

# Investigating Energy Transformations

## Teacher Facilitation Notes

### In General . . .

- Project the slide deck in edit mode—do not show it as a slideshow.
- Hide the speaker notes before projecting. (View/Show Speaker Notes)
- Hide the filmstrip to the left. (View/Hide Filmstrip.)
- Hide the toolbar. (Click on the up arrow at the right end of the tool bar.)
- Call on students to read the various content shown on slides.

### Materials Needed Per Group:

#### Engage:

Gallon-sized baggie or small plastic tub with lid

Small, rectangular, plastic or paper mirrors, 2

Wind-up toy

Masking tape

Christmas light bulb with wires\*, 2

Sheet protectors, 6

Empty plastic water bottles, 2

Ice water

Balloons, 2

Plastic spoon

Funnel

Goggles

Plastic metric ruler

Batteries (AA), 2

Sandwich baggie, 1

Large button or googly eye, 1

Hot (NOT boiling) water

Large beakers, 2

Paper towels

Beaker (50 mL), 1

Baking soda

#### Explore:

Small electric table fan

Large beakers, 2 per group

Cold water

Paper towels

Flashlight

Electric or battery-operated pencil sharpener

Glow sticks, 2 per group

Hot water

Black construction paper, 1 sheet

Hair dryer

Batteries for flashlight

#### Elaborate:

Colored card stock (2 different colors)

Scissors, 1 pair per student OR 2 pairs per group

\*



# Investigating Energy Transformations

## Teacher Facilitation Notes, p. 2

### Materials Needed Per Group, continued

#### Other Materials

Student Recording Sheets

Cardstock

Student Summative Evaluation

Science notebooks

Pencils

Goggles, 1 per student

### Advanced Preparations

- For Engage:
  - Light Energy–Tape two rectangular mirrors together on a short side so that they can open and shut like a book (Be sure to put the tape on the back–do not cover up any of the reflective surfaces.) Place the taped together mirrors and the button or googly eye in a baggie. Make one set for each group of students.
  - Cut apart old strands of Christmas lights, leaving as much wire as possible on each bulb. (You might have to just use every other bulb.) Strip the ends of the wires so using them in a circuit is easier.
- For Explore:
  - Remove the batteries from the flashlights before beginning the activity.
- For Elaborate:
  - Duplicate the slider frames on one color of card stock. Duplicate 1 for each student OR 1 for each group. Cut apart.
  - Duplicate the slider strips on a different color of card stock, either 1 set per student OR 1 set per group.

# Investigating Energy Transformations

## Teacher Facilitation Notes, p. 3

### **Engage: Forms of Energy**

- Read through the information on the opening slide. Ask students to look around the classroom and give examples of different forms of energy they might see or feel.
- Choose one of these options for completing this section of the lesson, depending on the ability level of the students:
  - Option 1: Each group has their own set of materials for each mission. Volunteers read the steps and the groups work together to complete each step. The whole class then discusses the answers to the questions.
  - Option 2: Each group has their own set of materials for each mission. The groups work independently to complete the mission. The whole class then discusses the answers to the questions.
- After all of the missions have been completed, discuss as desired.

### **Explore: Investigating Energy Transformation**

- Read and discuss the introductory slide about energy transformations.
- Depending on students' abilities levels and the availability of materials, choose one of the following options:
  - Option 1: Each group has their own set of materials for each mission. Volunteers read the steps and the groups work together to complete each step. The whole class then discusses the answers to the questions.
  - Option 2: Each group has their own set of materials for each mission. The groups work independently to complete the mission. The whole class then discusses the answers to the questions.
  - Option 3: Set up the 5 stations around the room. Groups work independently as they revolve through the stations.
- After students have finished the activities, discuss as desired.

### **Explain: Describing Energy Transformations.**

- Read the introductory slide.
- Discuss each station as desired. Have students identify the energy transformations that occur in each device for every station.
- As you discuss each station, show the explain slide for that station. Call on volunteers to identify the energy transformations taking place.

# Investigating Energy Transformations

## Teacher Facilitation Notes, p. 4

### **Elaborate**

- Make sure each student or group of students has a frame and strips to make their sliders.
- Show the first slide. Tell the students that they are going to be thinking about various devices or objects and identifying the main energy transformations that occur when the device or object is used.
- Display the directions for making the sliders. Ask students what energy transformations might occur as the trombonist plays his trombone.
- Have students make their sliders. Demonstrate how to cut out and thread the slits, if desired.
- Depending on student ability level, either let the students manipulate the sliders and record their results independently or do it as a whole class (calling on volunteers to identify the energy transformations).
- Discuss as desired.

