

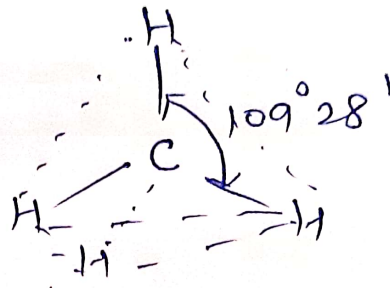
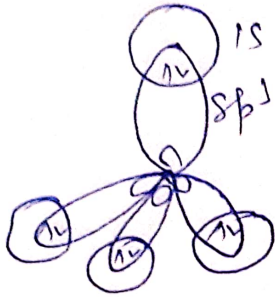
sp³-hybridisation

one s & three p-orbitals combine together to form four degenerate sp³ hybrid orbitals, used to form four σ-bonds having tetrahedral shape & structure of the molecule.

e.g. let us consider the formation of CH₄-molecule

C-atom in ground state → $\begin{array}{|c|} \hline 2s \\ \hline \uparrow\downarrow \\ \hline \end{array} \quad \begin{array}{|c|c|c|} \hline 2p \\ \hline \uparrow & \uparrow & \uparrow \\ \hline \end{array}$

C-atom in ex. state → $\begin{array}{|c|c|c|c|} \hline \uparrow & \uparrow & \uparrow & \uparrow \\ \hline \end{array}$
sp³-hybridisation.



structure - Tetrahedral
shape - " "
B.A. = 109° 28'

Similarly in higher alkanes tetrahedral carbon atoms are joined together, having a zig-zag structure. For simplicity they are written in one plain.

If the central carbon atom consists of lone pair of electrons, then the shape of the molecule is not a regular tetrahedron rather it is distorted and may be predicted by VSEPR theory.

S.W.R

Valence Shell Electron Pair Repulsion Theory (VSEPR)

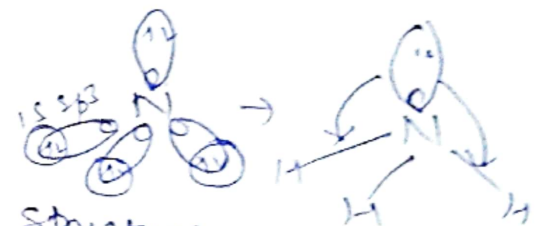
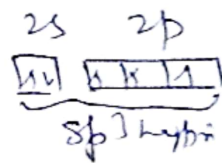
(Nyhholm & Gillespie; 1957)

- (i) If the central atom is surrounded by bond pairs of electrons only, the repulsions between them are similar. As a result the shape of the molecule is symmetrical and molecule is said to have a regular geometry.
- (ii) If the central atom is surrounded by bond pairs as well as lone pairs of electrons, the repulsions between them are different. As a result, the molecule has an irregular or distorted geometry.
- (iii) The order of repulsions between electron pairs is :-
 Lone pair - Lone pair > Lone pair - Bond pair > Bond pair - B.P.
- (iv) The exact shape of the molecule depends upon the total no. of electron pairs present round the central atom.

e.g. 1) NH_3 , H_2O , CH_3^- , $\text{CH}_3\text{-CH}_2^-$; $\text{R}_3\text{C}^- \dots \text{etc.}$

In NH_3 .

N-atom in ex. state \rightarrow

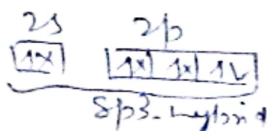


Structure - Tetrahedral
 shape \rightarrow Trigonal pyramidal
 B.A $\approx 107^\circ$

In H_2O , due to two L.P.
 its shape becomes angular \rightarrow
 B.A $\approx 105^\circ$

In CH_3^- (Methyl carbanion)

C-atom in ex. state \rightarrow



due to one L.P. its
 shape becomes pyramidal



(x \rightarrow electron of H-atom)