



Energy and Energy Resources

section 5 Energy Transformations

What You'll Learn

- to apply the law of conservation of energy
- energy changes form
- how electric power plants make energy

Before You Read

Explain how you used one kind of energy today.

Read to Learn

Changing Forms of Energy

Energy can have different forms such as chemical, thermal, radiant, and electrical. All around you, at all times, energy is being transformed. This means it is changing from one form to another. You see some of these transformations when you notice a change in your environment. Forest fires are an example of a change involving energy. They can happen naturally because of lightning strikes. Changes also happen as a mountain biker pedals up a hill.

How can you track energy transformations?

A mountain biker's leg muscles transform chemical energy into kinetic energy as he pedals. The kinetic energy of his leg muscles is transformed into kinetic energy of the bicycle as he pedals. As he moves up the hill, some of this energy is transformed into potential energy.

Some energy also is transformed into thermal energy. His body is warmer because chemical energy is being released. The parts of the bicycle are warmer too because of friction. When energy is transformed, heat energy usually is made. People exercising, cars running, and living things growing all produce heat.

The Law of Conservation of Energy

The law of conservation of energy states that energy is never created or destroyed. The only thing that changes is the form of the energy.

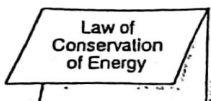
Mark the Text

Identify Main Ideas

Highlight the main point in each paragraph as you read this section. Study the main points, then state each point in your own words.

FOLDABLES

Describe Make the following Foldable. Inside, describe the law of conservation of energy and give examples.



When the biker is resting at the top of the hill, all of his original energy is still around. Some of his energy changed into potential energy. Some changed into thermal energy. Some energy is missing. It can all be accounted for.

Changing Kinetic and Potential Energy

The law of conservation of energy can be used to identify energy changes in a system. For example, tossing a ball into the air and catching it is a simple system. As the ball leaves your hand, most of its energy is kinetic. As it rises, it gets slower. It loses kinetic energy. The kinetic energy is changed into potential energy. The amount of kinetic energy that it loses equals the amount of potential energy that it gains. The total amount of energy stays the same.

Energy Changes Form

Energy changes form all the time all around you. Many machines transform energy from one kind to another. For example, an automobile engine transforms the chemical energy in gasoline into kinetic energy. Some of the chemical energy also is transformed into thermal energy, making the engine hot. An engine that converts chemical energy into more kinetic energy and less thermal energy is a more efficient engine. New kinds of cars use an electric motor along with a gasoline engine. These engines are more efficient so the car can travel farther on a gallon of gas.

How is chemical energy transformed?

Chemical energy can be transformed into kinetic energy inside your body. This happens in muscle cells. Chemical reactions take place and cause certain molecules to change shape. Many of these changes make your muscles contract. This makes a part of your body move.

Biomass Biomass is the matter in living organisms.

Biomass contains chemical energy. When organisms die, chemical compounds in their biomass break down. Bacteria, fungi, and other organisms help change these chemical compounds into simpler chemicals. These simpler chemicals are used by other living things. ✓

Thermal energy also is released when these biomass breaks down. For example, as a compost pile decomposes, chemical energy is changed into thermal energy. The temperature of a compost pile can reach 60°C.



Think it Over

1. Draw Conclusions

At what point does the ball have the most potential energy?

- a. when it reaches its highest point
- b. when it leaves your hand
- c. just before you catch the ball
- d. halfway up in the air



Reading Check

2. **Summarize** What kind of energy does bacteria and fungi help transform?

How is electrical energy transformed?

