Chemical Bonding

Fajan's rule

Dr. B. Kavitha

Assistant Professor

PG and Research Department of Chemistry

C.P.A. College, Bodinayakanur

Fajan's rule:

The rule regarding polarizion are known as Fajan's rule. These are given below

Large charge either on anion or cation:

- The cation with higher positive charge attracts the electron cloud of the anion more strongly towards itself than the cation with smaller positive charge and hence polarizes the anion more strongly.
- Consequence higher the positive charge on the cation greater its polarizing power to polarize a given nearly anion.
- For example:
- Polarizing power of cation :
- $Li^{+} < Be^{2+} < Al^{3+} < C^{4+}$
- An anion with higher negative charge repels the electrons cloud of its outermost shell towards the cations more effectively and hence is polarized by the cation more strongly.
- Consequently higher the negative charge on the anion more strongly it will be polarized by a given cation i.e., more will be its polarisibility.

For example

Polarising of anions :$C^{4-} > N^{3-} > O^{2-} > F^{-}$

Size of the cation:

- The nucleus of a smaller cation is shielded to a lesser extent by the electron shell. Therefore such a cation attracts the electron cloud of the anion more strongly than a larger cation.
- This means that smaller is the size of the cation, higher is its polarizing power to polarize a given near by anion.
- For example:
- polarisibility of cations
- $Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}$

Size of the anion :

- The electron of the outer most shell of a larger anion are less firmly bound to its nucleus and hence can be withdrawn by the cation more easily than a smaller anion.
- This means that larger is the size of the anion , more strongly (or) easily 'it will be' polarised by a given cation.
- For example

Polarisibility of halide ions

$F^- < Cl^- < Br^- < I^-$

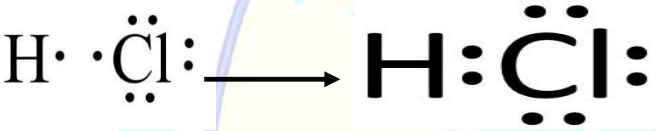
4) Electron configuration of the cation:

- The cations with 18 electrons structure have been found to effect greater anion deformation than those with inert gas structure (8 electrons structure) even if the same size and charge are taken.
- For example consider two different cations like cu^+ and Na^+ which have nearly the same size (cu^+=0.96Å and Na^+= 0.95Å) and same charge(+1) but have different valence shell electronic configuration.
- Cu^+ has 18 electron valance shell
- Configuration – (cu^+ $3s^2p^6d^{10}$) Na^+ has 8 electron valence shell configuration (Na^+ $2s^2p^6$)

Covalent bond:

Lewis concept of covalent bond:

- In 1916 G.N. Lewis suggest that atoms may combine with one another by sharing of electrons their valency shell so that the combining atoms attain the nearest noble gas configuration in their valency shells this type of linkage is called covalent linkage (or) covalent bond.
- For example, hydrogen and chlorine atoms share one electron each to form HCl.



(or) H-Cl

- In this process while H-atom acquires electronic configuration of He, Cl – atom acquires electronic configuration of the nearest noble gas Argon.

According to Lewis concept , the number of electrons which an atom contributes for sharing n a covalent bond is called its covalently. Thus, covalence of H, Cl and O is 1, 1 and 2