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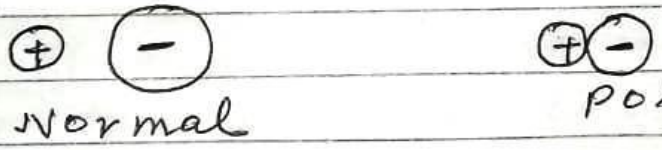
For Deg II chem. Hons Paper III &
Deg II chem. Sub. Course

## Fajan's rule :-

When a cation, approaches an anion and comes very close to the nucleus of anion undergoes repulsion whilst there is an attraction of the cation for the electron atmosphere of the anion. This causes a deformation or Polarisation of the anion




Similarly the approach of anion in the vicinity of the cation causes to Polarisation of the cation.

This phenomenon shows that transition between electrovalence and covalence is gradual and electrovalency passes into covalency when the attraction is sufficiently large and the distortion is to such a large extent that some of the electrons instead of being

associated with one of the ions are shared by both of them.

The increased covalency is favoured by a number of factors which are incorporated in Fajan's Rule. These are —

(1) Large charge on either anion or cation causes increased Polarisation.

(2) A small cation has a greater Polarisation effect upon an anion than a large cation.

(3) Large anions are more Polarisable than small anions

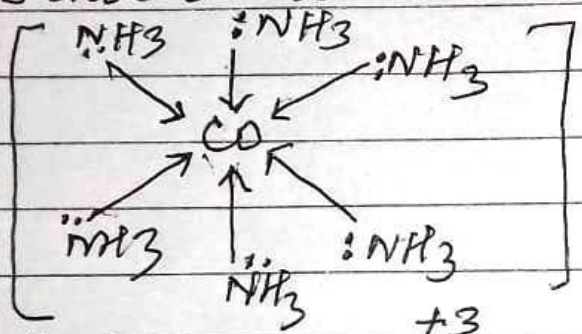
(4) Cations with 18 electron structures (e.g - Cu, Ag, Au) effect Polarisation deformation than those of inert gas or 8 electron structures (e.g Na, K, Rb)

## Effective atomic number (E.A.N) Theory of Complex Compound

With the help of this theory Sidgwick explained the stabilities and Properties of the complex compound. He introduced the term E.A.N to denote the total number of electrons around an atom after combination in a complex compound. He Pointed out that the EAN of Central atom in a complex is either equal to or very nearly equal to the atomic number of the nearest inert gas.

Sidgwick further observed that all the molecules or ions which Co-ordinate to metal ion (ie to behave as ligands) have atoms with atleast one unshared electron Pair in their Structure which is donated to the Central metal ion in the formation of bond. Thus according to Sidgwick Werner's Secondary Valencies are the special form of the Covalent bond

to which he called a co-ordinate bond. Thus according to sidgwick the cobaltic ammonia complex is represented as below —




(1) In $[Co(NH_3)_6]^{+3}$ complex (2) In ferrocyanide complex $[Fe(CN)_6]^{4-}$

$Co^{+3}$ — 24 electrons

6 $NH_3$ donate 12 electrons

EAN = 36 = Kr (36)

$Fe^{+2}$ — 24 electrons

6 $CN^-$ donate 12 electrons

EAN = 36 electrons

Defects :—

(1) This concept is not universally applicable. In case of $K_2[Ni(CN)_4]$ complex and other complexes the EAN concept does not hold good.

$Ni^{++}$ — 26 electrons

4 $CN^-$ donate 8 electrons

Total 34 electrons ≠ 36 (Kr (36))

(2) It cannot explain the directional nature of bonds. These are drawbacks of this theory.