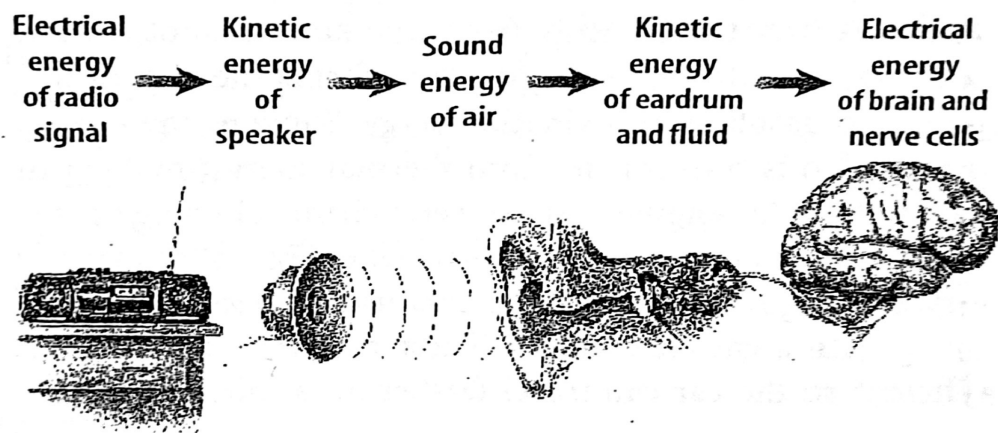
You use electrical energy every day. When you flip a light switch or turn on a radio, electrical energy is transformed into other forms of energy. You use electrical energy when you plug something into an electrical outlet or use a battery.

Hearing Sounds The figure shows how electrical energy is transformed into other kinds of energy when you listen to a radio. A loudspeaker in the radio changes electrical energy into sound waves. The sound waves travel to your ear. This energy in motion. The energy carried by the sound waves makes parts of your ear move too. This energy of motion is transformed into chemical and electrical energy in nerve cells. The nerve cells send the energy to your brain. Your brain figures out that the energy is a voice or music. Where does the energy go after the brain? It finally is transformed into thermal energy.

Picture This

3. **Identify** What kind of energy travels through the air from a radio?
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Energy Transformations



What changes into thermal energy?

Different kinds of energy can be transformed into thermal energy. When something burns, chemical energy changes into thermal energy. Electrical energy changes into thermal energy when a wire that is carrying an electrical current gets hot.

Thermal energy can be used to heat buildings and keep you warm. Thermal energy also can be used to heat water. If you heat water to its boiling point, it changes to steam. Steam can be used by steam engines to make kinetic energy. Steam engines were once used on steam locomotives to pull trains. Thermal energy also can be transformed into radiant energy. This happens when you heat a metal bar until it is so hot that it glows and gives off heat. ☑

✓ Reading Check

4. **Check Understanding**

How can thermal energy be used to make kinetic energy?

How does thermal energy move?

Thermal energy can move from one place to another. A cup of hot chocolate has thermal energy. Its thermal energy moves from the cup to the cooler air around it. Thermal energy only moves from something at a higher temperature to something at a lower temperature.

Generating Electrical Energy

Where does the electrical energy in an electrical outlet come from? It must be made all the time by power plants. In fossil fuel power plants, coal, oil, or natural gas is burned to boil water. Steam from the boiling water rushes through a turbine. A turbine is a machine that has a set of fan blades that are close together. The steam pushes on the blades and turns the turbine. The turbine rotates a shaft in the generator. A generator is a device that changes kinetic energy into electrical energy. All power plants work in a similar way—they use energy to turn a generator. ✓

Are there different kinds of power plants?

Almost 90 percent of the electrical energy in the United States comes from nuclear and fossil fuel power plants. Other kinds of power plants are hydroelectric (hi droh ih LEK trihk) and wind. ~~Hydroelectric power plants use generators to~~ change the kinetic energy of moving water into electrical energy. Wind power plants use generators to change the kinetic energy of wind into electrical energy.

You can diagram the energy transformations in a power plant using arrows. A power plant that burns coal makes energy through the following energy transformations. Nuclear power plants also use energy transformations like the ones below.

chemical energy of coal → thermal energy of water → kinetic energy of steam → kinetic energy of turbine → electrical energy out of generator

How are hydroelectric power plants different?

