

Potential and Kinetic Energy

Materials: Station 1

Consumable

none

Nonconsumable

1 flashlight without batteries

1 flashlight with 2 D batteries in place

Materials: Station 2

Consumable

none

Nonconsumable

metric ruler

flashlight with 2 D batteries

radiometer

Materials: Station 3

Consumable

none

Nonconsumable

2 flashlights without batteries

stack of 6 textbooks

board (one meter long)

paper drinking cup

Additional materials to set up the Stations

masking tape (Stations 2 and 3)

How to Set Up

Station 1

Materials

- 1 flashlight without batteries, labeled "A"
- 1 flashlight with 2 D batteries in place, labeled "B"

Preparation

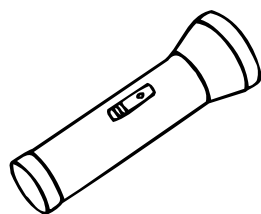
1. Because students will be asked to compare the two flashlights, the flashlights need to be labeled. Label the flashlight without batteries "A"; label the flashlight with batteries "B." Be certain flashlight B has two batteries and works.
2. Direct students to turn off the flashlights when they are not in use.

Helpful Information

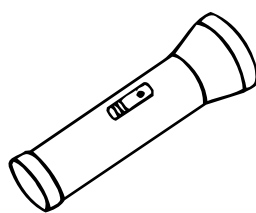
- When a flashlight lights, the (stored) chemical energy in the batteries is changed to electrical energy and then to light energy.
- Allow students to open flashlights to determine why one does not light.
- Students should note that no energy changes are taking place in the flashlight without an energy source.

Setup

Station 1



flashlight "A"



flashlight "B"

Be sure that the materials are set up like this before you leave this station.

How to Set Up

Station 2

Materials

- radiometer
- metric ruler
- flashlight with 2 D batteries
- masking tape

Preparation

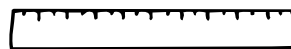
1. Make certain that the flashlight is working and that the batteries have not worn out.
2. Use masking tape to secure the base of the radiometer to the table so that it will not accidentally fall and break.
3. Direct students to turn off the flashlight when it is not in use.

Helpful Information

- Radiant energy from the flashlight reaches the vanes, heating them. The black sides of the vanes absorb more energy than the silver sides, causing the vanes to spin.
- Students should realize that the radiant energy from the flashlight somehow moves the vanes, therefore the radiant energy does work.
- The closer the light is to the radiometer, the faster the vanes spin.

Setup

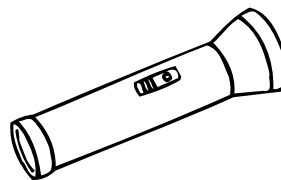
Station 2



metric ruler



radiometer



flashlight

Be sure that the materials are set up like this before you leave this station.

How to Set Up

Station 3

Materials

- 2 flashlights without batteries, label one "C" and the other "D"
- stack of 6 textbooks
- paper drinking cup
- board (one meter long)
- masking tape

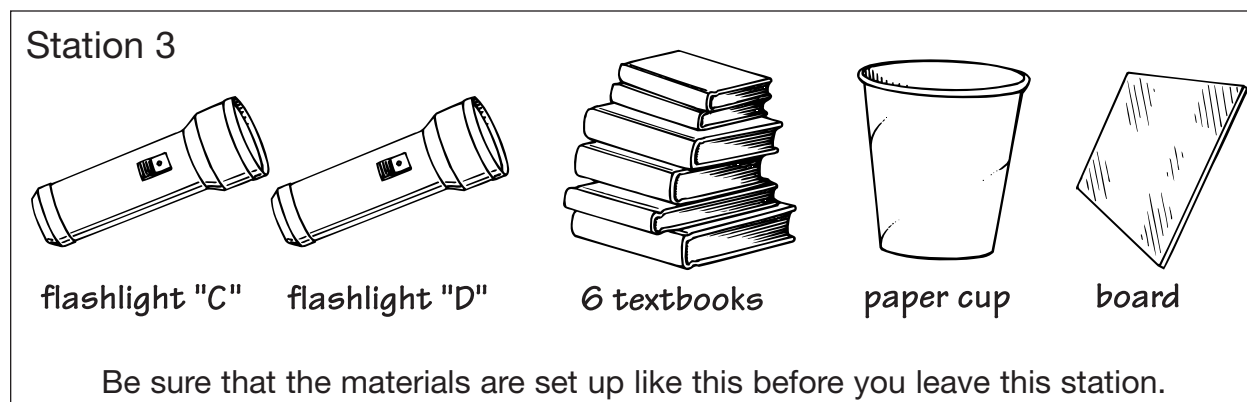
Preparation

1. Because students will be asked to compare flashlights, label one flashlight "C" and the other "D."
2. Make certain the batteries have been removed from each flashlight.
3. Place flashlight C on top of the stack of books. Use the board to make a ramp from the top of the books to the table top. Use tape to secure the board to the table top.
4. Place flashlight D on the table top.