### **Evaluate**

- Have students complete the quiz independently.
- Discuss as desired.

# Investigating Energy Transformations

Name: KEY

## Evaluation

- When a person plays the drums, what form of energy is transformed into sound energy?
  - Mechanical
  - Thermal
  - Electrical
  - Light
- Which of the following is the correct order for the energy transformations that occur in a working flashlight?
  - Electrical to chemical to thermal and light
  - Light to electrical to chemical and thermal
  - Thermal to electrical to light and chemical
  - Chemical to electrical to light and thermal
- What main energy transformation occurs when a lamp is turned on?
  - Electrical → mechanical
  - Thermal → mechanical
  - Electrical → light + thermal
  - Light → mechanical + thermal
- What energy transformation takes place when a radio is turned on?
  - Sound to chemical
  - Electrical to sound
  - Chemical to sound
  - Sound to electrical

# Investigating Energy Transformations

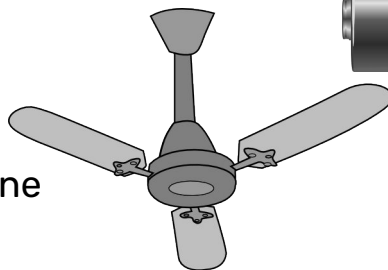
Name: KEY

## Evaluation

5. A hairdryer is a system of parts that work together. The main function is this system is to transform-
- A** electrical energy into chemical energy
  - B** electrical energy into thermal energy
  - C** chemical energy into mechanical energy
  - D** thermal energy into mechanical energy
6. Coal, wood, and oil are sometimes burned in furnaces to heat homes in very cold areas. When they are burned, chemical energy is transformed to-
- F** sound energy
  - G** light energy
  - H** thermal energy
  - J** mechanical energy
7. Which of the following shows an energy transformation from chemical energy to electrical energy to light energy?
- A** A candle glowing brightly in the dark
  - B** A bolt of lightning in the night sky
  - C** A battery causing a flashlight to shine
  - D** Burning wood in a fireplace warms up a room

8. Which two objects pictured here, transform electrical energy into mechanical energy? Mark two answers.

- F** Ceiling fan
- G** AA Battery
- H** Television
- J** Washing machine
- K** Stereo



# Investigating Energy Transformations

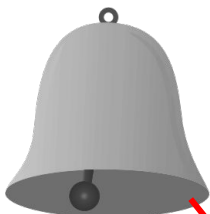
Name: KEY

## Evaluation

9. Match the pictures in column X with its corresponding energy transformation in column Y by drawing lines from the object to the energy transformation,

