

SCIENCE 705

CHEMICAL STRUCTURE AND CHANGE

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SIMPLE SUBSTANCES

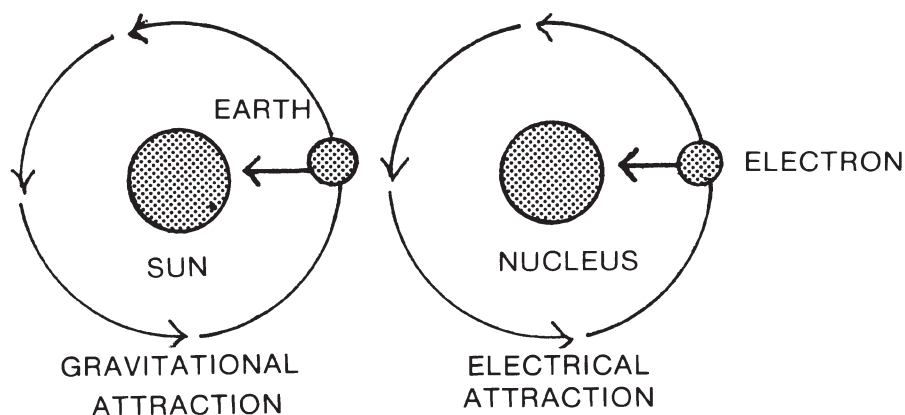
Matter is composed of simple substances. These simple substances are called the chemical **elements**. Men have identified ninety-two chemical elements that occur naturally in the world.

Elements and atoms. During the 1600's Robert Boyle suggested the idea of many elements. Boyle defined the word *element* as a *pure substance that cannot be broken down by chemical means*. For example, pure gold is an element. Pure gold cannot be broken down by chemical means into a

simpler substance. The very smallest particle of an element is called an **atom**. The element gold will have only atoms of gold.

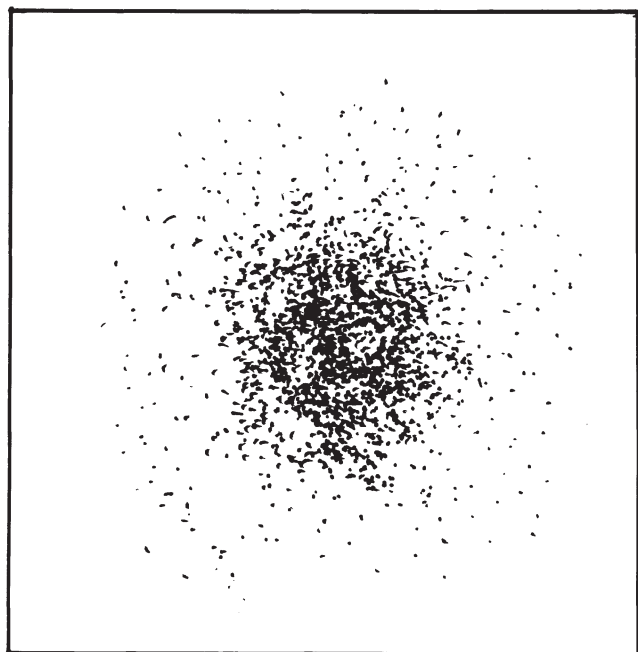
Atoms are so tiny that they cannot be seen. Even with the most powerful microscope, atoms are not visible. The presence of atoms can be verified by X-ray and by chemical reactions.

Models of atoms. Several models have been proposed for the atom.



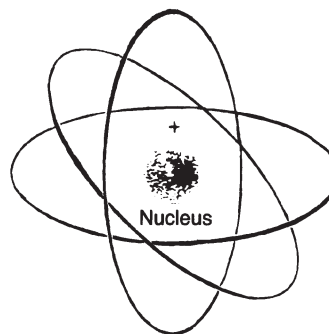
The Planetary Model of an Atom

The planetary model of an atom is made like a model of our sun with its planets. The center of the atom is the nucleus. The electrons that move around the nucleus of the atom are like the planets that move around the sun. This model is a simplified illustration of an atom. It does not fully represent what an atom is like. However, this model is sometimes used because it is simple to understand and convenient and easy to draw.



The Electron Cloud Model

One of the most recent models of the atom is the electron cloud model. This model suggests that the electrons **swarm** around the nucleus. The electron cloud model is difficult to show on paper.



The Simplified Model of an Atom

Still another model is sometimes shown in order to simplify the position of the electrons. This last model of the atom helps to show how the electrons move around the nucleus. None of these models completely explains the marvelously complex atom which God created and only He completely understands, but each model suggests ways the electrons could move around the nucleus.



