

Electricity & Circuits

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: Electricity and Circuits

Large foam plate, 1

Small foam plate, 1

Wash cloth, 1

Explore 1: Building Circuits

Bulbs, 3

Wire, 6-9

Batteries (AA or C), 2

Hand lenses, 1 per student

Bulb holders, 3

Battery holders, 2

Large baggie or small tub to hold materials for each group

Elaborate:

Duplicating paper

Scissors, 1 per student

Tape or glue

Manila envelopes (9" x12"), 1 per student

Evaluate:

Manila envelopes (9x12), 1 per group

Other Materials

Student Recording Sheets

Science notebooks

Student Summative Evaluation

Pencils

Card stock

Glue or tape

Scissors

Advanced Preparations

- Strip the ends of enough pieces of wire so that each group can have 6-8 pieces.
- Assemble group kits for the explore portion of this lesson. Place the following inside a quart-sized baggie:
 - 3 light bulbs
 - 2 batteries (AA or C)
 - 6-8 wires
 - 2 bulb holders
 - 1 battery holder (for AA or C battery)

Electricity & Circuits

Teacher Facilitation Notes, p. 2

Advanced Preparations, continued

- For the *Electrical Energy Transformations* booklet, duplicate a copy of the 5 blackline masters for each student on regular duplicating paper. (For ease of printing, the blackline masters are also included in this document.)
- For the *Escape Quest* game:
 - Using either the color or the grayscale masters, duplicating the following:
 - 5 copies of the title and directions pages on card stock
 - 1 copy of each set of station cards and station decoder pages on cardstock
 - 5 copies of the recording sheets on regular paper
 - 1 copy of the answer key on card stock.
 - OPTIONAL: enough copies of the certificates for each person to have one.
 - Glue or tape a copy of the title page to the front of each manila envelope. Place a directions sheet in each envelope.
 - Label one of the envelopes *Station 1*. Place the station decoder in the envelope. Cut apart the station question cards and place in the envelope.
 - Do the same for the other five stations.

Engage

- Show the opening slide. Read through the student expectation and discuss as desired.
- On the contents slide, have students study the photograph and describe what they see. Ask them to tell where they see electrical energy in the photo.
- Read and discuss the introductory paragraph about electricity, also known as electrical energy.
- Ask students to observe and discuss the two animations: static electricity (cat with balloons) and current electricity (electrical circuit).
- Read and discuss the paragraph about static electricity. Have the groups work independently to complete the Static Hover Plate Challenge. Discuss.
- Read and discuss current electricity. Let the groups work independently to complete the Simple Circuit Challenge.
- Discuss as desired.

Electricity & Circuits

Teacher Facilitation Notes, p. 3

Explore 1: Building Circuits*

- Read the introductory paragraph about circuits.
- Depending on students' abilities levels, have groups work independently to complete each challenge or have groups work simultaneously as volunteers read each step of the procedures.
- As groups work, circulate around the room, asking questions and redirecting thinking as necessary. Make sure that students are completing their recording sheets as they work.
- Call on volunteers from each group to demonstrate their solutions to each challenge. Discuss as desired.

Explore 2: Identifying Electrical Transformations

- Read the introductory slide about electrical energy transformations.
- Depending on students' abilities levels, have groups work independently to complete the challenge or have groups work simultaneously as volunteers read each step of the procedures.
- As groups work, circulate around the room, asking questions and redirecting thinking as necessary. Make sure that students are completing their recording sheets as they work.
- Call on volunteers from each group to describe their solutions to the challenge.
- On the *Changing Electricity* slide, drag a device to the middle of the table. Have students identify the MAIN energy transformation that occurs in the device (the energy transformation the device is designed to produce). Then drag the device to the correct column.
- Discuss as desired.

*The two explore activities are also designed to function as part of the Explain in this lesson. Discuss each carefully so that students can make connections between what they did and the energy transformations that occur.

Electricity & Circuits

Teacher Facilitation Notes, p. 4

Explain

- Read the introductory slide about electrical transformations. Review the electrical transformations they observed during the explore part of the lesson.
- Read and discuss the slide about circuits and their parts. Have students write their descriptions of the pictured circuit in their science notebooks.
- On the third slide, drag a circuit to a blank part of the page. Call on volunteers to identify the circuit as series or parallel. Make the volunteers explain why they identified it that way. Drop the circuits in the correct columns.
- Call on volunteers to help complete the High-5 Summary.
- Discuss as desired.

Elaborate

- Assist students in following the directions to make an *Electrical Energy Transformations* booklet. Make sure they are answering the questions or completing the diagrams as directed on each part of the activity. (The vocabulary words can be used in different ways—be creative and let the students play around with them!)
- Discuss as desired.

Electricity & Circuits

Teacher Facilitation Notes, p. 5

Evaluate

- Place each station envelope in prominent places around the classroom.
- Divide the class into 5 groups. Use the first *Escape Quest* slide to set the tone for the activity. Give each group a recording sheet.
- Tell the students that there are 5 stations set up around the classroom. Set a time limit for completing each station, depending on student ability level. Groups may have from 5 to 10 minutes to complete a station.
- Assign each group a starting station and an order for completing each station. For example, one group may do 1-2-3-4-5 while another group can be assigned 3-4-5-1-2.
- When a signal is give, one person from each group gets the envelope for their assigned station. Let students work and discuss the question cards, filling in their recording sheets as they work.
- As the groups finish their station, one person should bring their recording sheet to be checked by the teacher. If their answers are correct, this person can return the envelope to its original place in the classroom or keep it until the designated time is up.
- When the ending signal for a station is given, one person from each group must return the station envelope and get the one for the next station.
- Continue in this manner until the groups have completed all of the stations.
- Discuss and award certificates as desired.
- Have students complete the quiz for this lesson.