**X (Object)**

**Y (Energy Transformation)**



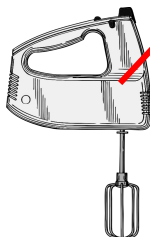
**Bell**



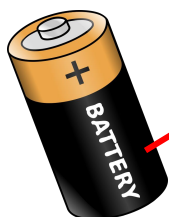
**Electric Coffeemaker**



**Doorbell**



**Electric mixer**



**Battery**

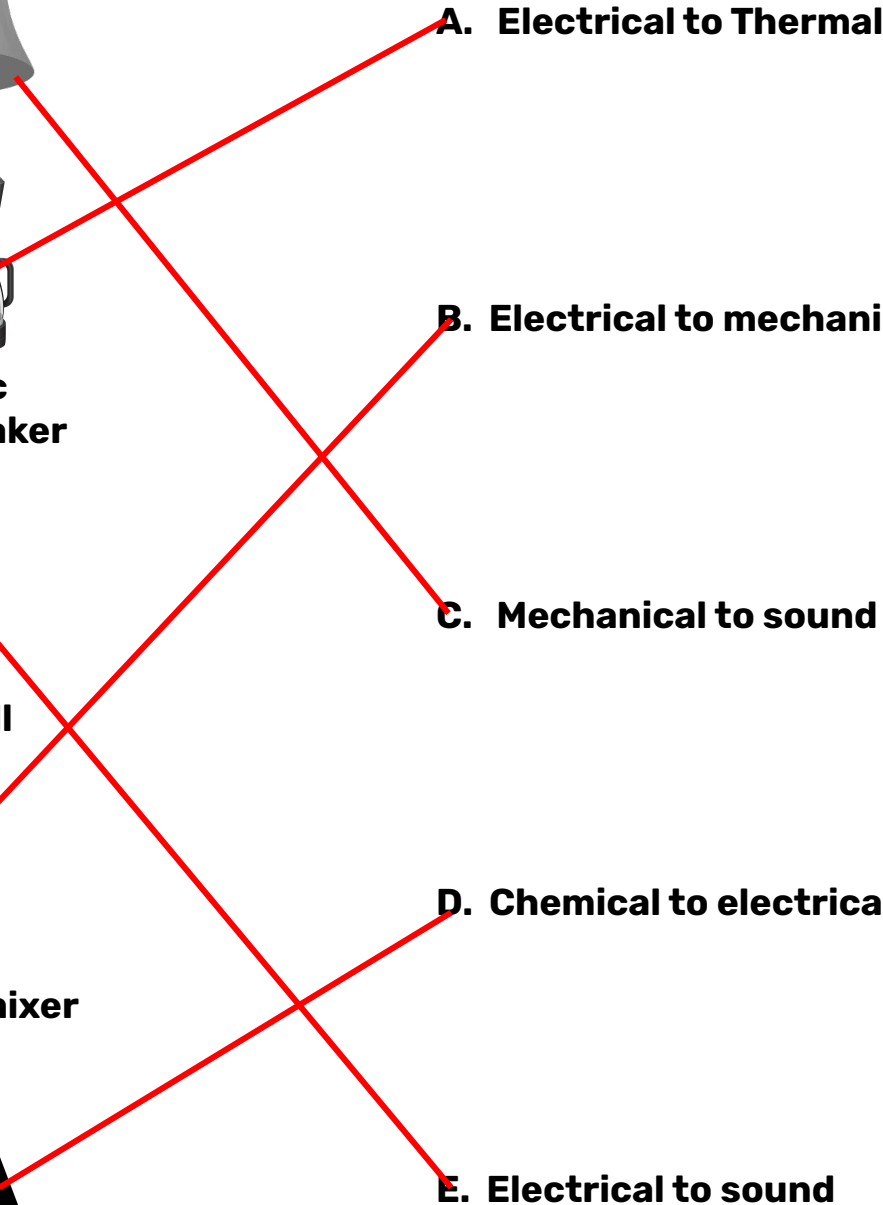
**A. Electrical to Thermal**

**B. Electrical to mechanical**

**C. Mechanical to sound**

**D. Chemical to electrical**

**E. Electrical to sound**



# Investigating Energy Transformations

Explore: Station #1-Cool Air for a Hot Day

## Procedures:

- A. Make sure the fan is plugged into an electrical outlet.**
- B. Turn on the fan.**
- C. Observe as the fan motor begins to work and the blades begin to turn.**
- D. Hold your hand in front of the fan about 15 cm away.**
- E. Carefully touch the part of the fan holding the motor.**
- F. Turn the fan off to stop the flow of energy.**



# Investigating Energy Transformations

Explore: Station #2-Get Ready to Shine

## Procedures:

- A. Gently pass around a glow stick and examine it carefully.**
- B. Shake the glow stick gently.**
- C. Snap the two glow sticks at the same time. Place one in the very warm water and one in the very cold water.**
- D. If possible, dim or turn off the lights and observe the sticks for about 45 seconds.**
- E. Carefully remove the glow sticks from the water and set them on a sheet of black paper.**

# Investigating Energy Transformations

Explore: Station #3-I See the Light!

## Procedures:

- A. Look carefully at the flashlight and the batteries.**
- B. Turn the flashlight on and off. Discuss what happens and why it happens with your group.**
- C. The batteries provide the energy for the flashlight to work. Open the flashlight and insert the batteries. (Make sure the poles of the battery are in the correct places!)**
- D. Now turn on the flashlight.**
- E. Answer the questions and identify the energy input and the energy outputs for the flashlight on your recording sheet.**

# Investigating Energy Transformations

Explore: Station #4-Things are Heating Up!

