Molecular Physics

2020

The molecules:

A molecule is one electrically neutral group of two or more atoms held together by chemical bonds . Molecules are distinguished from ions by their lack of electrical charge .

The term molecule is often used for any gaseous particle regardless of its composition.

According to this definition, noble gas atoms are considered molecules despite being composed of a single non-bonded atom.

Molecular formation:

A molecule is a stable arrangement of two or more atoms. By "stable" is meant that a molecule must be given energy from an outside source in order to break up in to its constituent atoms in other words, a molecule exists because the energy of the joint system is less than that of the system of separate non-interacting atoms. If the interactions among a certain group of atoms reduce their total energy a molecule can be formed if the interactions increase their total energy , the atoms repel one another .

Molecular Orbitals:

Covalent bonding in molecules other than H_2 , diatomic as well as polyatomic is usually a more complicated .

1- The inner electrons is much more tightly bound and hence less responsive to external influences.

2- The repulsive inter atomic forces in a molecule become predominant while the inner shells of its atoms are still relatively for a pant .

Types of bonding:

1- Hydrogen bond :

A hydrogen bond is the attractive interaction of a hydrogen atom with an electronegative atom , like nitrogen , oxygen or fluorine (thus the name "hydrogen bond" , which must not be confused with (a covalent bond to hydrogen) . The hydrogen must be covalently bonded to another electronegative atom to create the bond . These bonds can occur between molecules (inter molecularly) , or within different parts of a single molecule (intra molecularly) . The hydrogen bond is stronger than a Van der Waals interaction , but weaker than covalent or ionic bonds . This type of bond occurs in both inorganic molecules such as water and organic molecules such as DNA .

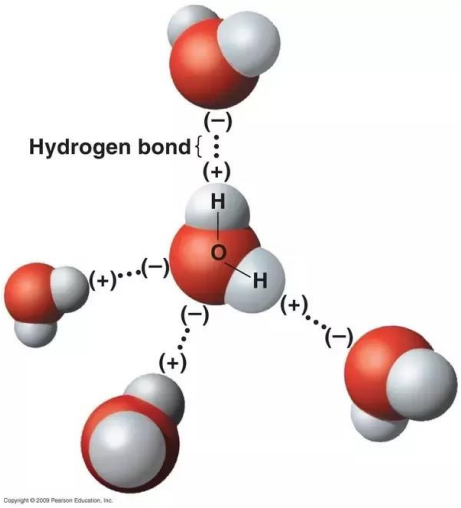

Fig. 1 Model of Hydrogen bonds between molecules of water

2- A covalent bond:

is a form of chemical bonding that is characterized by the sharing of pairs of electrons between atoms , and other covalent bonds . In short , the attraction-to-repulsion stability that forms between atoms when they share electrons is known as covalent bonding .

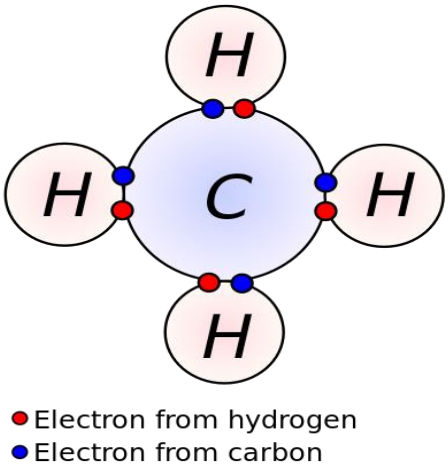

Fig. 2 Covalent molecule (Methane) (CH_4)

3- Ionic bond :

An ionic bond is a type of chemical bond that involves a metal and a nonmetal ion (or polyatomic ions such as ammonium) through electrostatic attraction .

In short , it is a bond formed by the attraction between two oppositely charged ions .

The metal donates one or more electrons , forming a positively charged ion or cation with a stable electron configuration . These electrons then enter the non metal , causing it to form a negatively charged ion or anion which also has a stable electron configuration . The electrostatic attraction between the oppositely charged ions causes them to come together and form a bond .

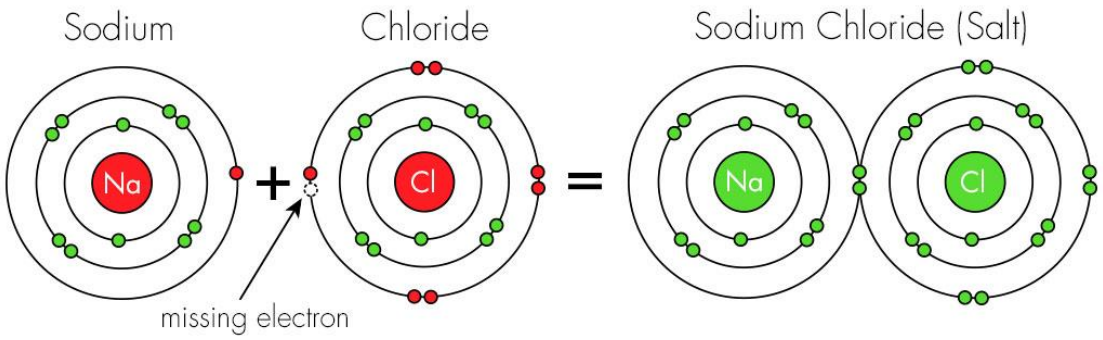

Fig. 3 Sodium and chlorine bonding ionicly to form Sodium Chloride