Helpful Information

- Allow students to inspect the inside of each flashlight.
- Potential energy is the energy of position. Flashlight C, on top of the stack of books, has more potential energy than the flashlight resting on the table top.
- Energy is the ability to do work. Students can show that flashlight C can do work by allowing the flashlight to slide down a ramp and move a paper cup at the bottom of the ramp. While it is moving, the flashlight exhibits kinetic energy.

Setup



Evaluation Guide

Station 1

Purpose

To evaluate a student's ability to identify which flashlight has more stored, or potential, energy and to identify the source of that energy.

Criteria

3 points = Student identified the flashlight with stored, or potential, energy and the source of the energy.

2 points = Student described what happened in one of the flashlights.

1 point = Student did not describe what happened in either flashlight.

Station 2

Purpose

To evaluate a student's ability to recognize radiant energy and kinetic energy and to describe how distance from the radiometer affects the speed of the vanes.

Criteria

3 points = Student identified radiant and kinetic energy and recorded observations using a radiometer.

2 points = Student observed the flashlight's effect on the radiometer.

1 point = Student did not record any observations.

Station 3

Purpose

To evaluate a student's ability to identify which flashlight has more potential energy, to show that the energy can do work, and to identify any kinetic energy observed.

Criteria

3 points = Student identified the flashlight with more potential energy, showed that the flashlight can do work, and identified kinetic energy.

2 points = Student identified the flashlight with more stored, or potential, energy.

1 point = Student did not record any observations.

Data Analysis

Purpose

To evaluate a student's ability to identify and describe any potential and kinetic energy in each of the three exhibits.

Answers to the exhibit tags

Tag 1: B; the flashlight with batteries and a complete circuit has chemical energy stored in its battery.

Tag 2: radiant; vanes turn; faster; kinetic

Tag 3: C; C; do work; C; it slides down the ramp

Criteria

3 points = Student accurately described the energy in all three exhibits.

2 points = Student accurately described the energy in one or two exhibits.

1 point = Student did not describe the energy in any of the exhibits.

Performance Activity Scoring Guide

Points	% equivalent
12	100
11	92
10	83
9	75
8	67
7	58
6	50
5	42
4	33
3	25
2	16
1	8

Imagine that you work in a science and energy museum. You've been asked to complete the information on the tags for an exhibit on potential and kinetic energy. The tags describe the types of energy in the exhibits.

My Data Collection

Station 1

Use the card at the station to correctly set up the equipment.

Exhibit 1

Turn on both flashlights. Observe what happens.

- Compare the energy changes, if any, you observe.

Station 2

Use the card at the station to correctly set up the equipment.

Exhibit 2

Shine the flashlight on the radiometer. Identify any type or kind of energy you observe. Describe how the speed of the vanes changes when the light is at different distances.

- Record your observations.

Station 3

Use the card at the station to correctly set up the equipment.

Exhibit 3

Turn on both flashlights. Observe what happens. Use the materials on the table to show that one of the flashlights has more potential energy than the other.

- Describe how you were able to show that one flashlight had more potential energy and could do work.

- Describe any observations you make about kinetic energy.

My Data Analysis **Answers appear on page 92F.**

Now that you have tested each part of the exhibit, use the data you have collected and what you know about energy to complete the following exhibit tags by filling in the blanks.

Exhibit 1 Tag

Flashlight _____ has more stored, or potential, energy. The flashlights have different amounts of potential energy because

_____.

Exhibit 2 Tag

The _____ energy from the flashlight did work by making the _____. The vanes turned _____ when the flashlight was close to the radiometer. The turning vanes are an example of _____ energy.

Exhibit 3 Tag

Flashlight _____ has more stored, or potential, energy. You can show that flashlight _____ has potential energy by showing that it can _____.

Flashlight _____ has kinetic energy while _____.