## Procedures:

- A. Look carefully at the hair dryer. Describe the parts of the hair dryer that you can see.**
- B. Make sure the hair dryer is plugged into an electrical outlet.**
- C. Turn on the hair dryer.**
- D. Observe as the hair dryer begins to run.**
- E. Hold your hand about 30 cm away from the front of the hair dryer.**
- F. Carefully touch the part of the hair dryer holding the motor.**
- G. Turn the hair dryer off to stop the flow of energy.**

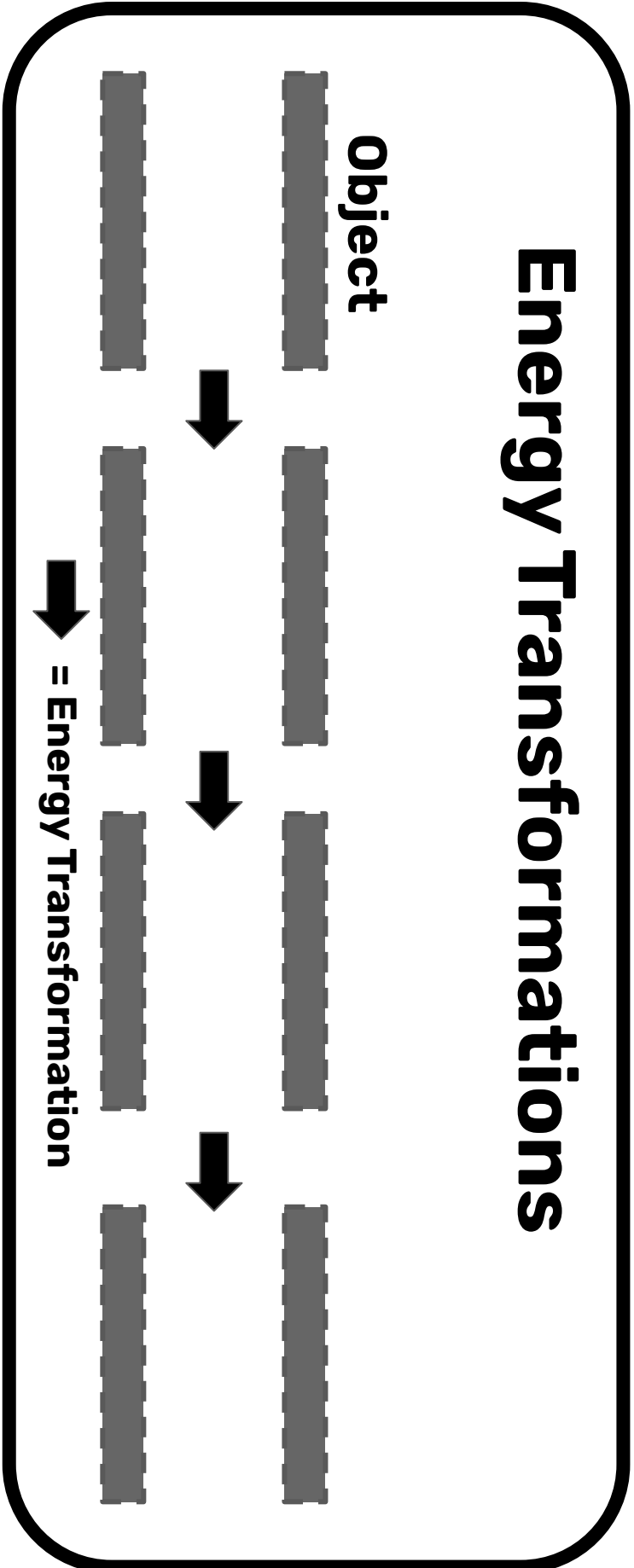
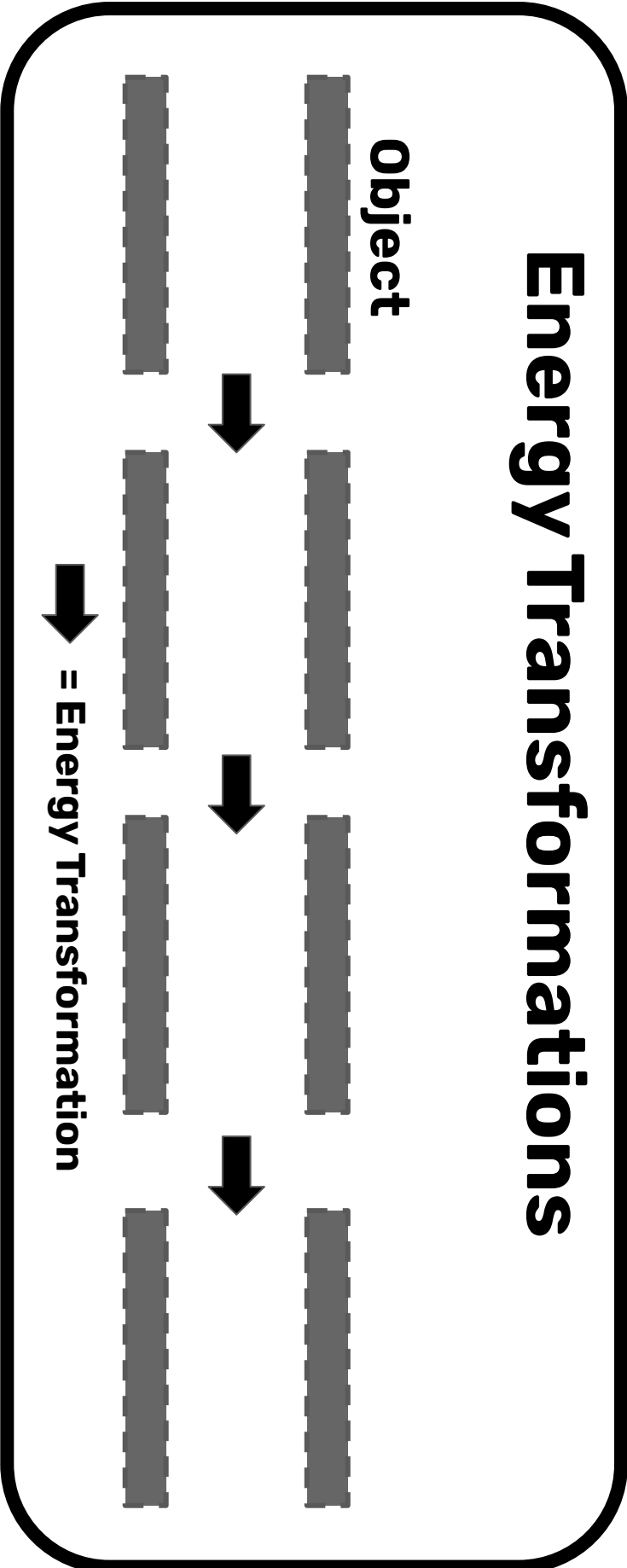
# Investigating Energy Transformations

