
</tr>
</thead>
<tbody>
<tr>
<td>These two sections represent the flaps that will fold and show on the outside of the Advance Organizer. Inside: The uses, sources, and definition of each energy Outside: Conductors, Insulators, and Space for recording vocabulary</td>
<td></td>
</tr>
<tr>
<td>Heat → metal</td>
<td>Heat and Electricity</td>
</tr>
<tr>
<td>electricity: copper, aluminum, graphite, salt water</td>
<td>wood, glass, plastic, paper, rubber</td>
</tr>
<tr>
<td>sound: metal, water, dense rocks</td>
<td>Heat and sound</td>
</tr>
<tr>
<td>VOCABULARY</td>
<td>Styrofoam, Cork, Fabric</td>
</tr>
<tr>
<td>VOCABULARY</td>
<td></td>
</tr>
</tbody>
</table>

©2012, TESCCC
To Reflect or Not to Reflect

Materials:
- 1 sheet of white paper
- 1 piece of foil
- colored paper (at least 4 different colors)

1. Place the white sheet of paper down on the ground (or the sidewalk or grass).

2. Hold the foil perpendicular to the white sheet of paper, facing the Sun.

3. Ask students if they see the light being reflected.

4. Continue this process with each of the colored sheets of paper.

5. Students should be able to see the color of each sheet of paper reflected on the white sheet of paper.
Mechanical Energy

Materials:

- 1 tennis ball
- 6 books of equal thickness
- 1 meter stick

1. Create a ramp using only two books (see illustrations above).

2. Place the ball at the top of the ramp, and let it go.

3. Measure the distance the ball travels in meters and centimeters.

4. Record the distance on the Handout: Mechanical Energy Recording Sheet.

5. Repeat the trial three times for each height of book ramp (1 book high, 2 books high, 3 books high, 4 books high, and 5 books high).

6. Create a graph to represent your data. Include a title, and remember to label each axis.
# Mechanical Energy Recording Sheet

<table>
<thead>
<tr>
<th>Number of stacked books</th>
<th>Distance traveled on trial 1 (in m/cm)</th>
<th>Distance traveled on trial 2 (in m/cm)</th>
<th>Distance traveled on trial 3 (in m/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Create a graph to represent your data.
### Dancing Pepper Instructions

1. Place plastic wrap on top of the cup.

2. Add a pinch of pepper on top of the plastic.

3. Use a tuning fork, and strike it on the bottom of your soft-soled shoe.

4. Place the tuning fork above the cup (Do not allow the tuning fork to touch the plastic or pepper.). Write down what you observed, and explain why this happened on the Handout: **Dancing Pepper**.

5. Strike the tuning fork again, while you pick up the cup, and allow the tuning fork to touch the bottom of the cup. Write down what you observed, and explain why this happened on the Handout: **Dancing Pepper**.

6. Strike the tuning fork the third time, allow it to touch the plastic on top of the cup. Write down what you observed, and explain why this happened on the Handout: **Dancing Pepper**.
## Dancing Pepper

<table>
<thead>
<tr>
<th>Observation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuning fork above the cup</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>Explanation</td>
</tr>
<tr>
<td>Tuning fork touching the bottom of the cup</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>Explanation</td>
</tr>
<tr>
<td>Tuning fork touching the plastic</td>
<td></td>
</tr>
</tbody>
</table>
# Dancing Pepper KEY

<table>
<thead>
<tr>
<th>Observations</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pepper seemed to bounce up and down, even though the tuning fork did not touch the cup.</td>
<td>The vibrations of the tuning fork traveled through the air (matter) in waves and eventually interacted with the pepper to make it move up and down.</td>
</tr>
</tbody>
</table>

**Tuning fork above the cup**

<table>
<thead>
<tr>
<th>Observations</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pepper seemed to move stronger up and down than with the first observation.</td>
<td>This is because the tuning fork was actually touching the bottom part of the plastic cup, allowing the vibrations to transfer into the plastic and then into the pepper. The waves did not have to travel through the air to get to the pepper.</td>
</tr>
</tbody>
</table>

**Tuning fork touching the bottom of the cup**

<table>
<thead>
<tr>
<th>Observations</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pepper seemed to move even stronger than the previous two observations.</td>
<td>This happened because now the tuning fork is touching the plastic, allowing the vibrations (waves) to affect the pepper more directly.</td>
</tr>
</tbody>
</table>