Electricity & Circuits

Name: KEY

Evaluation

- Which of the following energy transformations occur when a working lamp is plugged into a wall socket?
 - Chemical → electrical → light
 - Electrical → chemical → light
 - C** Electrical → light
 - Chemical → light
- Which of the following shows an energy transformation from chemical energy to electrical energy to light energy?
 - A campfire burning brightly in a national park
 - A bolt of lightning lights up the night sky
 - H** A battery causes a flashlight to shine
 - A stove causes water to boil
- Which energy transformations take place when a battery-operated stereo is in use?
 - A** Chemical → electrical → sound
 - Chemical → electrical → light
 - Thermal → electrical → sound
 - Chemical → electrical → mechanical
- When a hairdryer is used, it transforms—
 - F** electrical energy into thermal energy
 - electrical energy into chemical energy
 - chemical energy into mechanical energy
 - thermal energy into mechanical energy

Electricity & Circuits

Name: KEY

Evaluation

5. Which of the following devices best demonstrates that electrical energy can be transformed into mechanical energy?

A



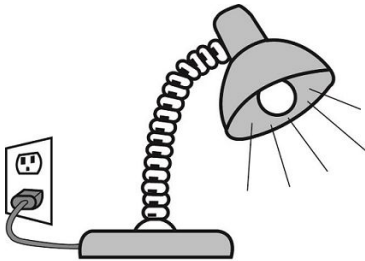
Toaster

B



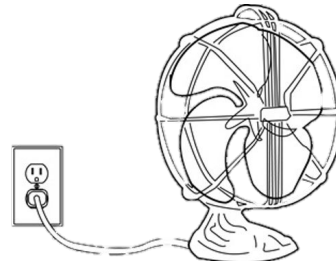
Stopwatch

C



Lamp

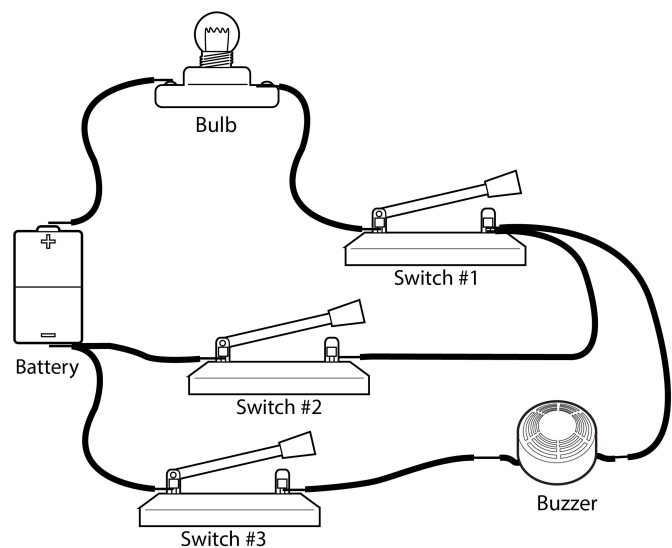
D



Electric fan

6. A circuit is set up with a bulb, a buzzer, and three switches as shown in the diagram. What must a student do to make the bulb light up and the buzzer buzz?

- F** Close all three switches.
- G** Close switches 1 and 3.
- H** Close switches 1 and 2.
- J** Close switch 3 only.

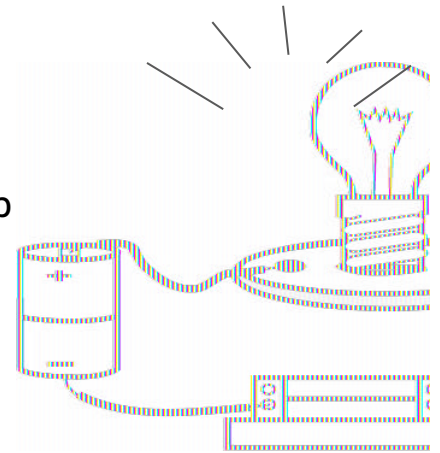


Electricity & Circuits

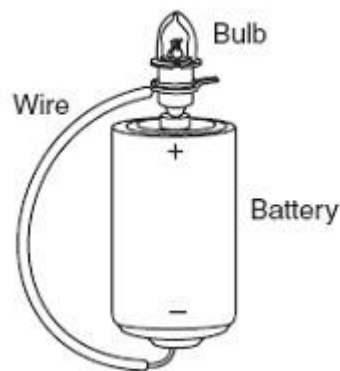
Name: KEY

Evaluation

7. Why does the bulb light up when the switch is closed?
- A The wires are good conductors of electricity.
 - B The battery is not strong enough to light the bulb unless the switch is on.
 - C The bulb cannot light up without a switch in the circuit.
 - D** The switch completes the circuit and allows the electricity to flow.



The diagram below shows a bulb and a wire attached to a battery.



8. What is the energy source in this system? The battery
9. What device uses electrical energy in this system? The bulb
10. What energy transformations take place in this system? Chemical energy to electrical energy to light and thermal energy
11. A working television is part of a complete circuit that transforms electrical energy into _____
light, sound, and thermal energy.



Energy Circle Thinking Map-Front Cover

What do you know about electrical energy?

What are the requirements for a complete circuit?

Circuit 3: Illustrate and label a circuit or device that transforms electrical energy into sound energy.

