The chemical Bond–

(10) Lecture–8

1. What is chemical bond. How many chemical bonds are mainly recognized.

Ans: A chemical bond is defined as a force that acts between two or more atoms to hold them together as a stable molecule.

There are three different types of bonds mainly recognized. They are–

① Ionic or Electrovalent bond

② Covalent bond

③ Coordinate covalent bond.

2. Define, explain and give example for ionic, covalent and coordinate covalent bond

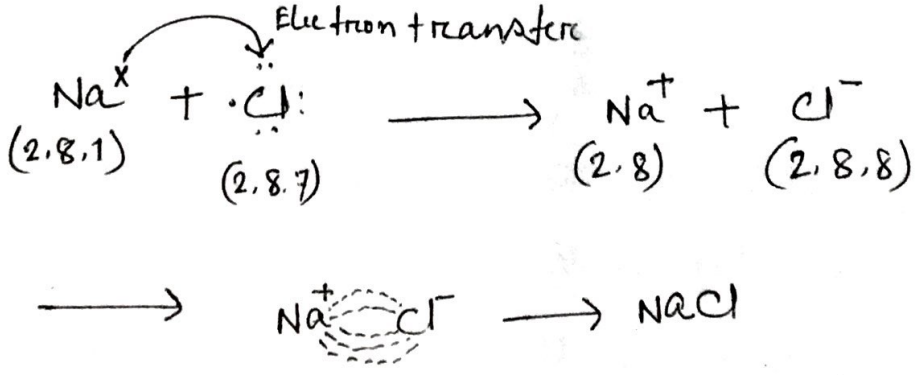
Ionic bond:— The chemical bond formed between two atoms by the transfer of one or more valence electrons from one atom to the other is called ionic bond.

Explanation: one of the combining atoms has excess of electrons than the stable number (2 or 8) in its valence-shell while the other atom is short of electron and hence needs electrons to complete its octet. When they combine, the former surrenders surplus [illegible] to the latter and as a result of this

transfer of electrons, each of the atoms attains the stable configuration of the nearest inert gas. The compounds which contain electrovalent bonds are called ionic compounds.

Example:

Let us consider NaCl molecule. Here Na (2,8,1) transfers its excess one electron to Cl atom (2,8,7) and thus Na atom acquires the configuration of Ne (2,8) and Cl acquires the configuration of Ar (2,8,8). The electron lost by Na atom is accepted by Cl atom and consequently Na atom is converted into a positively charged ion and Cl atom is converted into a negatively charged ion. The two ions thus formed attract each other by electrostatic force of attraction which leads to the formation of an ionic bond between Na^+ and Cl^- ions. Different steps are shown below.



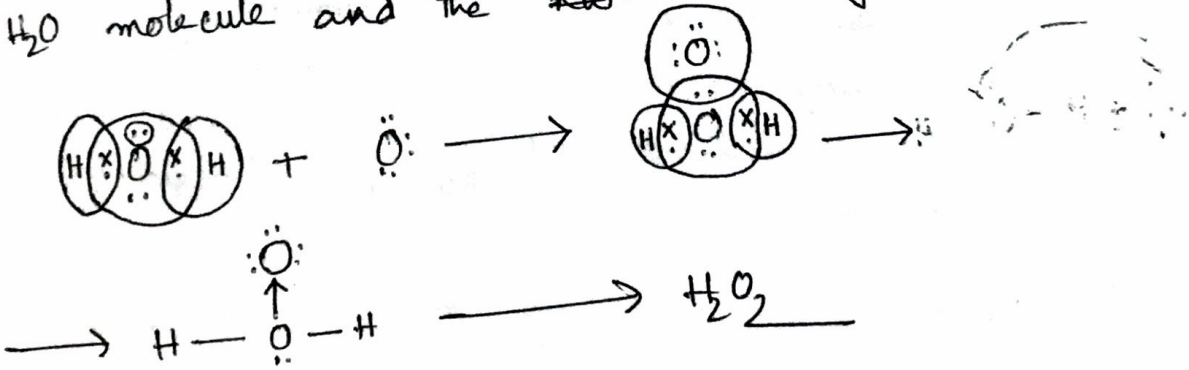
Co-ordinate bond: A covalent bond which is formed by the mutual sharing of two electrons both of which are provided entirely by one of the linked atoms is called a co-ordinate bond. co-ordinate bond is also sometimes referred to as co-ordinate covalent bond. The pair of shared electrons is called lone pair. The atom which furnishes the electron pair is called donor or ligand while the other atom which accepts the electron pair is called acceptor. A coordinate bond is represented by an arrow which points away from the donor to the acceptor.

Explanation: The donor atom has a spare lone pair of electrons on it while the acceptor atom is short of two electrons than the octet in its valence-shell. Donar atom donates its lone pair to acceptor which accepts it. Thus the two electrons of the lone pair which originally belonged to donor atom are now shared by both the atoms and this mutual sharing of electron pair results in the formation of a co-ordinate bond between the two atoms. The arrow indicates the origin of electrons.

Example: H_2O_2 molecule:

This molecule can be regarded as being formed by the combination of H_2O molecule and oxygen atom. oxygen atom of H_2O molecule has two lone pairs of electrons on it.

In the formation of H_2O_2 molecule by the combination of H_2O molecule and oxygen atom one of the two lone pairs on oxygen atom of H_2O molecule is donated to the new oxygen atom and thus a co-ordinate bond is established between oxygen atom of H_2O molecule and the new oxygen atom.



3. Distinguish between ionic, covalent and co-ordinate bond formed.

Ionic bond	Covalent bond	Co-ordinate bond
① Ionic bond is formed by the transfer of electrons from a metal atom which has 1, 2 or 3 valence electrons to a non-metal atom having 5, 6, or 7 valence electrons.	① Covalent bond is formed by sharing two electrons between non-metal atoms having 1, 4, 5, 6 or 7 valence electrons.	① It is formed by the sharing of two electrons between two atoms both electrons coming from one atom
② Ionic bond consists of electrostatic force between cations and anions.	② Covalent bond consists of two electrons that hold the atoms together.	② It consists of an electron pair between the linked atoms.
③ It is a weak bond since the electrostatic force can be broken easily.	③ It is a strong bond, since the paired electrons can not be separated easily.	③ It is also a strong bond, since the paired electrons cannot be separated easily.
④ It is a polar bond.	④ It is a non-polar bond.	④ It is a semi-polar bond.

4. State electronic theory of chemical bond.

As Bohr put forward his model of the atom, so electronic configuration of elements was known. G.N. Lewis and W. Kossel, working independently, used this knowledge to explain "why atoms joined to form molecules. They visualised that noble gas atoms had a stable electronic configuration. While atoms of all other elements has unstable or incomplete electronic configuration. In 1916, they gave the electronic theory of chemical bond. It states that:

In chemical bond formation, atoms interact by losing, gaining or sharing of electrons so as to acquire a stable noble gas configuration. Each noble gas except helium, has a valence shell of eight electrons. While atoms of noble gases - possess a stable outer shell of eight electrons or octet, atoms of most other elements have incomplete octets. They may have less than 8 electrons or in excess. Atoms interact by electron-transfer or electron-sharing, so as to achieve the stable outer shell of eight electrons. The tendency for atoms to have 8 electrons in the outer shell causes chemical bonds between the atoms.

The Chemical Bond—

(1b) Lecture—8

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