Match the following items. Write the letters in the blanks.

- | | | |
|------|--|-------------------------|
| 1.10 | _____ composed of simple substances | a. ninety-two |
| 1.11 | _____ cannot be broken down by chemical means | b. electron cloud model |
| 1.12 | _____ very smallest particle of an element | c. planetary model |
| 1.13 | _____ like a model of our sun with planets | d. atom |
| 1.14 | _____ suggests that electrons swarm around the nucleus | e. matter |
| 1.15 | _____ chemical elements that occur naturally in the world. | f. pure gold |
| | | g. pure substance |

MOLECULES AND COMPOUNDS

Atoms rarely exist alone in nature. Atoms are usually combined with other atoms to form **molecules**. Molecules may be defined as the chemical combination of two or more atoms. If the atoms that are combined are different from each other, the result is a **compound**. A molecule is then the smallest part of a compound.

Molecules. Molecules may consist of two or more atoms or even thousands of atoms. In this LIGHTUNIT you will study molecules which are rather simple. The human body contains substances whose molecules are very complex. These complex molecules may consist of thousands of atoms.

Compounds. When atoms of one kind combine chemically with atoms of another kind, they make compounds. For example, when two atoms of hydrogen unite with one atom of oxygen, water is formed. Both hydrogen and oxygen are gases, but they make a liquid compound (water). Water is a compound whose molecules are always made of two atoms of hydrogen and one atom of oxygen. A compound may be defined as a substance whose

molecules consist of atoms which are chemically united.

When you breathe, you inhale oxygen along with other substances found in air. Oxygen does not exist as a single atom of oxygen. It is so reactive that two atoms of oxygen unit to form O_2 . As you breathe out, you exhale a substance known as carbon dioxide. Carbon dioxide is a compound whose molecules consist of one atom of carbon and two atoms of oxygen. The prefix *di-* means *two*. The prefix *di-* tells us that two atoms of oxygen are attached to the carbon atom.

You may have observed bubbles of fizz in soda pop. The fizz is due to carbon dioxide gas dissolved in water. Thus it is called a carbonated drink.

Pure sodium is a metal. Pure chlorine is a gas. When these two substances are combined into a compound they form a salt known as sodium chloride or table salt. The sodium and chlorine in their original forms are very poisonous. When they are chemically combined into salt they are harmless. A compound has its own characteristics. A compound no longer resembles the atoms that go into it.



Try this experiment.

These supplies are needed:

- a copper penny
- iodine solution from your medicine cabinet
- a cotton swab
- a small pan
- a hot plate or heat source





Follow these directions to make a compound. Place a check mark in each box when the step is completed.

- ☐ 1. Before you start, ask the teacher or helper to place a check in the box to indicate if the method of heating the penny is approved.
- ☐ 2. Place the penny in the pan. Swab the top of the penny with iodine.
- ☐ 3. Heat the pan gently just a few seconds until a white substance is formed.
- ☐ 4. The white, dusty material that has formed on top of the coin is copper iodide.

You have chemically combined the elements copper and iodine to make a compound known as copper iodide.



Complete these statements.

- 1.16 The smallest particle of an element is called an_____.
- 1.17 Everything in the world is composed of_____, which has mass and occupies space.
- 1.18 An_____is a pure substance that cannot be broken down into simpler substances by chemical means.
- 1.19 Atoms rarely exist alone in nature. They are usually combined with other atoms to form_____.
- 1.20 In the experiment you have combined copper and iodine to make a compound called_____.



Complete these activities.

- 1.21 When two atoms of hydrogen unite with one atom of oxygen, what compound is formed?_____
- 1.22 When two atoms of oxygen unite with one atom of carbon, what substance is formed?_____
- 1.23 Does the new compound formed from copper and iodine resemble the copper, the iodine, or neither? _____
- 1.24 Define a *compound*. _____

- 1.25 Atoms are so tiny they cannot be seen. How can their presence be verified? _____

- 1.26 If you had some pure gold, the smallest particle of that gold would be an _____.

- 1.27 The smallest particle of a compound is a_____.
- 1.28 In the following chart list the three states of matter. Indicate yes or no in the space for volume and shape.

State of Matter	Is the Volume Fixed?	Is the Shape Fixed?
1.		
2.		
3.		

1.29



Memorize John 1:3. You will be asked to write it from memory later in this LIGHTUNIT. In the space provided write the verse for practice.

- 1.30 In the space provided draw the following models.
- a. Draw a planet revolving around the sun.

b. Draw an electron revolving around the nucleus of an atom. (This drawing is known as the planetary model of the atom.)