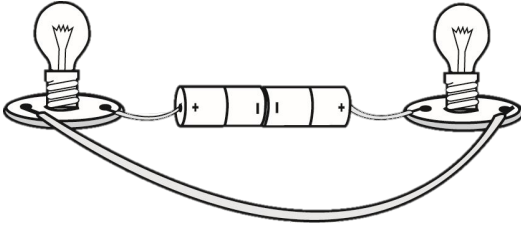
Circuit 1: Illustrate and label a circuit or device that transforms electrical energy into light energy.

Circuit 2: Illustrate and label a circuit or device that transforms electrical energy into thermal energy.

All About Circuits!

1. Every circuit requires 3 main parts. What are those three parts? _____

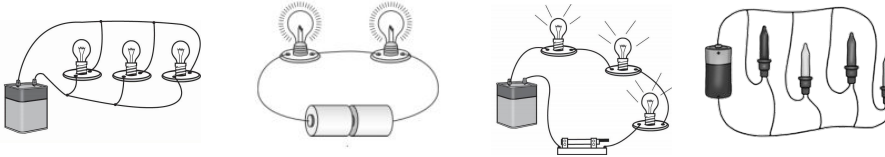
Use the illustration below to answer questions 2-3



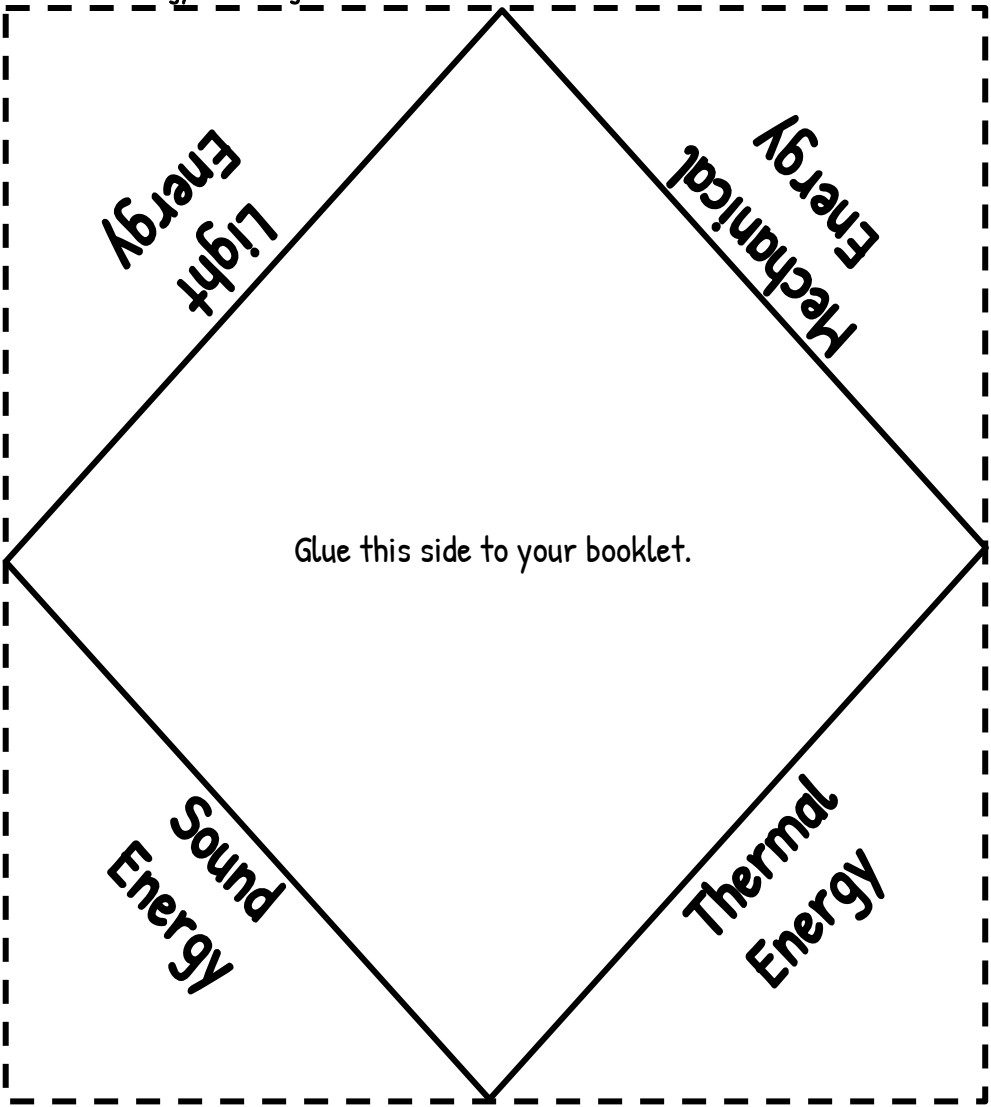
2. In the circuit above, why would the light bulbs not be lit? Explain. _____

3. In the circuit above, what needs to happen to make the light bulbs work? _____

4. Draw a ring around the series circuits. Draw a rectangle around the parallel circuits.

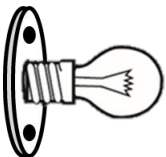
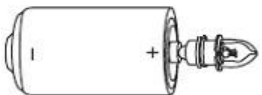


Circuit 4: Illustrate and label a circuit or device that transforms electrical energy into mechanical energy.



Join the Circuit!

1. The diagram to the right shows a bulb on a battery. Sketch and complete the drawing to show a COMPLETE circuit. Label the parts of the circuit. Use the words: *battery, wire, and bulb.*
2. Inside a working flashlight, energy is transformed into energy. This energy is then transformed into energy and energy.
3. Finish drawing the circuit below by using only one of the switches to make a complete circuit that will light the bulb. Label the parts of the circuit.



