

LESSON

22

What is the difference between a physical change and a chemical change?

There are different ways you can change things. For example, you can tear up a piece of paper into small pieces. What remains is still paper. You have changed the way the paper looks. But you have not made any new substance. You have made a physical change.

If, instead, you burned the paper, what would be left? What is left is no longer paper. In this case the substance has been changed. This is a chemical change.

A **physical change** does not change the way the atoms are linked up. The substance may look different, but no new substance has been formed. The chemical properties are not changed.

In a physical change, no energy is taken in or given off unless there is a change of state.

In a **chemical change**, matter changes from one kind of material to another kind of material. The atoms that make up the material do not change. Instead, the atoms change the way they are linked up. The new substances can have very different properties than the old substances.

Chemical changes take place during chemical reactions. In a **chemical reaction** there is never a change in the number of elements. There is never a change in the number of atoms of an one element. No elements are lost. No new elements are added. They just combine in different ways.

Energy is always part of a chemical reaction. In a chemical reaction, energy is either taken in or given off.

ELECTROLYSIS

Electrolysis is an example of a chemical change. Electrical energy is used to break water molecules apart into oxygen and hydrogen. Figure B shows a diagram of the chemical reaction taking place during electrolysis. The molecules on the left side of the arrow were present before the electrolysis took place. The molecules on the right side of the arrow were present after the electrolysis took place. Look at the diagram and then answer the questions below.

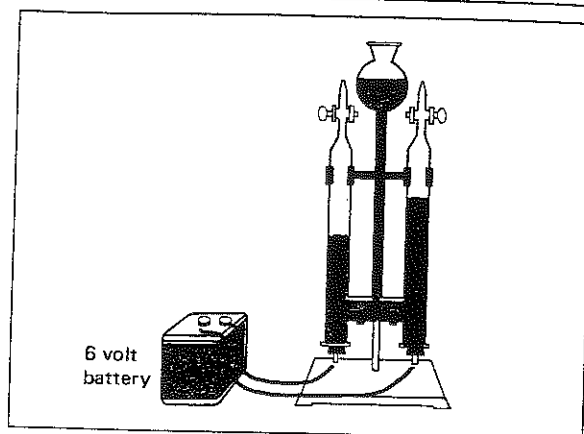


Figure A

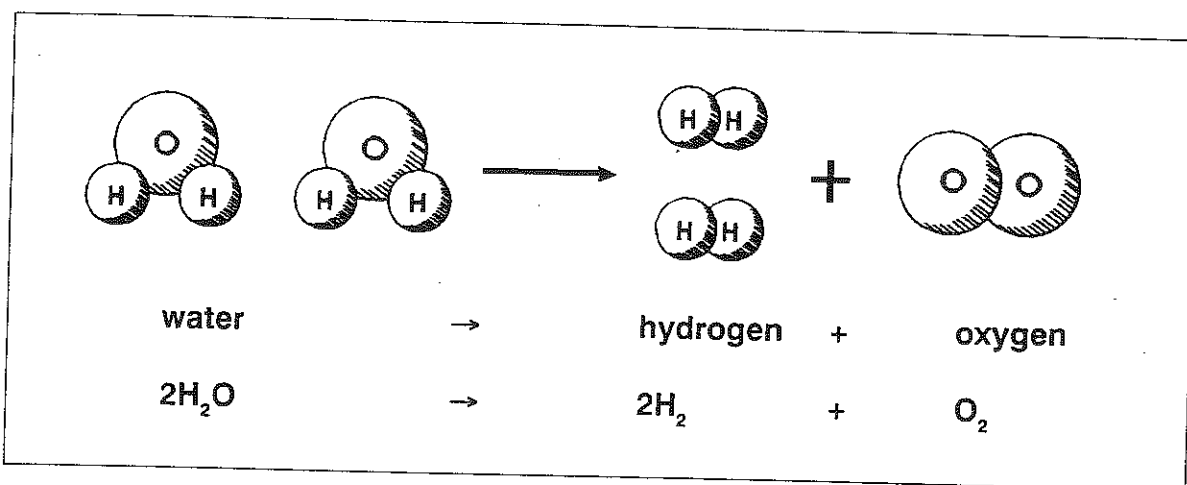


Figure B

1. What compound did we start with? _____
2. What two elements make up that compound? _____
3. What two elements did we end up with? _____
4. Were new substances formed? _____
5. Are the properties of the old and new substance different? _____
6. How many atoms of hydrogen did we start with? _____
7. How many atoms of oxygen did we start with? _____
8. How many atoms of hydrogen did we end up with? _____
9. How many atoms of oxygen did we end up with? _____
10. Did the type and number of atoms change? _____
11. Does electrolysis cause a chemical change or physical change? _____

