Name _____ 4th Grade Science

chapter 5 Energy and Energy Resources

section 1 What is energy?

Before You Read

What does the phrase "She has a lot of energy" mean to you?

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_____

What You'll Learn

- what energy is
- the difference between kinetic energy and potential energy
- the different forms of energy

Read to Learn

Mark the Text

Highlight Forms of Energy As you read this section, highlight the different forms of energy. Then write an example of each type of energy next to the places you highlighted.

The Nature of Energy

Energy is the ability to cause change. An object that has energy can make things happen. Look around you. Changes are happening. Someone might be walking by. Sunshine might be warming your desk. Maybe you can see the wind move the leaves on a tree. What changes are happening?

When is energy noticed?

You have a lot of energy. So does everything around you. But you only notice this energy when a change takes place. When a change happens, energy moves from one object to another. Energy from sunlight moves to the spot on the desktop and makes it warm. Energy from the wind moves to leaves. All objects, including desktops and leaves, have energy.

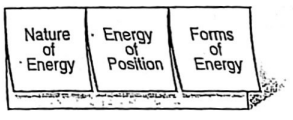
Energy of Motion

Things that move can cause change. Suppose a bowling ball rolls down the alley and knocks down some bowling pins. Does this involve energy? A change happens when the pins fall over. The bowling ball causes this change. Since energy is the ability to cause change, the bowling ball has energy. The energy in the movement of the bowling ball makes the pins fall. The energy an object has because of its motion is kinetic energy. So as a bowling ball moves, it has kinetic energy. If an object is not moving, it does not have kinetic energy.

FOLDABLES

A Organize Information

Make the following Foldable to organize information about the nature of energy, the energy of position, and the different forms of energy.



How are kinetic energy and speed related?

What would happen to the bowling pins if the bowling ball rolls faster? More of the pins might fall down or they might move farther. A faster bowling ball causes more change to happen than a slower bowling ball. The faster the bowling ball goes, the more kinetic energy it has. This is true for all moving objects. Kinetic energy increases as an object moves faster. ☑

Reading Check

1. **Apply** Does a slower-moving object have more or less kinetic energy than a faster-moving object?

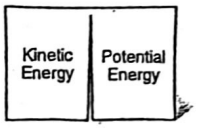
How are kinetic energy and mass related?

Suppose you roll a volleyball down the alley at the same speed as a bowling ball. Will the volleyball move the pins as far as the bowling ball will? The answer is no. The volleyball might not knock down any pins.

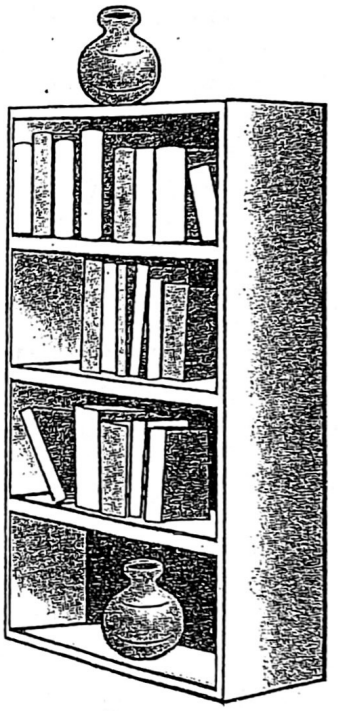
How are the volleyball and the bowling ball different? They are moving at the same speed, but the volleyball has less mass. The volleyball has less kinetic energy than the bowling ball because it has less mass. Kinetic energy increases as the mass of an object increases.

FOLDABLES

B Compare and Contrast Make the following Foldable to compare and contrast kinetic energy and potential energy.



Energy of Position



An object can have energy even if it is not moving. Look at the vase on top of the bookcase. The vase does not have any kinetic energy because it is not moving. What if it accidentally falls to the floor? Changes happen. Gravity pulls the vase downward. The vase has kinetic energy as it falls. Where did this energy come from?

When the vase was sitting on the shelf, it had potential (puh TEN chul) energy. **Potential energy** is the energy stored in an object because of its position. The position of the vase is its height above the floor. As the vase falls, the potential energy is transformed, or changed, from one form to another. It is transformed into kinetic energy. A vase has more potential energy if it is higher above the floor. Potential energy also depends on mass. The more mass an object has, the more potential energy it has. The objects in the figure have different amounts of potential energy.

Picture This

2. **Determine** Which vase on the shelves has the most potential energy?