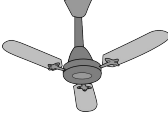





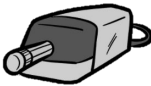

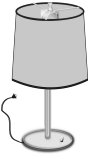







Vocabulary Cards

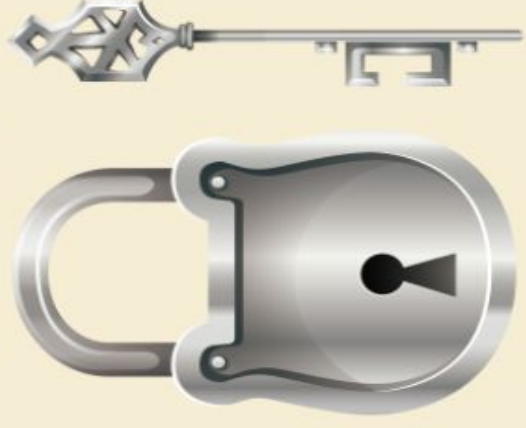
electrical energy	mechanical energy	light energy	thermal energy	sound energy
transformation	circuit	power source	conductor	load
motion	series circuit	parallel circuit	insulator	current electricity
electron	static electricity	complete circuit	open circuit	electricity

Designed to Transform

Directions: Write the number for each image in the appropriate category in the last column. Select the energy that the device was designed to transform electrical energy into!

1  Doorbell	2  Hairdryer	3  Ceiling fan	4  Camping lantern	<u>Light Energy</u>
5  Radio controlled car	6  Flashlight	7  Smart speaker	8  Microwave oven	<u>Sound Energy</u>
9  Electric pencil sharpener	10  Laptop	11  Lamp	12  Hair curling iron	<u>Thermal Energy</u>
13  Stereo	14  Toaster	15  Hand mixer	16  Speaker	<u>Mechanical Energy</u>

ESCAPE QUEST



Electrical Energy Transformations

ESCAPE QUEST

Electrical Energy Transformations



Your Mission

You are sitting in your classroom watching the hands of the clock move ever so slowly! Suddenly, you think, *What makes the hands of the clock move?* How can you find out and tell others what is going on with the clock and other devices you see in your classroom. Use your knowledge of electrical energy and other forms of energy so you can escape from your classroom and tell others about electrical energy. Answer the questions at each station to get the code that unlock the room and allows you to escape. Record your answers on the recording sheet and use the sacred decoder at the end of each station. Verify the code with your teacher BEFORE moving to the next station. Can you solve each code and unlock the room to make your escape possible??? Good luck!

Station 1

Question #1:

Which of the following circuit parts provides energy for the circuit to work?

- A A switch
- B A battery
- C A wire
- D A light bulb

Station 1

Question #2:

What is the function of a switch in an electric circuit?

- E To provide energy for the circuit to work
- F To connect the power source to the load
- G To protect the circuit from getting hot
- H To start and stop the flow of electricity

Station 1

Question #3:

In a cell phone, chemical and electrical energy are transformed into—

- J Light, sound, and thermal energy
- K Electrical, heat, and light energy
- L Chemical, electrical, and solar energy
- M Wind, light, and sound energy

Station 1

Question #4:

A teacher shaves every day with a battery powered shaver. Which transformations of energy occur when the shaver is used?

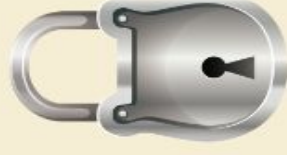
- R Electrical → chemical → mechanical and sound
- S Chemical → electrical → mechanical and sound
- T Mechanical → electrical → chemical and sound
- U Sound → chemical → mechanical and electrical

Station 1

Use the decoder below to get the lock combination for this station.

A	9
B	7
C	2
D	5
E	4
F	6
G	8
H	1

J	3
K	1
L	5
M	9
R	2
S	4
T	3
V	7



Enter the 4 digit code on your recording sheet to open the lock and move to the next room.

Station 2

Question #1:

Which of the following devices is designed to transform electrical energy to mainly light energy?

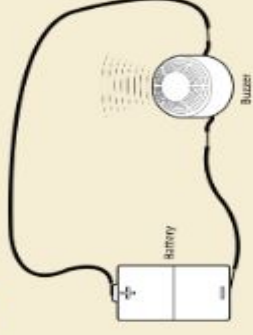
- A A vacuum cleaner
- B A table lamp
- C A bread toaster
- D An electric fan

Station 2

Question #2:

A buzzer in a complete circuit mainly transforms electrical energy into—

- A Chemical energy
- B Thermal energy
- C Solar energy
- D Sound energy

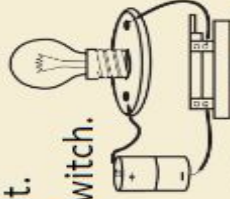


Station 2

Question #3:

The illustration shows an electrical circuit. Why does the bulb light up when the switch is closed?

- A The switch completes the circuit.
- B Circuits won't work without a switch.
- C The battery gets stronger.
- D The bulb gets hotter.



Station 2

Question #4:

An electric heater is designed to transform electrical energy into—

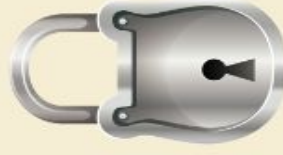
- A Mechanical energy
- B Light energy
- C Thermal energy
- D Sound energy

Station 2

Use the decoder below to get the lock combination for this station.

Q1	Q2	Q3	Q4
○	△	□	☆

(A dotted line connects Q1 to the circle, Q2 to the triangle, Q3 to the square, and Q4 to the star.)



