Chemistry Chapter 1
Questions on Pages 3-8
2 points

Name: _____

Date: _____ Hour: _____

Read the passage on the back of this worksheet taken from pages 5-7 of *Merrill Chemistry* (1995) and answer the following questions:

1. What is a chemical? _____
2. What is energy? _____
3. What two general forms of energy does an object have? _____

   _____
4. Explain how potential energy is related to electrons in an atom. _____

   _____

   _____
5. What is kinetic energy related to? _____
6. What are two ways energy is transferred between objects? _____

   _____
7. Energy can be _____ from one kind to another.
8. What is mass? _____

   _____
9. Write the three statements related to the law of conservation of mass:

   (a) _____

   (b) _____

   (c) _____
10. Write four statements related to the law of conservation of energy:

    (a) _____

    (b) _____

    (c) _____

    (d) _____
11. Who showed that the laws of conservation of mass and energy were not always true? _____

    _____

The Ingredients

You know that some materials are chemicals—for example, salt, copper, tin, chlorine, and petroleum. What is a chemical? Everything! All matter. Even you are a mixture of chemicals! **Matter** is anything that has the property of inertia. **Inertia** is a property of matter that shows itself as a resistance to any change in motion. This change can be in either the direction or the rate of motion, or in both. For example, suppose you are riding in a moving car. When the car is stopped suddenly, your body tends to continue moving forward. If the car makes a sharp turn, your body tends to continue to move in its original direction. Then, your body moves toward the side of the car opposite from the direction of the turn. In both cases, your body is showing the property of inertia. All matter has the property of inertia.

Matter also has energy. In their work with the structure and properties of materials, chemists are also interested in the energy changes that take place. **Energy** is a property possessed by all matter, and, in the proper circumstances, can be made to do work. All objects possess energy. A hockey stick, an automobile, an atom, and an electron have energy. An object has two general forms of energy: potential and kinetic. **Potential energy** depends upon the position of the object with respect to some reference point. A book on a table has a greater potential energy than the same book on the floor because the table is farther from Earth. The gravitational attraction between Earth and the book gives the book greater potential energy on the table. The book could fall farther from the table to the surface of Earth than from the floor to the surface of Earth. The book could, therefore, do more work by falling from the top of the table. For the same reason, an electron close to its nucleus has less potential energy than when it is farther away. Here, however, the attraction between the electron and nucleus produces the potential energy.

Kinetic energy is the energy possessed by an object because of its motion. An airplane traveling 700 kilometers per hour has a greater kinetic energy than when it is traveling 500 kilometers per hour.

Energy can be transferred between objects in two ways: through direct contact and through electromagnetic waves. An example of direct energy transfer is the collision of two billiard balls. Kinetic energy is transferred directly from one ball to another. An example of energy transfer by electromagnetic waves is the transfer of energy from the sun to Earth. Energy being transferred by electromagnetic waves is often called **radiant energy**.

Many other terms we use for energy are special cases or combinations of potential, kinetic, and radiant energy. Energy can be transformed from one kind to another. For instance, think about the battery-alternator system of a car. As the starter switch is turned on, the chemical energy in the battery is converted to electric energy. The electric energy is converted by the starter to mechanical energy used to start the car. When the car starts, chemical energy in the gasoline is converted into mechanical energy of the moving car. As the crankshaft gains speed, some of this mechanical energy is transferred by belt and pulley to the alternator. In the alternator, the mechanical energy is converted to electric energy. This electric energy is transferred to the battery, where it is converted to chemical energy as it recharges the battery. During this time, other energy transformations produce sound and change the temperature of engine parts.

The Rules

If you toss a burning match into a pile of crumpled paper, the paper will ignite. Paper is combustible. Chemists investigate the changes that matter undergoes, such as the burning of paper. You will begin studying these changes in Chapter 3. Whenever matter undergoes a change, there is an energy transfer. These changes are summarized by rules, or, as chemists refer to them, laws. Two of these laws are the *law of conservation of mass* and the *law of conservation of energy*. As you will study in Chapter 2, mass is a measure of the amount of matter in an object.

The **law of conservation of mass** states that matter is always conserved. This statement means that the total amount of matter in the universe remains constant. Matter is neither created nor destroyed. It is changed only in form. The **law of conservation of energy** states that energy is always conserved. This statement means that the total amount of energy in the universe remains the same. Energy is neither created nor destroyed. It, too, is changed only in form.

For almost two hundred years, scientists believed these two laws to be true under all circumstances. However, in the early 1900s, Albert Einstein showed that matter can be changed to energy and that energy can be changed to matter.