

# Transfer of Energy

## 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 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.
- For each investigation, assemble the needed materials for each group and place in a central location for ease of distribution.
- Duplicate copies of the data sheets for each student.

### TEACHING NOTES

- Throughout this lesson, encourage students to ask questions and answer others' questions.
- Encourage student to use evidence statements so that they can become more able to support their discussions with observations and/or facts.
- When discussing energy transfer, most students will need help in differentiating between energy TRANSFER and energy TRANSFORMATION. This lesson focuses on transfers of energy, not transformations!

### Materials Needed Per Group:

#### Engage

Golf ball

Table Tennis ball

Meter Stick

#### Explore 1: Energy in Motion

Paper bathroom cup, 1

Grooved ruler, 1

Large marble, 1

Pencil, 1

Dictionary or other thick book, 1

Meter stick, 1

#### Explore 2: Energy in Waves

Aluminum roasting pan, 1

Table tennis ball, 1

Ruler, 1

Water

Paper towels

#### Explore 3: Energy in Sound—per pair of students

Paper cups, 2

String, 2 m

Large paper clips, 2

#### Elaborate

Yarn, 50 cm per student

Large plastic spoon

Large wooden spoon

Large metal spoon

Wooden ruler

# Transfer of Energy

## Teacher Facilitation Notes, p. 2

### Other Materials

Nail or drawing compass  
Writing materials

Science notebooks

### Engage: Energy Transfers

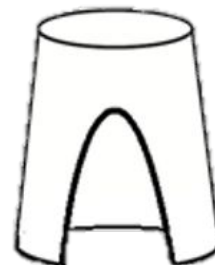
- Read the introductory question with the students.
- There are three semi-transparent rectangles on this slide above the picture. Move them to the appropriate places when mentioned in the directions below.
- Drag and drop the Blue highlighting rectangle over the word *energy*. Call on a volunteer to define the term in their own words. (Energy is the ability to do work or cause change in objects and matter.)
- Drag and drop the Light Pink rectangle over the word *transfer*. Ask students to infer what *transfer* means based on its context in the sentence. Explain that energy can move over distances (the space between things) and between objects.
- Drag and drop the Dark Pink rectangle over the word *evidence*. Call on volunteers to define evidence in their own words. (Evidence is details that provide clues to prove or disprove an idea or theory.)
- Read and discuss the question for this activity: *What evidence shows that energy is transferred from one object to another?*
- Make sure every group has a golf ball, a table tennis ball, and a meter stick.
- Discuss which ball they think will bounce the highest and why.
- Have the groups do Steps 2 and 3 of the procedures. Discuss.
- Let the groups complete the investigation independently. Circulate among the groups assisting and asking questions as needed. They might need to practice the release of the balls on top of each other several times to ensure that the balls hit the ground with one on top of the other.
- After the groups have completed the investigation, ask students to explain their results, especially where the energy came from that caused the table tennis ball to bounce so high when it was released on top of the golf ball.
- Discuss the activity as desired. Make sure students can give evidence for their conclusions.

**NOTE:** The ball on the bottom of the stack will transfer some of its energy to the ball on top, causing it to bounce higher than when it was dropped separately. Since it transfers energy to the ball on top, the lower ball will not bounce as high as it did when released separately.

# Transfer of Energy

## Teacher Facilitation Notes, p. 3

### Explore 1: Energy in Motion



- Before beginning this activity, cut a large notch on each of the paper cups. The notch should be large enough for the marble to roll into easily and for the cup to fit over the end of the ruler.
- Read and discuss the question for this activity. Point out the materials that will be used in learning about energy in motion.
- Have students write their hypothesis on the data sheet. Encourage them to write it in the form of an if . . . then statement. (If if \_\_\_\_\_, then \_\_\_\_.)
- If necessary, demonstrate how to set the end of the notched cup over the edge of the ruler.
- Depending on students' ability levels, let the groups work through the activity independently or go step-by-step as a class. Assist students with finding the average distances as needed.
- Facilitate a class discussion using the question on the slide. You may also, ask the following questions:
  - What is energy?
  - What does the term *transfer of energy* mean?
  - What conclusions can you draw about how the height of the ramp affected the transfer of energy in this activity?
  - In what other situations have you seen energy transferred between moving objects?