Enter the 4 pictures on your recording sheet to open the lock and move to the next room.

Station 3

Question #1:

Which of the following devices can transform electrical energy into sound energy?

- A An electric stove
- B A television
- C A table lamp
- D A large drum

Station 3

Question #2:

When you turn on a radio, what type of energy transformation takes place?

- A Electrical energy to sound energy
- B Chemical energy to sound energy
- C Sound energy to chemical energy
- D Sound energy to electrical energy

Station 3

Question #3:

Which of the following are requirements for a functioning electrical circuit?

- A A battery, a switch and at least 4 wires
- B An electric outlet and some conductors
- C A power source, conductors, and a load
- D An outlet, a buzzer, and some wires

Station 3

















Question #4:

Which of the following is the correct order for the energy transformations that occur in a flashlight?

- A Electrical → chemical → thermal
- B Light → chemical → electrical
- C Thermal → electrical → light
- D Chemical → electrical → mechanical and light

Station 3

Use the decoder below to get the lock combination for this station.

	A	B	C	D
Q1				
Q2				
Q3				
Q4				

Enter the 4 pictures on your recording sheet to open
the lock and move to the next room.



Station 4

Question #1:

Which of the following transforms electrical energy into mechanical energy?

- A A light switch
- B An electric fan
- C A light bulb
- D An electric stove

Station 4

Question #2:

What sort of energy transformations take place when an electric clothes iron is plugged in and turned on?

- A Electrical energy is changed to light energy.
- B Thermal energy is changed to electrical energy.
- C Electrical energy is changed to thermal energy.
- D Thermal energy is changed to steam energy.

Station 4

Question #3:

A teacher used a blender to make smoothies for her class. When using the blender, electrical energy was transformed mainly into—

- A Mechanical and sound energy
- B Thermal and sound energy
- C Mechanical and light energy
- D Electrical and sound

Station 4



Question #4:



A man installed a doorbell that allows him to talk to anyone who rings the doorbell. This kind of doorbell mainly transforms electrical energy into—



- A Mechanical energy
- B Sound energy
- C Light energy
- D Solar energy



Station 4

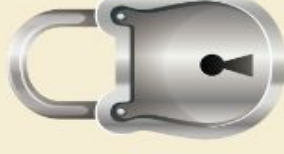
Use the decoder below to get the lock combination for this station.

A =  

B =  

C =  

D =  



Enter the two-digit numbers on your recording sheet to open the lock and move to the next room.

Station 5

Question #1:

What energy transformation occurs when an electric lamp is turned on?

- A Light energy to electrical and mechanical energy
- B Electrical energy to light and thermal energy
- C Electrical energy to mechanical and thermal energy
- D Thermal energy to electrical and light energy

Station 5

Question #2:

Which system below shows a transformation from chemical to electrical and light energy?

- E A burning candle lights up a room.
- F A display of fireworks lights up the night sky.
- G A battery causes the car's headlights to shine.
- H An avalanche rolls down a steep mountainside.

Station 5

Question #3:

When electric current flows through the metal filament of a light bulb, electrical energy is transformed to—

- J thermal and light energy
- K thermal energy only
- L light and mechanical energy
- M light energy only

Station 5

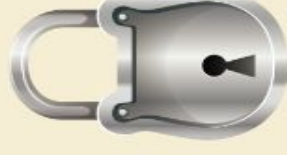
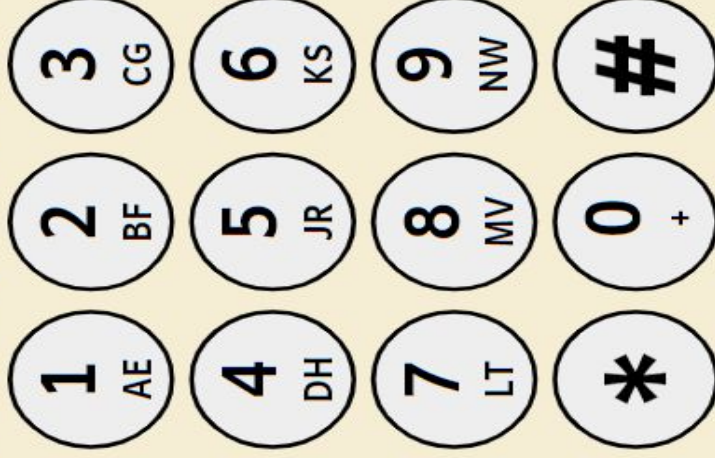
Question #4:

When the flashlight is turned on, the chemical energy of the batteries is changed into all of the following EXCEPT—

- R electrical energy
- S thermal energy
- T light energy
- V solar energy

Station 5

Use the decoder below to get the lock combination for this station.



Enter the four-digit code on your recording sheet to open the lock and move to the next room.

Escape Quest

Names:

Station #1

	Q1	Q2	Q3	Q4
Answer				
Code				

Station #4

	Q1	Q2	Q3	Q4
Answer				
Code				

Station #2

	Q1	Q2	Q3	Q4
Answer				
Code				

Station #5

	Q1	Q2	Q3	Q4
Answer				
Code				

Station #3

	Q1	Q2	Q3	Q4
Answer				
Code				

Escape Quest

Answer key

Station #1

	Q1	Q2	Q3	Q4
Answer	B	G	J	S
Code	7	8	3	4

Station #2

	Q1	Q2	Q3	Q4
Answer	B	D	A	C
Code	○	□	☆	△

Station #3

	Q1	Q2	Q3	Q4
Answer	B	A	C	D
Code	♠	♦	♥	♣

Station #4

	Q1	Q2	Q3	Q4
Answer	D	C	A	B
Code	32	54	26	13

Station #5

	Q1	Q2	Q3	Q4
Answer	B	G	J	V
Code	2	3	5	8

A decorative border with a light blue and white circuit board pattern surrounds the text.

