Name _____ Date _____ Class _____

SECTION 5-1 SECTION SUMMARY

The Nature of Energy

Guide for Reading

- **How are work and energy related?**
- **What are the two basic kinds of energy?**
- **What are some of the different forms of energy?**

Work is done when a force moves an object through a distance. The ability to do work or cause change is called **energy.**

When an object or organism does work on an object, some of its energy is transferred to that object. **You can think of work, then, as the transfer of energy.** Energy is measured in joules.

The energy of motion is called **kinetic energy.** The more work you do on an object, the more energy you give that object. The more mass a moving object has, the more kinetic energy it has. Kinetic energy also increases when velocity increases.

$$\text{Kinetic energy} = \frac{\text{Mass} \times \text{Velocity}^2}{2}$$

Energy that is stored and held in readiness is called **potential energy.** When you raise a book or when you compress a spring, you give it potential energy.

The potential energy associated with objects that can be stretched or compressed is called **elastic potential energy.** When you lift an object, you give it a different kind of potential energy. Potential energy that depends on height is **gravitational potential energy.**

$$\text{Gravitational potential energy} = \text{Weight} \times \text{Height}$$

$$\text{Gravitational potential energy} = \text{Mass} \times \text{Gravitational acceleration} \times \text{Height}$$

Both kinetic energy and potential energy have a variety of different forms. **Some of the major forms of energy are mechanical energy, thermal energy, chemical energy, electrical energy, electromagnetic energy, and nuclear energy.**

Mechanical energy is the energy associated with the motion or position of an object. Mechanical energy can be kinetic energy or potential energy.

Thermal energy is the total energy of the particles in an object. When the thermal energy of an object increases, the object becomes warmer.

Chemical energy is stored in chemical compounds. Chemical energy is potential energy stored in chemical bonds that hold chemical compounds together.

Moving electrical charges produce electricity, or **electrical energy.**

Electromagnetic energy, such as light, results from the motion of particles within the atoms that make up matter.

Nuclear energy is potential energy stored in the core, or nucleus, of an atom.

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SECTION 5-1 REVIEW AND REINFORCE

The Nature of Energy

◆ Understanding Main Ideas

Answer the following questions on a separate sheet of paper.

1. How are work and energy related?

2. Compare and contrast kinetic energy and potential energy.

◆ Building Vocabulary

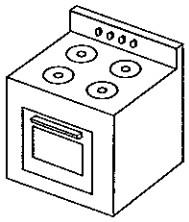
Match each illustration with the correct form(s) of energy by writing the letter or letters of the form(s) of energy on the line at the left.

a. mechanical energy **b.** electrical energy

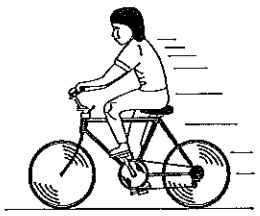
c. thermal energy **d.** nuclear energy

e. chemical energy **f.** electromagnetic energy

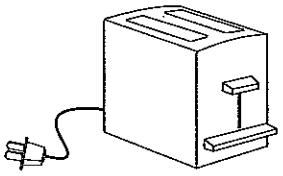
_____ **3.**



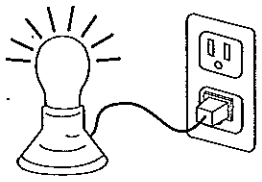
_____ **4.**



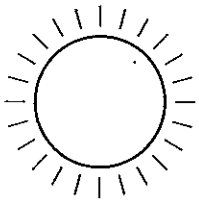
_____ **5.**



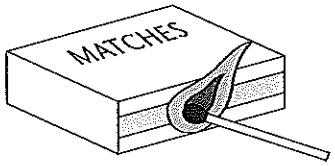
_____ **6.**



_____ **7.**



_____ **8.**



Match each term with its definition by writing the letter of the correct definition in the right column on the line beside the term in the left column.

_____ **9.** energy

_____ **10.** elastic potential energy

_____ **11.** gravitational potential energy

a. the energy that depends on height

b. the ability to do work or cause change

c. the energy associated with objects that can be stretched or compressed

Name _____ Date _____ Class _____

SECTION 4-1 SECTION SUMMARY

What Is Work?

Guide for Reading

- When is work done on an object?
- How do you calculate the work done on an object?

In science, you do **work** on an object when you exert a force on the object that causes the object to move some distance. **In order to do work on an object, the object must move some distance as a result of your force.** If the object does not move, no work is done no matter how much force is exerted.

In order to do work on an object, the force you exert must be in the same direction as the object's motion. When you carry an object at constant velocity, you exert an upward force to hold the object so that it doesn't fall to the ground. The motion of the object is in the horizontal direction. Since the force is vertical and the motion is horizontal you don't do any work on the object as you carry it.

The amount of work you do depends on both the amount of force you exert and the distance the object moves. **The amount of work done on an object can be determined by multiplying force times distance.**

$$\text{Work} = \text{Force} \times \text{Distance}$$

When force is measured in newtons and distance is measured in meters, the SI unit of work is the newton × meter (N•m). This unit is also called a joule. One **joule** (J) is the amount of work you do when you exert a force of 1 newton to move an object a distance of 1 meter.

