CHEMICAL BONDING – 02

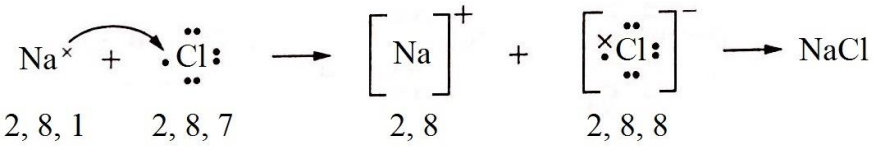
COMPUTER SCIENCE – (SECTION – B)

31 – 03 – 2021 (4TH PERIOD)

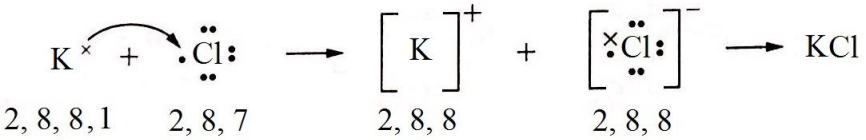
ELECTROVALENT BOND (IONIC BOND):

A bond formed by the complete transfer of one or more electrons from a highly electropositive metal atom to a highly electronegative non-metal atom is called electrovalent bond or ionic bond and the compounds formed in this way are called ionic or electrovalent compounds. For example: NaCl, KCl, KBr, MgO, $CaCl_2$, MgF_2, Na_2S etc.

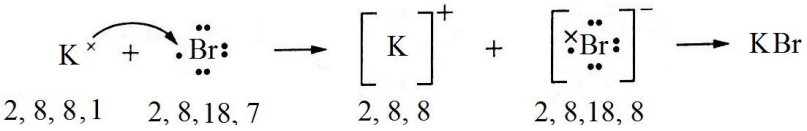
Formation of Sodium Chloride (NaCl):



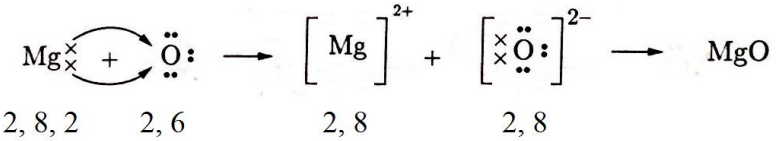
Formation of Potassium Chloride (KCl):



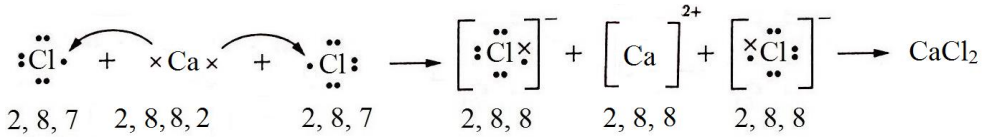
Formation of Potassium Bromide (KBr):



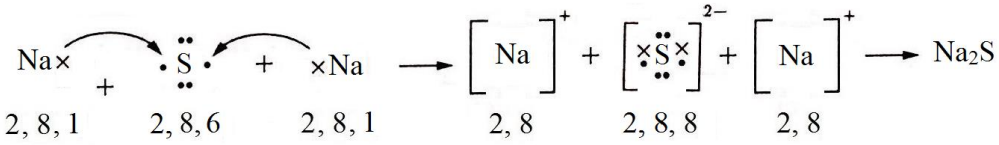
Formation of Magnesium Oxide (MgO):



Formation of Calcium Chloride ($CaCl_2$):



Formation of Sodium Sulphide (Na_2S):



CHARACTERISTICS OF ELECTROVALENT (IONIC) COMPOUNDS

1. Ionic compounds are usually crystalline solids.
2. These compounds are generally hard and brittle.
3. The melting and boiling points of these compounds are generally high.
4. These compounds are generally soluble in polar solvents such as water.
5. These compounds are insoluble in non-polar solvents i.e. organic solvents like Alcohols, Benzene, Carbon tretrachloride, Chloroform, Acetone etc.
6. These compounds produce ions in their molten states as well as in their solution.
7. These compounds conduct electricity in their solutions as well as in their molten states.
8. Ionic compounds do not conduct electricity in their solid states.
9. These compounds generally have high heats of fusion.
10. These compounds generally have high density.

Electrovalency:

The number of electrons either lost or gained by an atom so as to acquire stable inert gas configuration during the formation of electrovalent bond is called electrovalency.

Types of Electrovalency:

The elements whose atom lose electron(s) show positive electrovalency and the elements whose atom gain electron(s) show negative electrovalency. Generally, positive and negative signs are not used in practice and only the number is taken to represent electrovalency. However, the electrovalency is considered to be of the following two types.