**Tuning fork touching the plastic**
Questions to Guide Facilitated Discussion  KEY

- What caused the tuning fork to vibrate? *(Striking the tuning fork on a soft surface caused it to vibrate.)*
- What did you observe when you placed the tuning fork above the cup? *(The pepper seemed to move.)*
- What made the pepper seem to move? *(The vibrations of the tuning fork and waves that traveled through the air caused the pepper to move.)*
- What happened when you placed the tuning fork under the cup? *(The vibrations from the tuning fork traveled from the tuning fork to the plastic cup and then to the pepper. The pepper appeared to move up-and-down more than when the waves traveled only through the air.)*
- What happened when you placed the tuning fork on the plastic? *(The sound energy (vibrations of the tuning fork) transferred, and the waves caused the pepper to move.)*
- What appeared to be created in the water when the tuning fork touched the cup? *(Waves)*
- What form of energy occurred when the tuning fork vibrated? *Sound energy*
- How does sound energy travel, and how do you know? *(Sound energy travels in waves because when you put the tuning fork on the cup, you are able to see the waves in the water.)*
- What kind of matter did the sound waves interact with? *(The plastic cup, air, and water.)*
- How do you think sound energy travels when it interacts with air? *(The same way; waves)*
- In what ways are mechanical and light energy different from sound energy? Answers will vary.
Glossary

**Matter**: anything that takes up space and has mass

**Vibration**: a fast back-and-forth motion

**Volume**: how loud or how soft a sound is

**Wave**: movement of some kinds of energy from one place to another

**SOUND**

Sounds are all around us.

What are some sources of sound?

What are the uses of sound?
What makes sound?

**Vibrations** make sound.

**Strong** vibrations make loud sounds.

**Weak** vibrations make quiet sounds.

**Fast** vibrations make high sounds.

**Slow** vibrations make low sounds.

How do we use sound?

We use sounds in many ways.

Sounds are used to warn us.

Sounds are used to communicate.

People *talk*, and people *listen*.

Sounds are used to celebrate.

How do you use sound?

_______________________________
Evaluating a Product

Some questions to consider when evaluating a product, a label, or an advertisement:

- What is the advertiser’s purpose in creating this message?
- What is the message?
- Are there other messages that different people take away from this?
- Who is the target audience?
- What techniques are used to gain or keep my attention?

Marketing firms use data to determine the best way to design an advertisement or a product label. They want to place the elements of the advertisement or label in such a way that it catches your attention.

The “Z” shape is one of the most common designs used in advertisements. The science behind it is this: When you learned to read, you were taught to move your eyes left to right and from the top of the page to the bottom.
# Toy Labels

## Hex Bug© Micro Robotic Creatures

This is a robotic creature that reacts to touch and sound!

- Batteries included
- Five exciting colors
- Changes direction as a reaction to things in its path
- Changes direction as a reaction to loud sounds
- $5.99

![Hex Bug](image)

## MindFlex Mental Game©

Think it. Move it. Believe it.

- Requires four C batteries (not included)
- Move a small foam ball through an obstacle course using only your mind.
- Uses brain wave technology
- $56.00

![MindFlex](image)

## Brush with Genius©

Control sound with the stroke of a brush!

- Paint pictures, and bring them to life by creating sound effects.
- Includes a “magical” brush that works on regular paper
- Includes watercolor paints
- Can be used with plain tap water
- Encourages social interaction
- $15.00

![Brush with Genius](image)

## Stikits®

Stick them together; make whatever.

- Includes instructions with pictures
- Includes toolkit and sponge
- Pieces stick together with water; no glue necessary.
- Eco-friendly, biodegradable
- $20.36

![Stikits](image)
Easy Bake Ultimate Oven

Bake up sweet and tasty treats.

* No light bulb needed.
* Oven comes with baking pan, cupcake pan, pan pusher, treat mixes, and instructions/recipe booklet.
* Caution: This toy has a heating element.
* Caution: Supervision is required.
* $44.99

K’Nex (Amusement Parks)

Imagine, build, play.

* Build a giant dueling roller coaster.
* 1,100 pieces
* Rises to a height of over a meter
* Includes a motorized chain lift and two cars
* Color-coded for easy assembly
* Instructions included
* $45.00
Evaluating Toy Labels

1. What is the name of the product you are evaluating? __________________________________________________________

2. Describe your product: ________________________________________________________________________________
______________________________________________________________________________________________________

3. The label advertises that the product can ________________________________________________________________
______________________________________________________________________________________________________

4. I think the product actually ____________________________________________________________________________
______________________________________________________________________________________________________

5. The words used to persuade a consumer to purchase this product include: __________________________________
______________________________________________________________________________________________________

6. In what ways are the words on the label or picture for your product misleading? ____________________________
______________________________________________________________________________________________________

7. What is your advice to a consumer who is interested in this product? Should they buy the product? Justify your response.____
______________________________________________________________________________________________________

8. Other comments:
The Heat is On! Instructions

1. Place chocolate chips in a row across a 4 inch (11 cm) aluminum pie pan.

2. Without scattering the chocolate chips, carefully clip a clothespin on one end of the row.

3. Wait for the teacher to light your tea candle.

4. Place the aluminum pie pan over the flame of the candle; the bottom of the pan should be about 1 cm above the flame. Make sure that the chocolate chip farthest away from the clothespin is over the candle flame. Continue to hold the aluminum pie pan in this position for about fifteen minutes, and then complete the Handout: The Heat is On.
The Heat is On

1. Draw an illustration to show how the chocolate chips looked before and after heat (energy) was applied to the aluminum pie pan and chocolate chips (matter).