Congratulations!

This certificate is proudly awarded to

for completing the *Electrical Energy Transformations* Escape Quest!

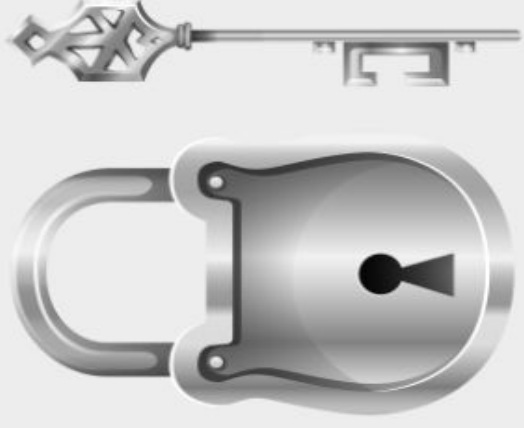
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ESCAPE QUEST



Electrical Energy Transformations

ESCAPE QUEST

Electrical Energy Transformations



Your Mission

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Question #1:

Which of the following circuit parts provides energy for the circuit to work?

- A A switch
- B A battery
- C A wire
- D A light bulb

Station 1

Question #2:

What is the function of a switch in an electric circuit?

- E To provide energy for the circuit to work
- F To connect the power source to the load
- G To protect the circuit from getting hot
- H To start and stop the flow of electricity

Station 1

Question #3:

In a cell phone, chemical and electrical energy are transformed into—

- J Light, sound, and thermal energy
- K Electrical, heat, and light energy
- L Chemical, electrical, and solar energy
- M Wind, light, and sound energy

Station 1

Question #4:

A teacher shaves every day with a battery powered shaver. Which transformations of energy occur when the shaver is used?

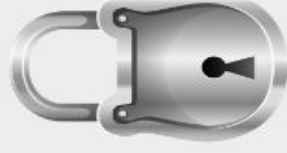
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- S Chemical → electrical → mechanical and sound
- T Mechanical → electrical → chemical and sound
- U Sound → chemical → mechanical and electrical

Station 1

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B	7
C	2
D	5
E	4
F	6
G	8
H	1

J	3
K	1
L	5
M	9
R	2
S	4
T	3
V	7



Enter the 4 digit code on your recording sheet to open the lock and move to the next room.

Station 2

Question #1:

Which of the following devices is designed to transform electrical energy to mainly light energy?

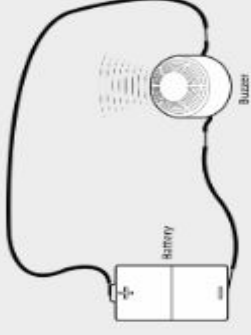
- A A vacuum cleaner
- B A table lamp
- C A bread toaster
- D An electric fan

Station 2

Question #2:

A buzzer in a complete circuit mainly transforms electrical energy into—

- A Chemical energy
- B Thermal energy
- C Solar energy
- D Sound energy

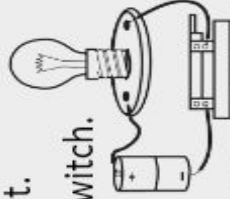


Station 2

Question #3:

The illustration shows an electrical circuit. Why does the bulb light up when the switch is closed?

- A The switch completes the circuit.
- B Circuits won't work without a switch.
- C The battery gets stronger.
- D The bulb gets hotter.



Station 2

Question #4:

An electric heater is designed to transform electrical energy into—

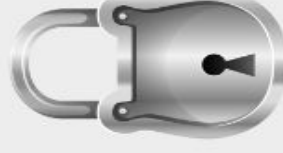
- A Mechanical energy
- B Light energy
- C Thermal energy
- D Sound energy

Station 2

Use the decoder below to get the lock combination for this station.

Q1	Q2	Q3	Q4
○	△	□	☆

(A dotted line connects Q1 to the circle, Q2 to the triangle, Q3 to the square, and Q4 to the star.)



Enter the 4 pictures on your recording sheet to open the lock and move to the next room.

Station 3

Question #1:

Which of the following devices can transform electrical energy into sound energy?

- A An electric stove
- B A television
- C A table lamp
- D A large drum

Station 3

Question #2:

When you turn on a radio, what type of energy transformation takes place?

- A Electrical energy to sound energy
- B Chemical energy to sound energy
- C Sound energy to chemical energy
- D Sound energy to electrical energy

Station 3

Question #3:

Which of the following are requirements for a functioning electrical circuit?

- A A battery, a switch and at least 4 wires
- B An electric outlet and some conductors
- C A power source, conductors, and a load
- D An outlet, a buzzer, and some wires

Station 3

















Question #4:

Which of the following is the correct order for the energy transformations that occur in a flashlight?

- A Electrical → chemical → thermal
- B Light → chemical → electrical
- C Thermal → electrical → light
- D Chemical → electrical → mechanical and light

Station 3

Use the decoder below to get the lock combination for this station.

	A	B	C	D
Q1				
Q2				
Q3				
Q4				

Enter the 4 pictures on your recording sheet to open
the lock and move to the next room.



Station 4

Question #1:

Which of the following transforms electrical energy into mechanical energy?

- A A light switch
- B An electric fan
- C A light bulb
- D An electric stove

Station 4

Question #2:

What sort of energy transformations take place when an electric clothes iron is plugged in and turned on?