1. **Positive Electrovalency**: The number of electrons being lost by an atom of an element so as to acquire stable noble gas configuration during the formation of electrovalent is called its positive electrovalency. For example:

(a) Sodium (Na) atoms undergo loss of one electron to complete its octet in the valence shell and attain stable electronic configuration of the nearest noble gas, neon (2, 8). Thus, electrovalency of sodium is +1.

$$\underset{2,8,1}{Na} \longrightarrow \underset{2,8}{Na^{+}} + e^{-}$$

(b) Calcium (Ca) atoms undergo loss of two electrons to complete its octet in the valence shell and attain stable electronic configuration of the nearest noble gas, argon (2, 8, 8). Thus, electrovalency of sodium is +2.

$$\underset{2,8,8,2}{Ca} \longrightarrow \underset{2,8,8}{Ca^{++}} + 2e^-$$

(c) Aluminium (Al) atoms undergo loss of three electrons to complete its octet in the valence shell and attain stable electronic configuration of the nearest noble gas, neon (2, 8). Thus, electrovalency of aluminium is +3.

$$\underset{2,8,3}{Al} \longrightarrow \underset{2,8}{Al^{3+}} + 3e^-$$

2. Negative Electrovalency: The number of electrons being gained by an atom of an element so as to acquire stable noble gas configuration during the formation of electrovalent is called its negative electrovalency. For example:

(a) Fluorine (F) atoms undergo gain of one electron to complete its octet in the valence shell and attain stable electronic configuration of the nearest noble gas, neon (2, 8). Thus, electrovalency of fluorine is –1.

$$\underset{2,7}{F} + e^- \longrightarrow \underset{2,8}{F^-}$$

(b) Sulphur (S) atoms undergo gain of two electrons to complete its octet in the valence shell and attain stable electronic configuration of the nearest noble gas, argon (2, 8, 8). Thus, electrovalency of sulphur is –2.

$$\underset{2,8,6}{S} + 2e^- \longrightarrow \underset{2,8,8}{S^{--}}$$

(c) Nitrogen (N) atoms undergo gain of three electrons to complete its octet in the valence shell and attain stable electronic configuration of the nearest noble gas, neon (2, 8). Thus, electrovalency of nitrogen is –3.

$$\underset{2,5}{N} + 3e^- \longrightarrow \underset{2,8}{N^{3-}}$$

COVALENT BOND

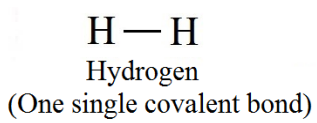
A bond formed by the mutual sharing of electrons between two similar or dissimilar atoms is called covalent bond or molecular bond and the compounds thus formed are called covalent compounds.

Types of Covalent Bonds

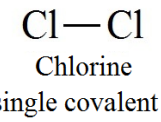
The covalent bonds may classified as below.

A. Classification based upon the number of shared pair: On the basis of the number of electron pairs shared between the two combining atoms, the covalent bonds are of the following three types.

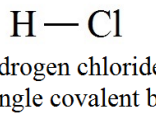
(i) **Single covalent bond**: When only one electron pair is shared between the two combining atoms (either same or different), then the covalent bond formed between the combining atoms, is called single covalent bond. The single covalent bond is represented by a single line (—) between the two combining atoms. Molecules of hydrogen (H_2), chlorine (Cl_2), hydrogen chloride (HCl), water (H_2O), ammonia (NH_3), methane (CH_4), carbon tetrachloride (CCl_4) etc. are the examples involving single covalent bonds. The single covalent bond in hydrogen molecule is shown below.



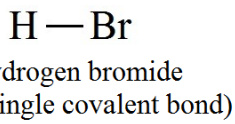
Hydrogen
(One single covalent bond)



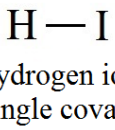
Chlorine
(One single covalent bond)



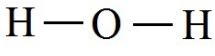
Hydrogen chloride
(One single covalent bond)



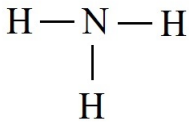
Hydrogen bromide
(One single covalent bond)



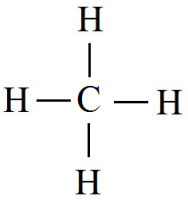
Hydrogen iodide
(One single covalent bond)



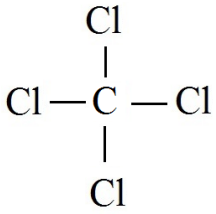
Water
(Two single covalent bonds)



Ammonia
(Three single covalent bonds)

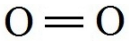


Methane
(Four single covalent bonds)

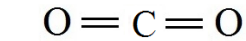


Carbon tetrachloride
(Four single covalent bonds)

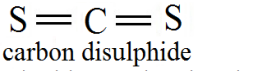
(ii) **Double covalent bond**: When two electron pairs are shared between the two combining atoms (either same or different), the covalent bond formed between them is called double covalent bond. The double covalent bond is represented by a double line (═) between the two combining atoms. Molecules of O_2, CO_2, Cs_2, C_2H_4 etc. involves double covalent bonds.



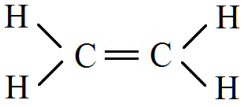
Oxygen
One double covalent bond



Carbon dooxide
Two double covalent bonds



carbon disulphide
Two double covalent bonds

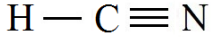


Ethene
One double covalent bond

(iii) Triple covalent bond: When three electron pairs are shared between the two combining atoms (either same or different), the covalent bond formed between them is called triple

covalent bond. The triple covalent bond is represented by a triple line (≡) between the two combining atoms. Molecules of N_2, HCN, C_2H_2 etc. involves triple covalent bonds.

Nitrogen
One triple covalent bond



Hydrogen cyanide
One triple covalent bond

Ethyne
One triple covalent bond