Explore: Station #4-Things are Heating Up!

## Procedures:

- A. Look carefully at the pencil sharpener.**
- B. Make sure the pencil sharpener is plugged or has batteries.**
- C. Put a pencil in the sharpener and observe as it sharpens the pencil.**
- D. Think carefully about what you see, hear, and feel.**
- E. Carefully touch the part of the pencil sharpener holding the motor.**
- F. Remove the pencil from the sharpener to stop the flow of energy.**

Investigating Energy Transformations  
Slider Frames



# Investigating Energy Transformations

## Slider Strips

Object

Forms of Energy

Forms of Energy

Forms of Energy

**Flashlight**

**Chemical  
Energy**

**Chemical  
Energy**

**Chemical  
Energy**

**Playing a  
Guitar**

**Electrical  
Energy**

**Electrical  
Energy**

**Electrical  
Energy**

**Toasting  
Bread in a  
Toaster**

**Light  
Energy**

**Light  
Energy**

**Light  
Energy**

**Burning a  
Candle**

**Mechanical  
Energy**

**Mechanical  
Energy**

**Mechanical  
Energy**

**Watching a  
Television**

**Sound  
Energy**

**Sound  
Energy**

**Sound  
Energy**

**Wind Turbine**

**Thermal  
Energy**

**Thermal  
Energy**

**Thermal  
Energy**

# Investigating Energy Transformations

Name: \_\_\_\_\_

## Engage: Forms of Energy

### Mission #1: Mechanical Energy

1. How far did the toy travel when you turned the knob 3 times? \_\_\_\_\_
2. How far did the toy travel when you turned the knob 6 times? \_\_\_\_\_
3. What do you think caused the difference in the distance the toy traveled?  
Explain. \_\_\_\_\_  
\_\_\_\_\_

4. What is mechanical energy? \_\_\_\_\_  
\_\_\_\_\_

### Mission #2: Electrical Energy

5. Draw a labeled sketch to show how you used the light bulb and the battery to demonstrate electrical energy.

6. What is electrical energy? \_\_\_\_\_  
\_\_\_\_\_

### Mission #3: Light Energy

7. How many buttons can you count when the mirrors are at a  $90^\circ$  angle?  
\_\_\_\_\_
8. How many buttons can you count at each of these distances apart?  
10 cm apart \_\_\_\_\_  
8 cm apart \_\_\_\_\_  
6 cm apart \_\_\_\_\_