- A Electrical energy is changed to light energy.
- B Thermal energy is changed to electrical energy.
- C Electrical energy is changed to thermal energy.
- D Thermal energy is changed to steam energy.

Station 4

Question #3:

A teacher used a blender to make smoothies for her class. When using the blender, electrical energy was transformed mainly into—

- A Mechanical and sound energy
- B Thermal and sound energy
- C Mechanical and light energy
- D Electrical and sound

Station 4

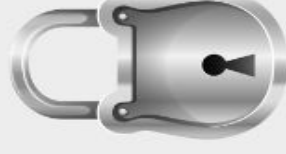
Question #4:

A man installed a doorbell that allows him to talk to anyone who rings the doorbell. This kind of doorbell mainly transforms electrical energy into—

- A Mechanical energy
- B Sound energy
- C Light energy
- D Solar energy

Station 4

Use the decoder below to get the lock combination for this station.



Enter the two-digit numbers on your recording sheet to open the lock
and move to the next room.

Station 5

Question #1:

What energy transformation occurs when an electric lamp is turned on?

- A Light energy to electrical and mechanical energy
- B Electrical energy to light and thermal energy
- C Electrical energy to mechanical and thermal energy
- D Thermal energy to electrical and light energy

Station 5

Question #2:

Which system below shows a transformation from chemical to electrical and light energy?

- E A burning candle lights up a room.
- F A display of fireworks lights up the night sky.
- G A battery causes the car's headlights to shine.
- H An avalanche rolls down a steep mountainside.

Station 5

Question #3:

When electric current flows through the metal filament of a light bulb, electrical energy is transformed to—

- J thermal and light energy
- K thermal energy only
- L light and mechanical energy
- M light energy only

Station 5

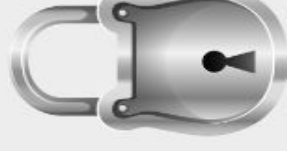
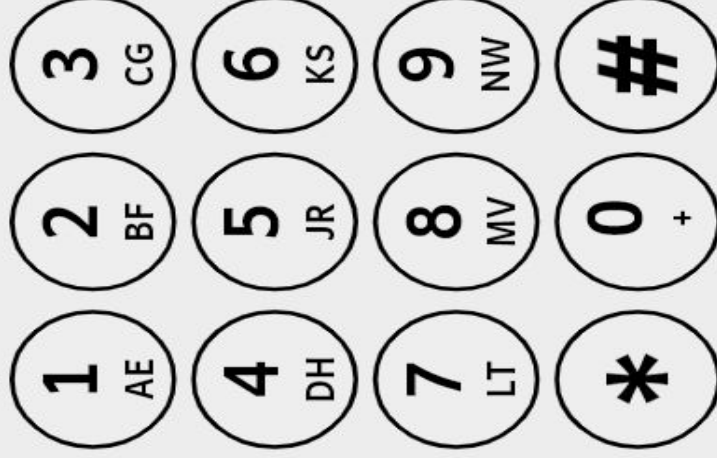
Question #4:

When the flashlight is turned on, the chemical energy of the batteries is changed into all of the following EXCEPT—

- R electrical energy
- S thermal energy
- T light energy
- V solar energy

Station 5

Use the decoder below to get the lock combination for this station.



Enter the four-digit code on your recording sheet to open the lock
and move to the next room.

Escape Quest

Names:

Station #1

	Q1	Q2	Q3	Q4
Answer				
Code				

Station #2

	Q1	Q2	Q3	Q4
Answer				
Code				

Station #3

	Q1	Q2	Q3	Q4
Answer				
Code				

Station #4

	Q1	Q2	Q3	Q4
Answer				
Code				

Station #5

	Q1	Q2	Q3	Q4
Answer				
Code				

Escape Quest

Answer key

Station #1

	Q1	Q2	Q3	Q4
Answer	B	G	J	S
Code	7	8	3	4

Station #2

	Q1	Q2	Q3	Q4
Answer	B	D	A	C
Code	○	□	☆	△

Station #3

	Q1	Q2	Q3	Q4
Answer	B	A	C	D
Code	♠	♦	♥	♣

Station #4

	Q1	Q2	Q3	Q4
Answer	D	C	A	B
Code	32	54	26	13

Station #5

	Q1	Q2	Q3	Q4
Answer	B	G	J	V
Code	2	3	5	8

A decorative border with a repeating pattern of circuit board traces and components, framing the top and sides of the certificate.

Congratulations!

This certificate is proudly awarded to

for completing the *Electrical Energy Transformations* Escape Quest!

A decorative border with a repeating pattern of circuit board traces and components, framing the bottom and sides of the certificate.

Congratulations!

This certificate is proudly awarded to

for completing the *Electrical Energy Transformations* Escape Quest!

Electricity and Circuits

Name: _____

Explore 1: Building Circuits

Challenge #1

1. Draw a labeled diagram in each box below to show different arrangements that created complete circuits. (There are 4 ways to do it!)

1	2
3	4

Challenge #2

2. Draw a labeled diagram of your circuit that has two bulbs lit.

Electricity and Circuits

Name: _____

Explore 1: Building Circuits, page 2

3. What happens to the bulb left in the circuit when the other bulb is removed from the bulb holder. Explain why this happens. _____

4. What type of circuit did you make in Challenge #2? _____

Challenge #3

5. Draw a labeled diagram of your circuit that has two bulbs lit.

6. What happens to the bulb left in the circuit when the other bulb is removed from the bulb holder. Explain why this happens. _____

7. How did the brightness of the bulb in the parallel circuit compare to the brightness of the bulbs in the series circuit? Why do you think this happens? _____

Electricity & Circuits

Name: _____

Explore 2: Identifying Electrical Transformations

Directions: Complete the table below as you use and observe each electrical device. For the electrical source column, write either *plugs in* or *battery*.