4

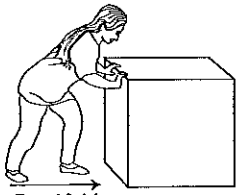
Name _____ Date _____ Class _____

SECTION 4-1 **REVIEW AND REINFORCE**

What Is Work?

◆ Understanding Main Ideas

Use the following illustration to answer questions 1 through 3.



1. The illustration shows Beatrice pushing on a heavy box. Beatrice pushes with a force of 40 N. How can you determine if Beatrice is doing work on the box?

_____

2. Beatrice pushes the box 2 m to the right. What formula should you use to calculate the amount of work done on the box?

_____

3. How much work does Beatrice do pushing the box?

_____

◆ Building Vocabulary

Write a definition for each of the following terms on the lines below.

4. work

_____

_____

5. joule

_____

_____

4

Name _____ Date _____ Class _____

SECTION 1-1 SECTION SUMMARY

Describing and Measuring Motion

1

Guide for Reading

- When is an object in motion?
- How can you find the speed and velocity of an object?

An object is in **motion** when its distance from another object is changing. Whether an object is moving or not depends on your point of view. For example, a woman riding on a bus is not moving in relation to the seat she is sitting on, but she is moving in relation to the buildings the bus passes. A **reference point** is a place or object used for comparison to determine if something is in motion. **An object is in motion if it changes position relative to a reference point.** You assume that the reference point is stationary, or not moving.

Units of measurement are used to describe an object's motion. The system of measurement used by scientists all over the world is called the **International System of Units,** or in French, Système International (SI). The SI system is based on the number 10.

The basic SI unit of length is the **meter** (m). A meter is a little longer than a yard. To measure the length of an object smaller than a meter, scientists use the metric unit called the centimeter (cm). There are 100 centimeters in a meter. Meters and centimeters can be used to describe the distance an object travels.

Rate is the amount of something that occurs or changes in one unit of time. Speed is a type of rate. The **speed** of an object is the distance the object travels in one unit of time. To calculate the speed of an object, divide the distance the object travels by the amount of time it takes to travel that distance. Speed measurements consist of a unit of distance divided by a unit of time, such as meters per second.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

When an object travels at a constant speed, its speed at any point during its motion is the same as it is at every other point. Most objects do not move at constant speeds. To find the average speed of an object, divide the total distance traveled by the total time. An object's speed tells how fast it is moving, but not the direction of the motion. **When you know both the speed and direction of an object's motion, you know the velocity of the object.** Speed in a given direction is called **velocity.**

A line graph in which distance is plotted against time can show the motion of an object. A straight line represents motion at a constant speed. The steepness of the line's slope depends on the speed of the object. A horizontal line represents an object that is not moving at all.

Name _____ Date _____ Class _____

SECTION 1-1 REVIEW AND REINFORCE

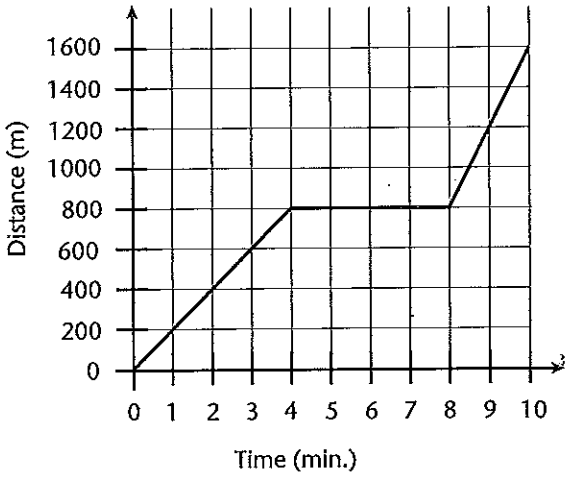
Describing and Measuring Motion

1

◆ Understanding Main Ideas

Use the following paragraph and graph to answer questions 1 through 5. Write your answers on a separate sheet of paper. Remember to include units in your answers.

On Saturday, Ashley rode her bicycle to visit Maria. Maria's house is directly east of Ashley's. The graph shows how far Ashley was from her house after each minute of her trip.



1. Ashley rode at a constant speed for the first 4 minutes of her trip. What was her constant speed?
2. What was her average speed for the entire trip?
3. What was her average velocity for the entire trip?
4. Ashley stopped to talk with another friend during her trip. How far was she from her house when she stopped?
5. Ashley's brother rode beside her for several minutes. During this time, was he moving relative to Ashley?

◆ Building Vocabulary

From the list below, choose the term that best completes each sentence. Write your answers on the line provided.

motion	International System of Units	foot
reference point	yard	meter
average	velocity	speed

6. Scientists around the world use the _____, a system of measurement based on the number ten.
7. An object is in _____ when its distance from a(n) _____ is changing.
8. Speed in a given direction is _____.
9. _____ can be calculated if you know the distance that an object travels in one unit of time.
10. The basic SI unit of length is the _____.

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