CHEMICAL COMBINATION OR BONDING

A chemical bond is formed when atoms are held together by attractive forces. This attraction occurs when electrons are shared between atoms, or when electrons are exchanged between the atoms that are involved in the bond. The sharing or exchange of electrons takes place so that the outer energy levels of the atoms involved are filled and the atoms are more stable. If an electron is shared, it means that it will spend its time moving in the electron orbitals around both atoms. If an electron is exchanged it means that it is transferred from one atom to another, in other words one atom gains an electron while the other loses an electron. A chemical bond is the physical process that causes atoms and molecules to be attracted to each other, and held together in more stable chemical compounds.

The type of bond that is formed depends on the elements that are involved. In this section, we will be looking at three types of chemical bonding: covalent, ionic and metallic bonding. You need to remember that it is the valence electrons that are involved in bonding and that atoms will try to fill their outer energy levels so that the care more stable.

The atoms are said to combine together because of the following two main reasons: (i) Concept of lowering of energy

It has tempter to that the agarges of the molecules) are lower in energy than the individual atoms from which they have been formed. This means when the individual atoms combine to form molecules through a bond, the potential energy of the combining atoms decreases and the resulting molecules are more stable than the free atoms. This energy difference between the free atoms and bonded atoms (or molecules) is generally 40kJ mol-1 or more. It follows from this that the process of bond formation between the atoms decreases the energy of the molecule formed from these atoms and forms a system of lower energy and greater stability.

(ii) Electronic theory of valence (the octet rule)

The atoms of the noble gases-helium to radon- do not, except a few cases, react with any other atoms to form the compounds and also, they do not react with themselves. Hence, they stay in atomic form. These atoms are said to have low energy and cannot be further lowered by forming compounds. This low energy of noble gas atoms is associated with their outer shell electronic configuration, i.e. the stable arrangement of eight electrons (called octet). It has also been



Polar and Non-polar covalent compounds

When a covalent bond is formed between atoms of different electronegativity, the more electronegative atom attracts bonding electrons towards itself leading to slight charge separation. Non-polar covalent bonds occur between two identical non-metal atoms, e.g. H₂, Cl₂ and O₂. Because the two atoms have the same electronegativity, the electron pair in the covalent bond is shared equally between them. However, if two different non-metal atoms bond then the shared electron pair will be pulled more strongly by the atom with the highest electronegativity. As a result, a polar covalent bond is formed where one atom will be called higher charge and the other a slightly positive charge. This is there extra using the symbols δ^+ (slightly positive) and δ^- (slightly negative). So, in a molecule such as hydrogen chloride (HCl), hydrogen is H^{δ^+} and chlorine is Cl^{δ^+}

Carbon dioxide and tetrachloromethane have polar bonds due to difference in electronegativity but the bond polarity cancels out because the molecule is symmetrical; therefore, they are called non-polar covalent compounds.

Trichloromethane the bonds are polar but the molecule is unsymmetrical and therefore it is a polar covalent compound.