BURNING MAGNESIUM

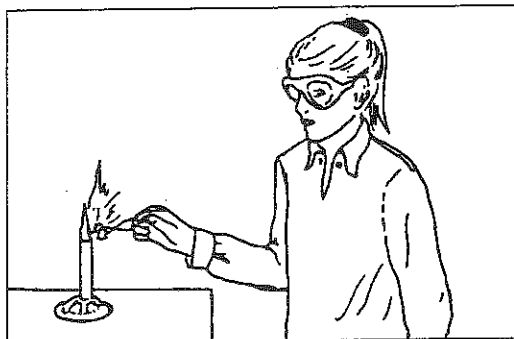


Figure C

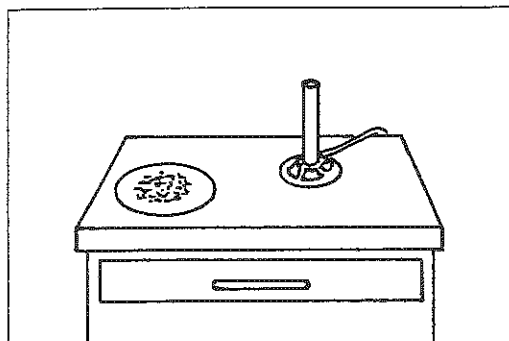


Figure D

Burning magnesium is another example of a chemical change. When magnesium is burned, the magnesium combines with oxygen in the air to form magnesium oxide. Study Figure E and then answer the questions below.

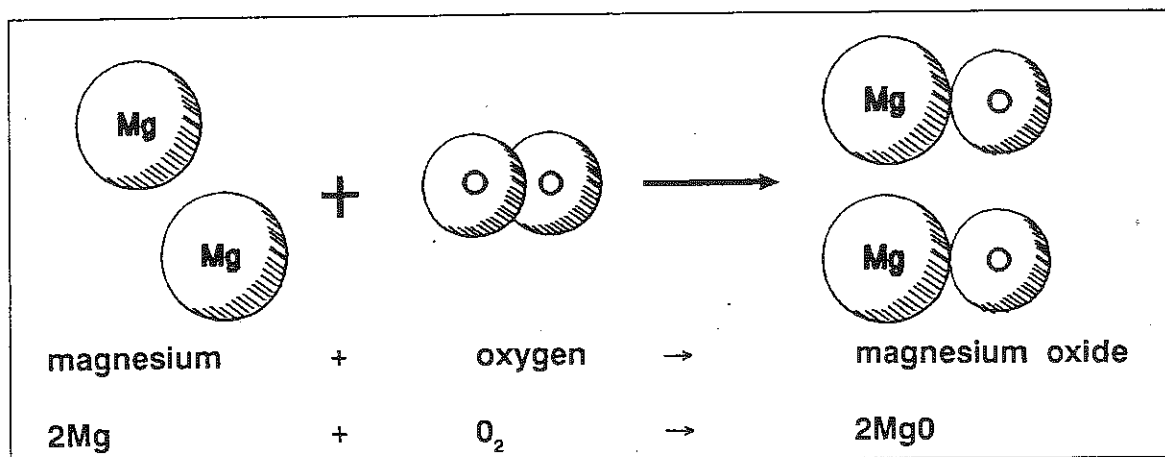


Figure E

1. What two elements did we start with? _____
2. What compound did we end up with? _____
3. What two elements make up that compound? _____
4. Were new substances formed? _____
5. Are the properties of the old and new substance different? _____
6. How many atoms of magnesium did we start with? _____
7. How many atoms of oxygen did we start with? _____
8. How many atoms of magnesium did we end up with? _____
9. How many atoms of oxygen did we end up with? _____
10. Did the type and number of atoms change? _____
11. Does burning magnesium cause a chemical change or physical change? _____

SHREDDING PAPER

Shredding paper is an example of a physical change. In a physical change, the atoms do not change the way they linked up. No new products are formed. Look at Figure F and then answer the questions below.