### Explore 2: Energy in Waves

- Discuss the question and the materials the students will be using in this part of the activity.
- Emphasize good science lab rules before beginning this activity.
  - The objects and materials used are learning tools—not playtime toys.
  - No horseplay is allowed!
  - All groups must clean up after themselves.
- Depending on students' ability levels, let the groups work through the activity independently or go step-by-step as a class. Ask questions and redirect thinking as necessary.
- Remind students that ocean waves are caused by wind blowing across the surface of the water. (Interestingly, the surface waves are caused by friction between the blowing air and the surface of the water.)

# Transfer of Energy

## Teacher Facilitation Notes, p. 4

### Explore 2: Energy in Waves, continued

- Facilitate a class discussion using the question on the slide. You may also, ask the following questions:
  - What is energy?
  - What are waves in water?
  - What evidence do you have that energy was transferred from the waves to the table tennis ball?
  - In what other situations have you seen energy transferred between waves and objects?

### Explore 3: Energy in Sound

- Before beginning this activity, use a nail or the pointed end of a drawing compass to poke holes in the bottom of each paper cup.
- Read and discuss the question for this activity. Point out the materials that will be used in learning about energy in sound.
- Have students write their hypothesis on the data sheet. Encourage them to write it in the form of an if . . . then statement. (If if \_\_\_\_\_, then \_\_\_\_.)
- Depending on students' ability levels, let the groups work through the activity independently or go step by step as a class. Encourage students to discuss the questions on the slides in their groups as they work.
- Facilitate a class discussion using the question on each slide. You may also, ask the following questions:
  - What is energy?
  - What does the term *transfer of energy* mean?
  - In which circumstance was it easier to hear through the string telephone—the loose string or the taut string? Why do you think this is so?
  - What conclusions can you draw about how sound moves from place to place?
  - What evidence do you have that sound energy can be transferred from one object to another?

### Explain

- Read through and discuss the explanatory slides as desired.
- Ask questions to make sure students understand that energy can transfer from one object to another.

# Transfer of Energy

## Teacher Facilitation Notes, p. 5

### **Elaborate**

- Read and discuss the question with the students. Call on volunteers to give their hypothesis about which material (plastic, wood, or metal) will transfer the most sound energy.
- Depending on students' ability levels, let the groups work through the activity independently or go step by step as a class. Make sure students are recording their observations on their data sheets.
- Once the students have completed their sketches and sentences, call on volunteers to share with the class.
- Discuss as desired.

### **Evaluate**

- Read and discuss the directions for the High Five Summary with the students. Assist them in completing the activity as needed.
- Let students complete the quiz independently.
- Discuss evaluation as desired.

# Transfer of Energy

Name: KEY

## Evaluation

**Directions:** Complete each sentence with the correct vocabulary term. Not every word in the Word Bank will be used and some may be used more than one time.

### Word Bank

ball	boat	energy	foot
person	sound	transfer	waves

1. Whistling produces sound, a form of energy you can hear.
2. Energy can transfer from one moving object to another.
3. Energy is the ability to do work or cause change.
4. Sound is a type of energy caused by vibrations.
5. A boat bobbing up and down in waves shows a transfer of energy from the waves to the boat.
6. When you kick a soccer ball, energy is transferred from your foot to the ball.
7. When a wagon is pulled, energy is transferred from the person pulling the wagon to the wagon itself.
8. Which sentences below describe evidence of energy being transferred? Mark each correct answer.
  - F A person opens a door
  - G You hear a sound when the doorbell rings.
  - H A book is lying on a table.
  - J A surfer rides a large wave to the shore.
  - K A stuffed toy dog sits on your bed.

