Name ______________________ Date ____________ Class ____________

Assess Your Understanding

What Is Energy?

How Are Energy, Work, and Power Related?

got it?

○ **I get it!** Now I know that since the transfer of energy is work, then power is ______________________________

○ **I need extra help with** ______________________________

What Are Two Types of Energy?

1a. IDENTIFY The energy an object has due to its motion is called (kinetic/potential) energy. Stored energy that results from the position or shape of an object is called (kinetic/potential) energy.

b. SUMMARIZE What are the two factors that affect an object's kinetic energy? ______________________________

c. APPLY CONCEPTS What type of energy does a cup sitting on a table have? Why? ______________________________

got it?

○ **I get it!** Now I know that the two basic types of energy are ______________________________

○ **I need extra help with** ______________________________

Name _____ Date _____ Class _____

Key Concept Summaries

What Is Energy?

How Are Energy, Work, and Power Related?

Energy is the ability to do work or cause change. When you do work on an object, some of your energy is transferred to that object. You can think of work as the transfer of energy. Both work and energy are measured in joules.

You may recall that power is the rate at which work is done. **Since the transfer of energy is work, then power is the rate at which energy is transferred, or the amount of energy transferred in a unit of time.**

$$\text{Power} = \frac{\text{Energy Transferred}}{\text{Time}}$$

What Are Two Types of Energy?

The two basic types of energy are kinetic energy and potential energy. Whether energy is kinetic or potential depends on the motion, position, and shape of the object.

The energy an object has due to its motion is **kinetic energy.** The kinetic energy of an object depends on its speed and its mass. The faster an object moves, the more kinetic energy it has. Kinetic energy also increases as mass increases. You can use the following equation to solve for the kinetic energy of an object.

$$\text{Kinetic energy} = \frac{1}{2} \times \text{Mass} \times \text{Speed}^2$$

Note that changing the speed of an object will have a greater effect on its kinetic energy than changing its mass by the same factor. This is because speed is squared in the kinetic energy equation.

Potential energy is energy that results from the position or shape of an object. This type of energy has the potential to do work. Potential energy related to an object's height is called **gravitational potential energy.** The gravitational potential energy of an object is equal to the work done to lift it to that height. You can calculate an object's gravitational potential energy using this equation.

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

Elastic potential energy is the energy associated with objects that can be compressed or stretched. The energy stored in a trampoline is elastic potential energy.

On a separate sheet of paper, describe the two basic kinds of energy and explain how energy and power are related.

Name _____ Date _____ Class _____

Lesson Quiz

What Is Energy?

Write the letter of the correct answer on the line at the left.

1. ___ The kinetic energy of an object is equal to one half its mass multiplied by its speed
   - A squared
   - B cubed
   - C to the fourth power
   - D to the fifth power

2. ___ The gravitational potential energy of an object is equal to its weight multiplied by its
   - A depth
   - B height
   - C volume
   - D diameter

3. ___ Energy is the ability to do work or cause
   - A events
   - B change
   - C friction
   - D explosions

4. ___ Energy and work are measured in
   - A newtons
   - B joules
   - C hertz
   - D kilograms

Fill in the blank to complete each statement.

5. When you do work on an object, some of your energy is _____ to that object.

6. Power is the rate at which energy is _____.

7. Potential energy results from the _____ or position of an object.

8. A stretched rubber band has _____ energy.

9. A change in an object's speed has a(n) _____ effect on its kinetic energy than a change in its mass.

10. A mountain climber at the peak has _____ energy.

Name _____ Date _____ Class _____

Assess Your Understanding

Forms of Energy

How Can You Find an Object's Mechanical Energy?

1a. DEFINE Mechanical energy is the form of energy associated with the _____, _____, or _____ of an object.

b. CALCULATE At a certain point the kinetic energy of a falling apple is 5.2J and its potential energy is 3.5J. What is its mechanical energy? _____

_____

c. INFER If an object's mechanical energy is equal to its potential energy, how much kinetic energy does the object have? Explain. _____

_____

got it?

○ **I get it!** Now I know you can find an object's mechanical energy by _____

_____

○ **I need extra help with** _____

_____

What Are Other Forms of Energy?

2a. EXPLAIN Why do the particles of objects have both kinetic and potential energy? _____

_____

_____

b. CLASSIFY The energy you get from eating a peanut butter and jelly sandwich is in the form of _____ energy.

got it?

○ **I get it!** Now I know the forms of energy associated with the particles of objects include _____

_____

○ **I need extra help with** _____

_____

Name _____ Date _____ Class _____

Key Concept Summaries

Forms of Energy

How Can You Find an Object's Mechanical Energy?

The form of energy associated with the motion, position, or shape of an object is called **mechanical energy.** An object's mechanical energy is a combination of its potential energy and its kinetic energy. **You can find an object's mechanical energy by adding the object's kinetic energy and potential energy.** An object with mechanical energy can do work on another object. The more mechanical energy an object has, the more work it can do.

What Are Other Forms of Energy?

Some forms of energy involve the particles that make up objects, which are far too small to see with the naked eye. **Forms of energy associated with the particles of objects include nuclear energy, thermal energy, electrical energy, electromagnetic energy, and chemical energy.** **Nuclear energy** is stored in the nucleus of an atom and released during a nuclear reaction. Two kinds of nuclear reactions are fission and fusion. Fission occurs when a nucleus splits. A nuclear power plant uses fission to produce electricity. Fusion occurs when nuclei join together. Nuclear fusion occurs constantly in the sun, releasing huge amounts of energy. **Thermal energy** is the total kinetic and potential energy of the particles in an object. Adding heat causes particles to move faster, so the higher its temperature, the more thermal energy an object has. **Electrical energy** is the energy of electric charges. Depending on whether the charges are moving or stored, it can be a form of kinetic or potential energy. **Electromagnetic energy** is a form of energy that travels though space in waves. The source of these waves is vibrating electric charges. Electromagnetic waves do not require a medium, so they can travel through the vacuum of space. **Chemical energy** is potential energy stored in chemical bonds. Chemical energy is in the foods you eat, the matches you light, and the cells of your body. Chemical bonds hold atoms together. When chemical bonds are broken, stored energy is often released.