2

Forms of Energy

Food, sunlight, and wind have energy. But they have different kinds of energy. The energy in food and sunlight is different from the kinetic energy in the wind. The warmth you feel from sunlight is different from kinetic energy or potential energy.

What is thermal energy?

When you sit near a sunny window, you get warm. The feeling of warmth is a sign that you are getting more thermal energy. **Thermal energy** is energy of an object that increases as the object's temperature increases. All objects have thermal energy. In the figure below, a cup of hot chocolate has more thermal energy than a bottle of cold water. The bottle of cold water has more thermal energy than a block of ice with the same mass.

Picture This

3. **Identify** Circle the object with the greatest thermal energy. Put a box around the object with the least thermal energy.

Your body makes thermal energy all the time. Chemical reactions that happen inside your cells make thermal energy. Where does this energy come from? Thermal energy is released by chemical reactions. Thermal energy comes from another kind of energy called chemical energy.

What is chemical energy?

Chemical energy is the energy stored in chemical bonds. Some of this energy is released when chemicals are broken apart and new chemicals are made.

For example, food has chemical energy that your body uses to help you think, move, and grow. Food has chemicals, such as sugar. The chemicals are made of atoms that are bonded together. Energy is stored in the bonds between atoms. These chemical bonds can be broken down in your body to release energy. ☑

Also, the flame of a candle comes from chemical energy stored in wax. When the wax burns, chemical energy changes into thermal energy and light energy.

Reading Check

4. **Explain** What has stored chemical energy that your body uses?

3

What is radiant energy?

Light from the candle flame travels very fast through the air. It moves at a speed of 300,000 km/s. This is fast enough to circle Earth almost eight times in 1 s. When light hits an object, three things can happen. The light can be absorbed by the object, reflected by the object, or be passed through the object. When an object absorbs light energy, the object can get warmer. The light energy changes into thermal energy. You can feel this happening if you wear a black shirt outside on a sunny day. ☑

The energy carried by light is **radiant energy**. You can use electrical energy to make radiant energy. Imagine a metal heating coil on an electric stovetop. As it is heated, it becomes red hot. The hotter it gets, the more radiant energy it gives off. Electrical energy is being used to make the heating coil warmer.

Reading Check

5. **Summarize** When does light energy change to thermal energy?

What is electrical energy?

Electrical energy is used in many ways. **Electrical energy** is carried by the electric current that comes out of batteries and electrical outlets. Electrical lighting uses electrical energy. Look around at all the devices that use electrical energy.

The amount of electrical energy depends on the voltage. The current out of a 120-V electrical outlet can carry more energy than the current out of a 1.5-V battery. Large power plants are needed to make the huge amount of electrical energy people use every day. About 20 percent of the electrical energy made in the United States comes from nuclear power plants.

Think it Over

6. **Compare** Which of the following can carry the most current?

   a. 9-V battery
   b. 220-V electrical outlet
   c. 12-V battery
   d. 110-V electrical outlet

What is nuclear energy?

Nuclear power plants use the energy stored in the nucleus of an atom to make electricity. **Nuclear energy** is the energy in the nucleus of every atom. Nuclear energy can be transformed into other kinds of energy. Releasing nuclear energy is difficult. Complicated power plants are necessary to produce nuclear energy. Releasing nuclear energy from an atom is very different from releasing chemical energy from wood. To do that, all you need is a lighted match.

4

ıfter You Read

ıi Glossary

ıical energy: the energy stored in chemical bonds

rical energy: the energy carried by the electric current that comes out of batteries and electrical outlets

gy: the ability to cause change

tic energy: the energy an object has because of its motion

nuclear energy: the energy in the nucleus of every atom.

potential energy: the energy stored in an object because of its position

radiant energy: the energy carried by light

thermal energy: the energy of an object that increases as temperature increases

Read the key terms and definitions in the Mini Glossary above. On the lines below, explain the difference between the terms *potential energy* and *kinetic energy.*

_____

_____

Match the forms of energy with the correct examples. Write the letter of each example in Column 2 on the line in front of the form of energy it matches in Column 1.

Column 1	Column 2
_____ 1. potential energy	a. the energy that makes a television work
_____ 2. kinetic energy	b. a lamp giving off light
_____ 3. electrical energy	c. the energy in food
_____ 4. thermal energy	d. a ball rolling
_____ 5. chemical energy	e. a book sitting on a shelf
_____ 6. nuclear energy	f. the energy in a cup of hot tea
_____ 7. radiant energy	g. the energy in an atom's nucleus

3. You were asked to highlight the different forms of energy in this section. What do you think would be another way to help you remember the different forms of energy?

_____

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End of Section