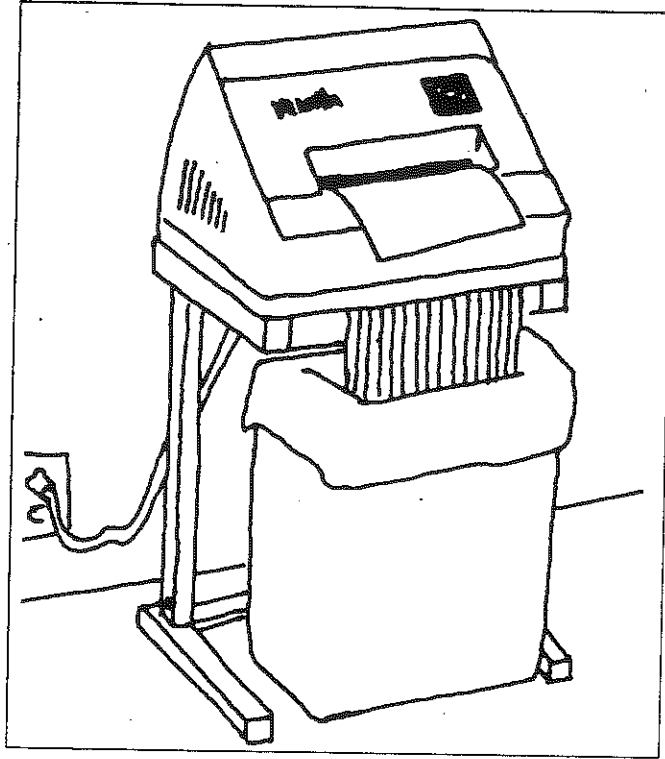


Figure F

1. Does the paper look different after being shredded? _____
2. Is the paper still paper? _____
3. Are the atoms taking in energy? _____
4. Are the atoms giving off energy? _____
5. In a physical change, the atoms _____ change the way they link up.
do, do not
6. The chemical properties of the paper _____ changed.
do, do not

MELTING ICE

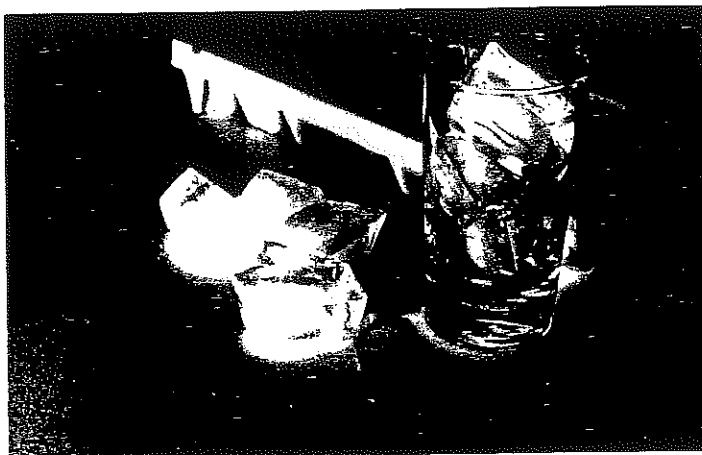


Figure G

Melting ice is an example of a change of state. A solid (ice) changes into a liquid (water). The formula for water is H_2O . The formula for ice also is H_2O . Both ice and water have the same chemical formula. Therefore no chemical change takes place. A change of state (such as melting ice) is a physical change.

Energy is taken in when ice is melted. Changes of state are the only physical changes where energy is taken in or given off. Look at Figure G and then answer the questions below.

1. Does the ice look different after it is melted? _____
2. When ice changes to water, the link-up of the atoms _____ change.
does, does not
3. When water changes to ice, the link-up of the atoms _____ change.
does, does not
4. The melting of ice is an example of a _____ change.
physical, chemical
5. When ice changes to a liquid, the ice _____ take in energy.
does, does not
6. Usually, energy _____ part of a physical change.
is, is not
7. Energy is part of a physical change only when there is _____.
electrolysis, a change of state

TRUE OR FALSE

In the space provided, write "true" if the sentence is true. Write "false" if the sentence is false.

- _____ 1. A chemical reaction causes a chemical change.
- _____ 2. A chemical change makes new products.
- _____ 3. Elements can be lost or gained in a chemical reaction.
- _____ 4. Energy can be taken in only during a chemical reaction.
- _____ 5. The substances that take part in a chemical reaction keep their properties.
- _____ 6. The new substances made in a chemical reaction have new properties.
- _____ 7. A physical change makes new products.
- _____ 8. The boiling of water is an example of a chemical change.
- _____ 9. The electrolysis of water is an example of a chemical change.
- _____ 10. Some physical changes involve taking in or giving off energy.

Tell whether each of the following is a chemical change or a physical change.

1. mixing salt and pepper _____
2. evaporation of water _____
3. electrolysis of water _____
4. cutting a marshmallow _____
5. toasting a marshmallow _____
6. burning magnesium _____
7. demolishing a car _____
8. the rusting of iron _____
9. melting of sugar _____
10. baking a cake _____