SUBJECT- CHEMISTRY
CLASS - BSc (SUBSIDIARY) PART-I
GROUP - B
TOPIC - Valence bond theory

Dr Hari Mohan prasad Singh
Department of Chemistry
Dr. L. K. V. D College Tajpur Samastipur

Valence Bond Theory (VBT): This theory was proposed by Heitler-London, Pauling and Slater in 1927. followings are the main points of This theory -

1 It deals with the electronic Configuration of elements.
2 The valency of an element is the number of unpaired electrons present in valence shell of its atom.
3 The paired electrons of the valence shell usually do not pasticipate in bonding. They can pasticipate only when they are unpaired. The energy released in the formation of a bond provides the energy required to unpair such electrons so that these electrons get excited and finally accommodated in the empty orbitals of the same shell.
4 The covalent bond formation occurs by pairing of electronic spins and overlapping of appropriate orbitals. The overlapping of orbitals leading to the formation of a covalent bond is not possible if such orbitals have parallel electronic spins.
5 Greater the overlapping of orbitals, the stronger is the bond. Hence the valence orbitals of the element undergo proper hybridisation prior to the bond formation. Bond length, bond angle and thus The structure of molecules are governed by the type of hybridisation
(6) During the overlapping of orbitals, the unpaired electrons are paired to form a covalent bond. Thus the bond pair of electrons is localised to give a region of common electron density between

Scanned with CamScanner

Combining atoms of the molecules.

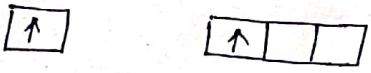
formation of $BeCl_2$: $BeCl_2$ has the central atom Be. The electronic Configuration of Be is given as:

Be_4 : $1s^2\ 2s^2$ $2p^0$

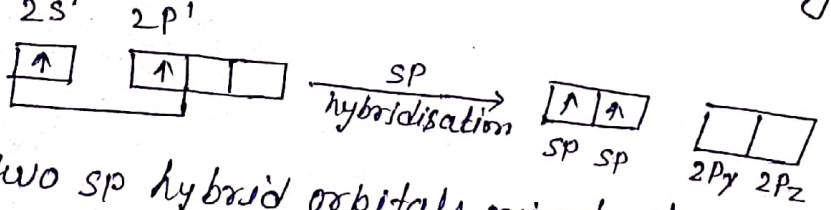
Ground state 

Since Be has no unpaired electron, hence it is expected to form no bond. But it forms two bonds. This much can be explained by Considering the excited state electronic Configuration of Be:

Be: $2s^1$ $2p^1$

Excited state 

Now, Be can form two bonds as it has two unpaired electrons. But one of the electron is obtained from 2s and another from 2p, hence it is expected to form two types of bonds. Actually, these two bonds of Be are identical. Hence Be undergoes sp hybridisation.

Be 

These two sp hybrid orbitals orient at an angle of 180° to give linear structure, Therefore Be forms two identical Covalent bonds with two Cl-atoms by the overlap of sp-orbital of Be and 3Px-orbital of Cl-atom leading to the formation of $BeCl_2$

Cl_{17} [10] $3s^2\ 3p_x^1\ 3p_y^2\ 3p_z^2$

$Cl \xrightarrow[3p_x - sp]{\sigma} Be \xrightarrow[sp - 3p_x]{\sigma} Cl$

Hence $BeCl_2$ has the linear structure.

Scanned with CamScanner