Hydroelectric power plants do not change water into steam. This is because the water hits the turbine. So the first two steps in the diagram are not needed. The process starts with the kinetic energy of the water.



Think it Over

5. **Describe** Imagine you are taking a hot pan out of the oven using an oven mitt. Describe where thermal energy moves in this example.

✓ Reading Check

6. **Define** What machine turns a generator to make electricity?

● After You Read

Mini Glossary

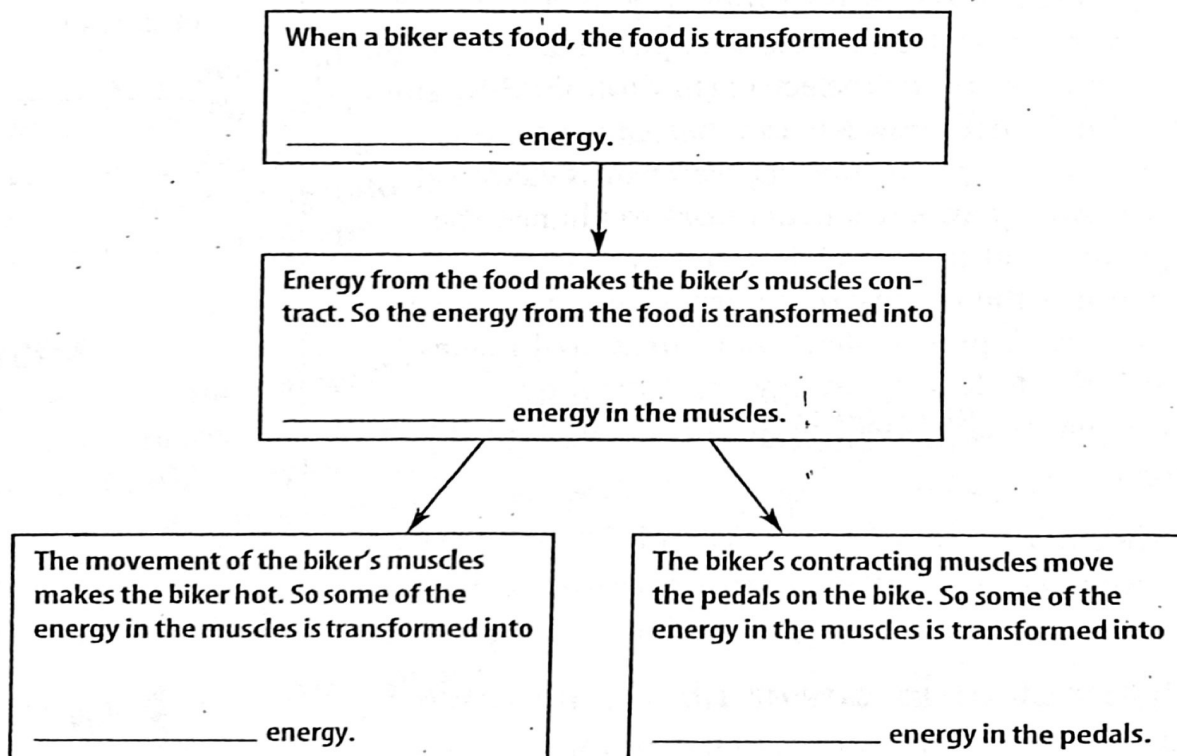
generator: a device that transforms kinetic energy into electrical energy

law of conservation of energy: states that energy is never created or destroyed

turbine: a set of steam-powered fan blades that spins generator at a power plant

1. Review the terms and their definitions in the Mini Glossary. Write a paragraph about how a turbine and a generator are used to make electrical energy.

2. Fill in the blanks to tell what type of energy is being transformed as a biker rides a bicycle.



End of
Section

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