# Investigating Energy Transformations

Name: \_\_\_\_\_

## Engage: Forms of Energy, continued

### Mission #3: Light Energy, continued

9. What property of light makes it possible for you to see the images of the buttons in the mirrors? \_\_\_\_\_
10. Why do you think you see more images of the button when the edges of the mirrors are moved closer together? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### Mission #4: Thermal Energy

11. What is inside the balloon? \_\_\_\_\_
12. What is inside the empty water bottle? \_\_\_\_\_
13. What happened to the balloon when you placed the water bottle in the very warm water? Why do you think this happened? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
14. What happened to the balloon when you moved the water bottle to the ice water? Why do you think this happened? \_\_\_\_\_  
\_\_\_\_\_
15. How does thermal energy affect the air around us? \_\_\_\_\_  
\_\_\_\_\_

### Mission #5: Sound Energy

16. What happened when you pushed down on the part of the ruler that was 10 cm over the edge of the table? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



# Investigating Energy Transformations

Name: \_\_\_\_\_

## Engage: Forms of Energy, continued

### Mission #5: L Sound Energy, continued

17. How did the vibrations differ when you increased the amount of ruler hanging over the edge of the table? \_\_\_\_\_  
\_\_\_\_\_

18. How does sound reach your ears? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### Mission #6: Chemical Energy

19. What do you think will happen if you lift the balloon and allow the baking soda to mix in with the vinegar? \_\_\_\_\_  
\_\_\_\_\_

20. What happened when the baking soda mixed with the vinegar? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

21. What kind of energy was released when the baking soda mixed with the vinegar? \_\_\_\_\_

### Vocabulary Match: Match each term to its definition.

- |                            |   |
|----------------------------|---|
| 22. ____ Chemical energy   | (A) Energy of moving objects                  |
| 23. ____ Electrical energy | (B) Energy that allows us to see objects      |
| 24. ____ Light energy      | (C) Energy produced by vibrating objects      |
| 25. ____ Mechanical energy | (D) Energy released when substances combine   |
| 26. ____ Sound energy      | (E) Energy of moving particles in a substance |
| 27. ____ Thermal energy    | (F) Energy found in charged particles         |

# Investigating Energy Transformations

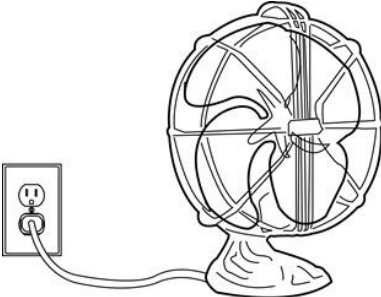
Name: \_\_\_\_\_

## Explore: Investigating Energy Transformations

### Station #1: Cool Air for a Hot Day

1. What type of energy is required to turn on the fan? \_\_\_\_\_
2. What type of energy causes the fan motor to run? \_\_\_\_\_
3. What type of energy do the fan blades have as they turn? \_\_\_\_\_
4. What type of energy is produced by the moving blades? \_\_\_\_\_

**Identify the energy inputs and energy outputs to make the fan run.**

Energy Inputs		Energy Outputs
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5. In a working electric fan \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy and \_\_\_\_\_ energy.

### Station #2: Get Ready to Shine

6. What do you see when you observe the glow stick? \_\_\_\_\_  
\_\_\_\_\_
7. What do you feel when you shake the glow stick? \_\_\_\_\_  
\_\_\_\_\_
8. What happens when the glow sticks are bent? \_\_\_\_\_  
\_\_\_\_\_
9. How did the light from the glow stick in the hot water differ from the one in the cold water? \_\_\_\_\_
10. In a glow stick, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy.

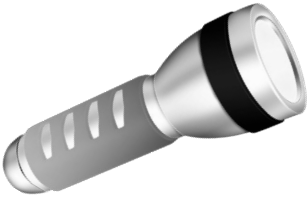
# Investigating Energy Transformations Name: \_\_\_\_\_

## Explore: Investigating Energy Transformations, page 2

### **Station #3: I See the Light**

11. What is the purpose of a flashlight? \_\_\_\_\_
12. What provides the flashlight with energy? \_\_\_\_\_
13. What kind of energy is in the batteries? \_\_\_\_\_
14. What do you observe when you turn on the flashlight? \_\_\_\_\_  
\_\_\_\_\_

### **Identify the energy inputs and energy outputs when the flashlight is on.**

Energy Inputs		Energy Outputs
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15. In a working flashlight, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy and \_\_\_\_\_ energy.