On a separate sheet of paper, list five forms of energy associated with the particles of an object. Identify each form as a type of potential energy, kinetic energy, or both (depending on whether it is moving or stored).

Name _____ Date _____ Class _____

Lesson Quiz

Forms of Energy

Write the letter of the correct answer on the line at the left.

1. ___ To find an object's mechanical energy, you add its
   - A kinetic and potential energy
   - B kinetic and thermal energy
   - C potential and thermal energy
   - D kinetic and chemical energy

2. ___ A form of energy NOT associated with the particles of objects is
   - A thermal energy
   - B mechanical energy
   - C nuclear energy
   - D chemical energy

3. ___ Nuclear fusion reactions occur in
   - A nuclear power plants
   - B a microwave oven
   - C a match that is struck
   - D the sun

4. ___ The total potential and kinetic energy of the particles of an object is the object's
   - A nuclear energy
   - B electromagnetic energy
   - C thermal energy
   - D mechanical energy

Fill in the blank to complete each statement.

5. Mechanical energy is associated with the motion, position, or _____ of an object.

6. Electromagnetic energy travels through space in the form of _____.

7. Lightning is a form of _____ energy.

8. The breaking of _____ bonds in food releases energy for your body to use.

9. The _____ the temperature of an object, the lower its thermal energy.

10. Electrical energy is the energy of _____.

Name _____ Date _____ Class _____

Assess Your Understanding

Energy Transformations and Conservation

How Are Different Forms of Energy Related?

1a. DEFINE A change in one form of energy to another form of energy is called a(n) _____

_____

b. RELATE CAUSE AND EFFECT When you turn on an iron, _____ energy is transformed into _____ energy.

c. APPLY CONCEPTS Describe the energy transformations that occur in a waterfall. _____

_____

_____

got it?

○ **I get it!** Now I know that all forms of energy can be transformed into _____

_____

○ **I need extra help with** _____

_____

What Is the Law of Conservation of Energy?

2a. ANSWER How is energy conserved in a transformation? _____

_____

_____

got it?

○ **I get it!** Now I know that according to the law of conservation of energy, energy _____

_____

○ **I need extra help with** _____

_____

Name _____ Date _____ Class _____

Key Concept Summaries

Energy Transformations and Conservation

How Are Different Forms of Energy Related?

All forms of energy can be transformed into other forms of energy. A change from one form of energy to another is called an **energy transformation.**

Sometimes, one form of energy needs to be transformed into another to get work done. For example, a toaster transforms electrical energy to thermal energy to toast bread. Often, a series of energy transformations is needed. For example, the mechanical energy used to strike a match is transformed to thermal energy, which causes the particles in the match to release stored chemical energy, which is transformed to more thermal energy and to the electromagnetic energy you see as light.

The transformation between potential and kinetic energy is one of the most common energy transformations. For example, when you stretch a rubber band, you give it elastic potential energy. If you let go, the rubber band flies across the room, displaying kinetic energy.

A transformation between potential and kinetic energy also occurs when you throw a ball up into the air. As the ball falls toward the Earth and its height decreases, it loses potential energy. At the same time, its kinetic energy increases because its speed increases. Its potential energy is transformed into kinetic energy. In a pendulum, there is a continuous transformation between gravitational potential energy and kinetic energy.

What Is the Law of Conservation of Energy?

The **law of conservation of energy** states that when one form of energy is transformed to another, no energy is lost in the process. **According to the law of conservation of energy, energy cannot be created or destroyed.** The total amount of energy is the same before and after any transformation.

Whenever a moving object experiences friction, some of its kinetic energy is transformed into thermal energy. Friction is the reason why no machine is 100 percent efficient. The output work of any real machine is always less than the input work.

On a separate sheet of paper, describe a single transformation of energy from one form into another. Explain whether there is more or less energy after the transformation has occurred.

Name ______________ Date ________ Class ________

Lesson Quiz

Energy Transformations and Conservation

Fill in the blank to complete each statement.

1. All forms of energy can be ________________ into other forms of energy.

2. A change from one form of energy to another is called a(n) ________________ ________________.

3. When you use a match to light a candle, multiple ________________ of energy occur.

4. The law of ________________. of energy tells how much energy is present after electromagnetic energy changes to sound.

5. Whenever a moving object experiences friction, some of its kinetic energy is changed into ________________ energy.

6. Your body changes chemical energy into ________________. energy when you walk upstairs.

Write the letter of the correct answer on the line at the left.

7. ___ Fusion reactions in the sun change nuclear energy into
   - A mechanical energy
   - B chemical energy
   - C electromagnetic energy
   - D potential energy

8. ___ In a pendulum, a continuous change occurs between kinetic energy and
   - A potential energy
   - B electromagnetic energy
   - C thermal energy
   - D mechanical energy

9. ___ A baseball in play has its lowest gravitational potential energy
   - A when it is at its highest point
   - B before it hits the ground
   - C when the bat contacts it
   - D after it hits the ground

10. ___ Energy can be neither destroyed nor
    - A created
    - B transformed
    - C changed
    - D transferred