

# The difference between a mixture and a compound



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A compound is a chemical substance that consists of several (minimum two) elements. The compound has defined structure, chemical and physical properties. These are typically found in chemistry or physics books. The constituents of the compound can not be separated by physical method, for instance, boiling, freezing, sieving, or gravity thickening. The elements lose their properties when bonded in a compound. The example of a compound is water (H<sub>2</sub>O). It consists of two atoms of hydrogen (H) and one atom of oxygen (O). Two atoms of H and two atoms of O form a different substance, hydrogen peroxide. Hydrogen and oxygen are odorless and explosive gasses, while water is odorless liquid. Other chemical properties of water are different from those of oxygen and hydrogen. At standard atmospheric pressure, its boiling point is 100°C, and freezing point is 0°C.

We obtain a mixture when we mix two or more compounds together. In a mixture, the compounds are not chemically bonded. They preserve their chemical properties. Different mixtures of two (or more) compounds can be mixed in different proportions. The mixture has no chemical properties and can be separated by physical methods. For example, a mixture of sand and salt may be obtained by mixing sand and salt in any proportions. Salt and sand in mixture have the same properties as individual compounds. If we add water to the mixture of sand and salt, sand precipitates, and salt dissolves in water, forming solution of salt (Moore, 2010)

### A Way to Distinguish an Element From a Compound

In most cases, it is impossible to distinguish an element from a compound by sensory evaluation. One needs to examine chemical and physical properties

of pure substance. The chemical properties test includes reaction with water, oxygen, hydrogen, acids, or alkali. One may determine a boiling, melting or freezing point, or test if the substance decomposes when heated (only compounds will). The boiling (melting or freezing) points of all elements and most common compounds (like water, common acids and alkali) can be found in a reference book. If you are not able to find it, the substance is a compound.

In addition, advanced methods of research may be used. These are X-ray spectroscopy, nuclear magnetic resonance, mass spectroscopy (Moore, 2010).

#### The Difference Between an Ionic and a Covalent Bond

Ionic bond is formed when an atom passes its electron to another atom. This can happen between two atoms that significantly differ in their electronegativity, which is an ability to attract electrons. As a result, less electronegative atom forms a positively charged ion (cation), and more electronegative atom turns into a negatively charged ion (anion). The ionic bond is between metal and non-metal, or metals and acid residuals in salts, e. g. sodium chloride (NaCl), or potassium sulphate (K<sub>2</sub>SO<sub>4</sub>) (Houk, 1996).

When atoms do not differ significantly by their electronegativity, a covalent bond is formed. In this case, the electron partially comes to another atom so that atoms share it. Thus, the atoms are bonded by electron they share.

Typically, covalent bond joins two non-metals, for instance H<sub>2</sub>O (water), NH<sub>3</sub> (ammonia), CO<sub>2</sub> (carbon dioxide).

## Why Ionic Compounds are Formed When a Metal from the Left Side of the Periodic Table Reacts with a Nonmetal from the Right Side

Metals are located on the left of the periodic table (Ca, K, Na, Rb, Ba, Al, etc.). They have low electronegativity, thus, they are ready to pass electrons. Non-metals are located on the right of the periodic table (Cl, S, O, P). They possess high electronegativity, which means they are able to pull the electronic cloud from metal. When a metal joins with nonmetal, the latter pulls the electronic cloud and the ionic bond is formed (Houk, 1996).

The examples of ionic bond are barium bromide ( $\text{BaBr}_2$ ) and cesium chloride ( $\text{CsCl}$ ).

## Why Two Nonmetals from the Right Side of the Periodic Table form a Covalent Bond

Nonmetals, located on the right side of the periodic table, have high electronegativity. This enables them to pull the electrons (or electron cloud). If two atoms with high electronegativity meet, none of them is able to allocate the whole electron cloud. Thus, they have to share the electron cloud, which is a covalent bond. This means they join in a compound by forming a covalent bond (Houk, 1996).

The examples of the covalent bond between nonmetals are  $\text{CS}_2$ ,  $\text{NH}_3$ ,  $\text{SO}_2$ .