14-4 What is work?

Objective

Relate work, force, and distance.

Key Term

work: force exerted through a distance

Work When are you doing work? **Work** is done when a force moves an object through a distance. This relationship can be shown in the following equation.

$$\text{work} = \text{force} \times \text{distance}$$

Suppose two boys push a car stuck in the mud. No matter how hard they push, they are not able to move the car. They are very tired afterward. Did the boys do any work?

The answer is no. For work to be done, something must be moved. The boys used a great deal of energy, but the car did not move. Work was not done.

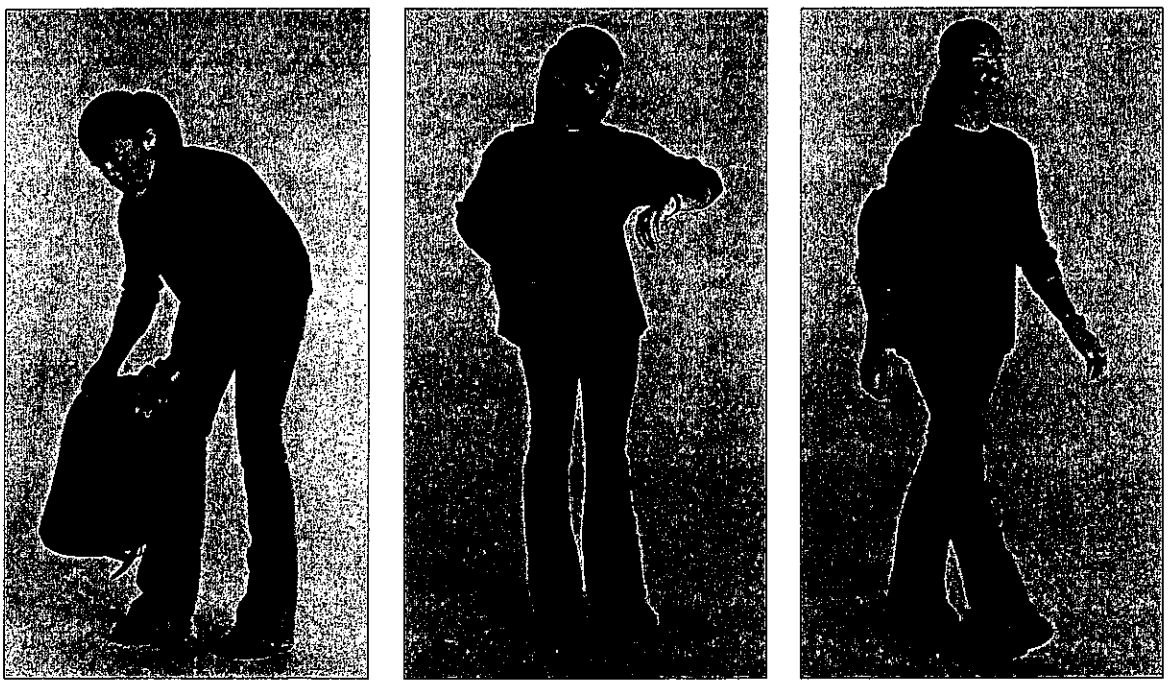
1 **DESCRIBE:** What is the relationship between work, force, and distance?

Work and Energy Energy has been defined as the ability to make something happen. Energy is also often defined as the ability to do work. When a force moves an object, work is done.

Anything that can make something else move has energy. A moving bowling ball has energy. When the ball hits the pins, the pins move. The energy stored in gasoline can do work. It can make a car move. However, energy can be changed in form without any work being done. If you hold a heavy bag of groceries, your arms will get tired. Chemical energy in your muscles is changed to other forms of energy. However, because this energy is not being used to move the bag of groceries, you are not doing work.

2 **EXPLAIN:** How do you know a moving bowling ball has energy?

Direction of Motion For work to be done, a force must make an object move in the same direction as the force. Look at the three pictures in Figure 14-12. In the first picture, the girl is picking up a backpack. The backpack is moving in the direction of the force she used on it. She is doing work. In the middle picture, she is standing still with the pack on her back. She is using force, but no work is being done. In the third picture, she is moving the backpack as she begins to walk. Because she is causing the backpack to accelerate, she is doing work again.



◀ **Figure 14-12** Work is being done in the first and last pictures but not the middle picture.

Name _____ Class _____ Date _____

14-4 What is work?

Lesson Review

Place a check mark beside each statement that is true.

_____ 1. For work to be done, no motion has to take place.

_____ 2. Energy can be used without doing work.

_____ 3. *Force = distance × work*

_____ 4. For work to be done, a force must make an object move in a direction opposite to the direction of force.

_____ 5. If a man pushes a rock five meters, he has done work.

_____ 6. Anything that can make something else move has energy.

_____ 7. The ability to do work is force.

_____ 8. A moving bowling ball has energy.

_____ 9. Energy that is stored in gasoline can do work.

_____ 10. *Distance × force = work*

Skill Challenge

Skills: *observing, explaining, listing*

Observe five examples of people doing work. List each example and explain how you knew each person was doing work.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____