Device	Electrical Source	Energy Transformations that Occur when the Device is Working
Table Fan		
Flashlight		
Hair Dryer		
Cell Phone		
Calculator		

1. What different forms of energy was the electrical energy transformed into in these devices? _____

2. Why do you think most of these devices have a switch to start and stop the flow of electrical energy? _____

3. Which form of energy transformation seems to be found in each device? Why do you think this is so? _____

Electricity & Circuits

Name: _____

Evaluation

- Which of the following energy transformations occur when a working lamp is plugged into a wall socket?
 - Chemical → electrical → light
 - Electrical → chemical → light
 - Electrical → light
 - Chemical → light
- Which of the following shows an energy transformation from chemical energy to electrical energy to light energy?
 - A campfire burning brightly in a national park
 - A bolt of lightning lights up the night sky
 - A battery causes a flashlight to shine
 - A stove causes water to boil
- Which energy transformations take place when a battery-operated stereo is in use?
 - Chemical → electrical → sound
 - Chemical → electrical → light
 - Thermal → electrical → sound
 - Chemical → electrical → mechanical
- When a hairdryer is used, it transforms—
 - electrical energy into thermal energy
 - electrical energy into chemical energy
 - chemical energy into mechanical energy
 - thermal energy into mechanical energy

Electricity & Circuits

Name: _____

Evaluation

5. Which of the following devices best demonstrates that electrical energy can be transformed into mechanical energy?

A



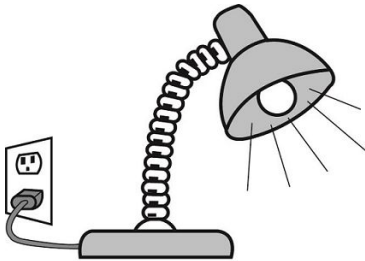
Toaster

B



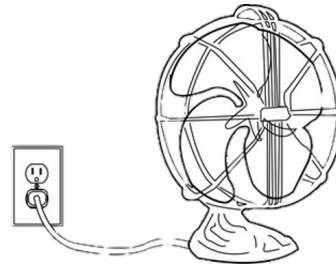
Stopwatch

C



Lamp

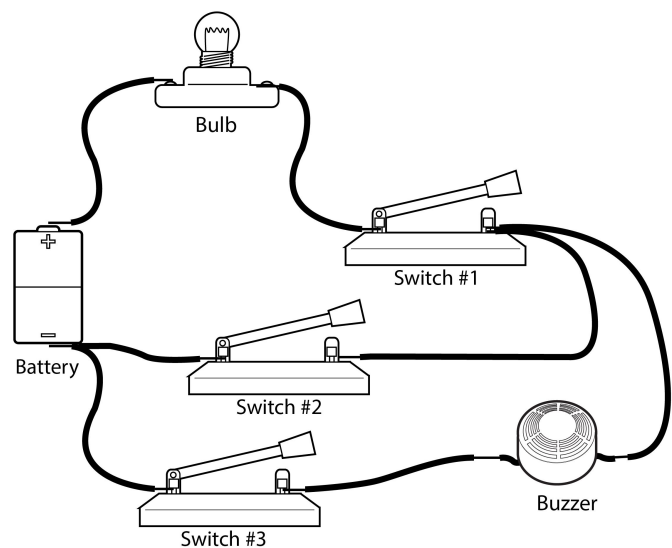
D



Electric fan

6. A circuit is set up with a bulb, a buzzer, and three switches as shown in the diagram. What must a student do to make the bulb light up and the buzzer buzz?

- F** Close all three switches.
- G** Close switches 1 and 3.
- H** Close switches 1 and 2.
- J** Close switch 3 only.

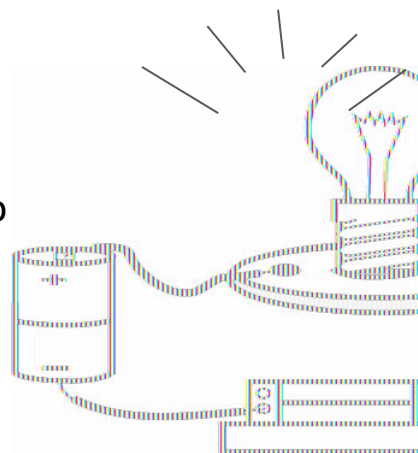


Electricity & Circuits

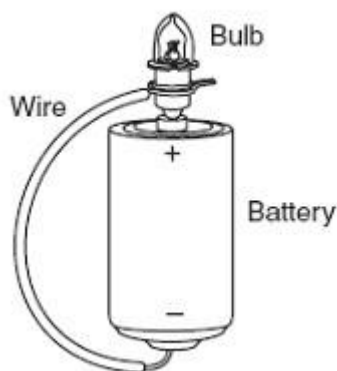
Name: _____

Evaluation

7. Why does the bulb light up when the switch is closed?
- A** The wires are good conductors of electricity.
 - B** The battery is not strong enough to light the bulb unless the switch is on.
 - C** the bulb cannot light up without a switch in the circuit.
 - D** The switch completes the circuit and allows the electricity to flow.



The diagram below shows a bulb and a wire attached to a battery.



8. What is the energy source in this system? _____
9. What device uses electrical energy in this system? _____
10. What energy transformations take place in this system? _____

11. A working television is part of a complete circuit that transforms electrical energy into _____