### **Station #4: Things are Heating Up!**

16. Write a brief description of the parts of the hair dryer you can see. \_\_\_\_\_  
\_\_\_\_\_
17. What type of energy is required to turn on the hair dryer? \_\_\_\_\_
18. What type of energy is required for the hair dryer to run? \_\_\_\_\_
19. What type(s) of energy are produced by a running hair dryer? \_\_\_\_\_  
\_\_\_\_\_
20. In a running hair dryer, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy, \_\_\_\_\_ energy, and \_\_\_\_\_ energy .

# Investigating Energy Transformations

Name: \_\_\_\_\_

## Explore: Investigating Energy Transformations, page 2

### Station #5: Whirring and Grinding

21. Write a description of the parts of the pencil sharpener you can see.

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22. What type of energy is required for the pencil sharpener to work?

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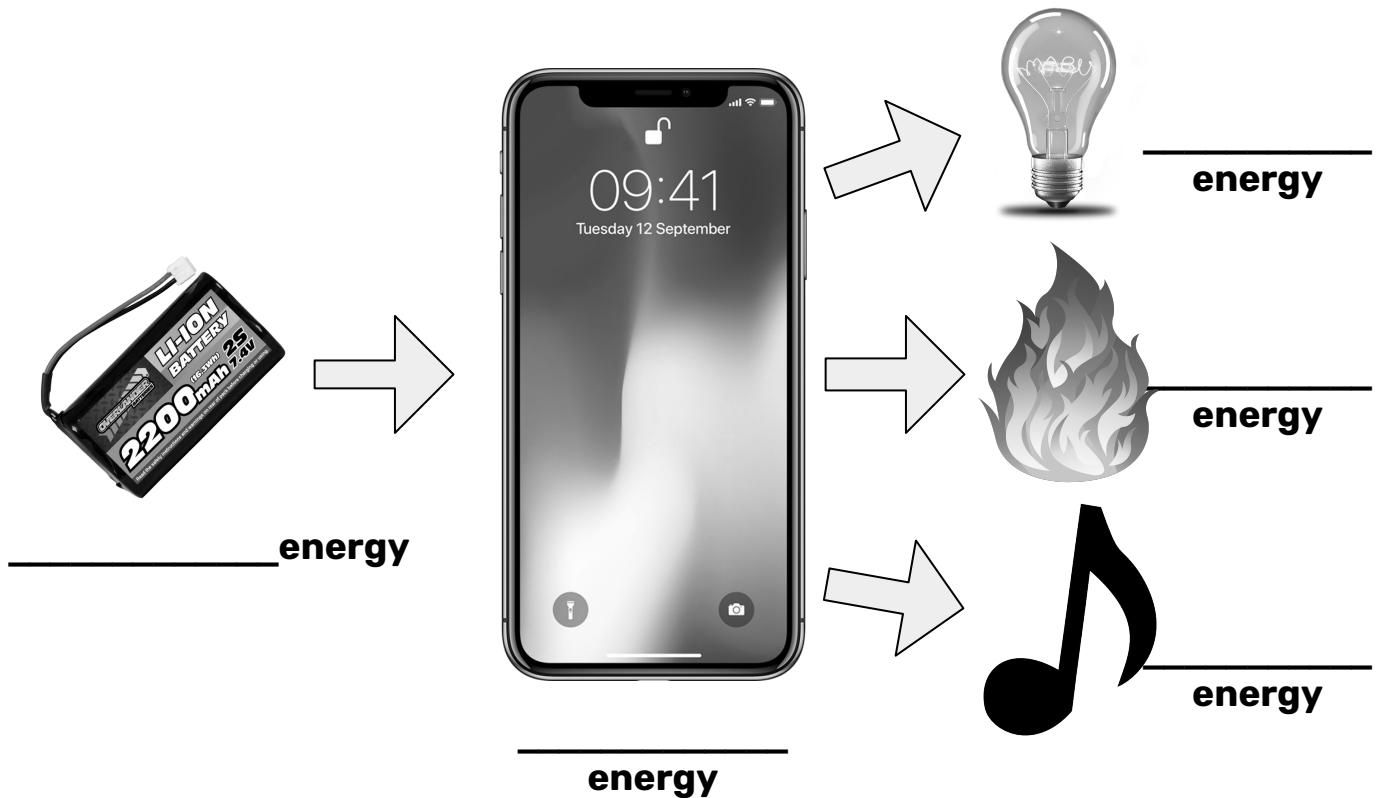
23. What type(s) of energy are produced as the pencil sharpener works?