# Transfer of Energy

Name: KEY

## Evaluation

9. Which best describes the transfer of energy that occurs when the bat hits the ball? Energy transfers–

- A from the bat to the catcher's mitt
- B from the pitcher's arm to the ball
- C from the bat to the ball
- D from the batter to the air



10. In the picture you can see that a car hit a tree. Which best describes the transfer of energy that occurs when the car hits the tree?

- F The car's energy is transferred to the air.
- G The car's energy is transferred to the tree.
- H The tree's energy is transferred to the car.
- J No energy is transferred to the tree.

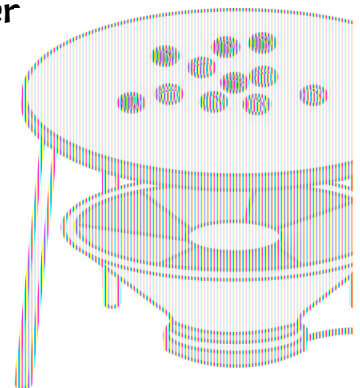


11. Energy transfer is–

- A when an object is moving from place to place
- B the movement of energy from one object or place to another
- C a change in energy from electricity to sound
- D measured by the height of the waves in the ocean

12. The picture shows some marbles on a table above a speaker. When music comes through the speaker, the marbles roll around on the table. What makes the marbles roll? Sound energy is–

- F transferred to the table and then to the marbles
- G soaked up by the table and transferred to the air
- H transferred to the air around the marbles
- J made by electricity flowing through the wire



# Transfer of Energy

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

## Engage: Bouncing Balls

**Question:** What evidence shows that energy is transferred from one object to another?

1. Record your observations about what how high the balls bounced when you dropped them at the same time.
2. Record your observations about what how high the balls bounced when you dropped the two balls together with the table tennis ball on top.
3. Record your observations about what how high the balls bounced when you dropped the two balls together with the golf ball on top.

**My Conclusions:**



# Transfer of Energy

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

## Explore: Energy in Motion

### Question:

How does the height of a ramp affect how much energy is transferred from a rolling marble to a stationary cup?

### Hypothesis:

1. If you place a marble at the top of the ramp and release it, what do you think will happen? Why?

	Pencil Ramp	Book Ramp
Trial 1	_____cm	_____cm
Trial 2	_____cm	_____cm
Trial 3	_____cm	_____cm
Average Distance	_____cm	_____cm

2. On which ramp did the marble transfer more energy to the cup? What is your evidence for this answer?

My Conclusions:

# Transfer of Energy

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

## Explore: Energy in Waves

**Question:** How can energy be transferred from waves to an object?

1. Record your observations about what how high the balls bounced when you dropped them at the same time.
  
2. Record your observations about what how high the balls bounced when you dropped the two balls together with the table tennis ball on top.
  
3. Record your observations about what how high the balls bounced when you dropped the two balls together with the golf ball on top.



**My Conclusions:**

# Transfer of Energy

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

## Elaborate

**Question:** What types of materials transfer sound energy better?

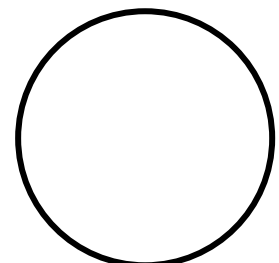
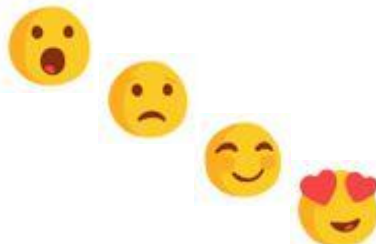
1. Record your observations about the sound each type of spoon transfers in the table below.

<b>Plastic Spoon</b>	
<b>Wooden Spoon</b>	
<b>Metal Spoon</b>	

## *Quick Sketch Showing What You Learned*

## Sentence Explaining Your Sketch

Draw an emoji reflecting how well you understand the transfer of sound energy. Use one of these or create your own!



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