<table>
<thead>
<tr>
<th>Before Heat was Applied</th>
<th>After Heat was Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. What type of energy was being used?

3. Did the chips all melt at the same time?

4. Why did the chocolate chips start to melt at different rates?

5. Explain the pattern of melting you observed.

6. Was there a transfer of energy?

7. Explain or illustrate how the transfer of energy occurred.
The Heat is On **KEY**

1. Draw an illustration to show how the chocolate chips looked before and after heat (energy) was applied to the aluminum pie pan and chocolate chips (matter).

<table>
<thead>
<tr>
<th>Before Heat was Applied</th>
<th>After Heat was Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will draw and label an illustration.</td>
<td>Students will draw and label an illustration.</td>
</tr>
</tbody>
</table>

2. What type of energy was being used? **Heat energy was being used in this activity.**

3. Did the chips all melt at the same time? **No, the chips did not all melt at the same time.**

4. Why did the chocolate chips start to melt at different rates? **The chocolate chips that were closer to the source of heat/thermal energy began to melt first.**

5. Explain the pattern of melting you observed. **The chip that was closer to the source of heat began to melt first. Then the chip next to the first one began to melt. The chips began to melt in the order of the one closest to the source of heat/thermal energy to the one farthest from the source of heat/thermal energy.**

6. Was there a transfer of energy? **There was a transfer of energy. Heat energy transferred into the aluminum pie pan, and then the heat transferred into the chocolate chips.**

7. Explain or illustrate how the transfer of energy occurred. **Students may draw a picture here.**
# Conduction and Insulation of Heat Energy

1. Place the thermometer in the plastic bowl of ice water. Leave it for three minutes. Take the temperature of the ice water. Record the temperature in degrees Celsius. __________ Remove the thermometer from the ice water.

2. Your teacher will provide you with another container. Record the material from which your container is made, such as metal, glass, Styrofoam™, plastic, or cardboard.

My container is made from ________________.

3. Place the thermometer into the empty container. Your teacher will pour hot water into the container with the thermometer. Very carefully place the container of hot water into the bowl of ice water. Immediately read the temperature on the thermometer. Start the timer, and wait three minutes. Read the temperature on the thermometer. Leave thermometer in the hot water, and take two more readings; take one at six minutes and one at nine minutes.

<table>
<thead>
<tr>
<th>Initial Temperature of Hot Water</th>
<th>After 3 Minutes</th>
<th>After 6 Minutes</th>
<th>After 9 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Complete the following chart. Use degrees Celsius when recording temperature.

<table>
<thead>
<tr>
<th>Material</th>
<th>Initial Reading</th>
<th>After 3 Minutes</th>
<th>After 6 Minutes</th>
<th>After 9 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Styrofoam™</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Beverage Paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Complete the graph for your investigation.

<table>
<thead>
<tr>
<th>Temperature in degrees Celsius</th>
<th>Initial Reading</th>
<th>After 3 Minutes</th>
<th>After 6 Minutes</th>
<th>After 9 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Answer the following questions.

1. In which container did the water stay the hottest?

2. What do you think this means about the material from which the container was made?

3. In which container did the water become the coolest?

4. What do you think this means about the material from which the container was made?

5. Why do you think cooking materials, such as pots, pans, and teapots, are made of metal?

6. If you were stirring a pot of spaghetti, would you rather stir it with a plastic or metal spoon? Justify your response.
Instructions for Performance Indicator

Performance Indicator

- Choose one form of energy to represent. Prepare a debate to convince classmates that the form of energy represented is the most useful. Explain the advantages that it has over all other forms of energy.

1G; 2G; 3G

(4.2F; 4.6A)

1. Remind the student that they have been exploring different kinds of energy over the last few weeks.

2. Explain that they will be assigned one form of energy and they must write a convincing argument about why their form of energy is the most useful.

3. Explain that their written argument will be presented to the class and must contain at least four facts about their energy to justify why their energy is the most useful.

4. Students will have one day to prepare their debate. The presentation of the debate will be completed on another day.

5. Share Performance Indicator rubric or expectations with students prior to students beginning the assessment.

6. Answer any questions students may have regarding the assessment.

Instructional Notes:

This Performance Indicator aligns with the ELAR TEKS Writing/Persuasive Texts.

Students write persuasive texts to influence the attitudes or actions of a specific audience on specific issues.

Students are expected to write persuasive essays for appropriate audiences that establish a position and use supporting details.