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24. In a working pencil sharpener, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy, \_\_\_\_\_ energy, and \_\_\_\_\_ energy .

25. The diagram below illustrates some transformations of energy that take place in a cell phone. Label each form of energy shown in the diagram.



# Investigating Energy Transformations

Name: \_\_\_\_\_

## Elaborate: Sliding into Energy Transformations

**Directions:** Record the energy transformations that occur in each object. (You might not need all of the spaces.)

1. In a working flashlight, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy, \_\_\_\_\_ energy, and \_\_\_\_\_ energy .
2. When playing a guitar, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy, \_\_\_\_\_ energy, and \_\_\_\_\_ energy .
3. When toasting bread in a toaster, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy, \_\_\_\_\_ energy, and \_\_\_\_\_ energy .
4. When a candle is burning, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy, \_\_\_\_\_ energy, and \_\_\_\_\_ energy .
5. In a working television, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy, \_\_\_\_\_ energy, and \_\_\_\_\_ energy .
6. When a wind turbine is turning, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy, \_\_\_\_\_ energy, and \_\_\_\_\_ energy .

**Think of a device you use often. Write the name of the device and the energy transformations that occur when you are using it.**

7. When I use a \_\_\_\_\_, \_\_\_\_\_ energy is transformed into \_\_\_\_\_ energy, \_\_\_\_\_ energy, and \_\_\_\_\_ energy .

# Investigating Energy Transformations

Name: \_\_\_\_\_

## Evaluation

1. When a person plays the drums, what form of energy is transformed into sound energy?
  - A** Mechanical
  - B** Thermal
  - C** Electrical
  - D** Light
  
2. Which of the following is the correct order for the energy transformations that occur in a working flashlight?
  - F** Electrical to chemical to thermal and light
  - G** Light to electrical to chemical and thermal
  - H** Thermal to electrical to light and chemical
  - J** Chemical to electrical to light and thermal
  
3. What main energy transformation occurs when a lamp is turned on?
  - A** Electrical → mechanical
  - B** Thermal → mechanical
  - C** Electrical → light + thermal
  - D** Light → mechanical + thermal
  
4. What energy transformation takes place when a radio is turned on?
  - F** Sound to chemical
  - G** Electrical to sound
  - H** Chemical to sound
  - J** Sound to electrical

# Investigating Energy Transformations

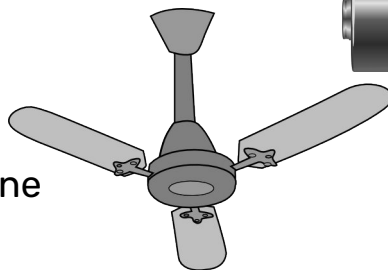
Name: \_\_\_\_\_

## Evaluation

5. A hairdryer is a system of parts that work together. The main function is this system is to transform-
- A** electrical energy into chemical energy
  - B** electrical energy into thermal energy
  - C** chemical energy into mechanical energy
  - D** thermal energy into mechanical energy
6. Coal, wood, and oil are sometimes burned in furnaces to heat homes in very cold areas. When they are burned, chemical energy is transformed to-
- F** sound energy
  - G** light energy
  - H** thermal energy
  - J** mechanical energy
7. Which of the following shows an energy transformation from chemical energy to electrical energy to light energy?
- A** A candle glowing brightly in the dark
  - B** A bolt of lightning in the night sky
  - C** A battery causing a flashlight to shine
  - D** Burning wood in a fireplace warms up a room

8. Which two objects pictured here, transform electrical energy into mechanical energy? Mark two answers.

- F** Ceiling fan
- G** AA Battery
- H** Television
- J** Washing machine
- K** Stereo



# Investigating Energy Transformations

Name: \_\_\_\_\_

## Evaluation

9. Match the pictures in column X with its corresponding energy transformation in column Y by drawing lines from the object to the energy transformation,

### X (Object)



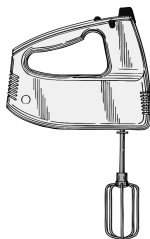
**Bell**



**Electric Coffeemaker**



**Doorbell**



**Electric mixer**



**Battery**

### Y (Energy Transformation)

**A. Electrical to Thermal**

**B. Electrical to mechanical**

**C. Mechanical to sound**

**D. Chemical to electrical**

**E. Electrical to sound**