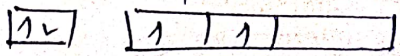
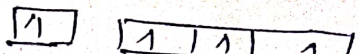
sp^3 - hybridisation :→ By the combination of one s and three p-orbitals, four sp^3-hybrid orbitals are formed, inclined at an angle of 109°28', to form four σ-bonds, having tetrahedral structure and shape. e.g. By this concept the structure and shape of organic molecules like CH_4, $CHCl_3$, CH_2Cl_2, CCl_4, C_2H_6, --etc and inorganic molecules like NH_3, NX_3(X=F, Cl, Br, I), PX_3(X=Cl, Br, I), H_2O, H_2S --etc can be predicted.

e.g **CH_4** :- C-atom in ground state → $2s^2$ $2p^2$

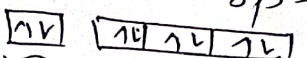


C-atom in excited " →



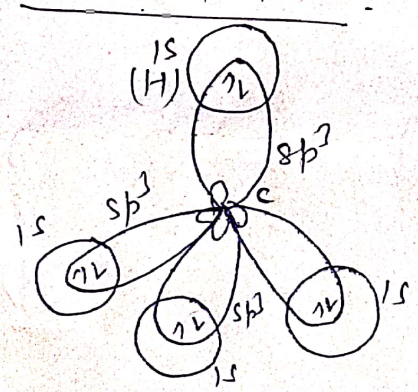
sp^3-hybrid.

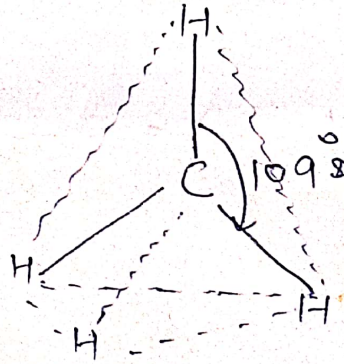
C-atom in CH_4-molecule →



sp^3-hybrid

Orbital picture :-





Bonding Parameter

Structure → Tetrahedral
Shape → "
Bond angle → 109°28'

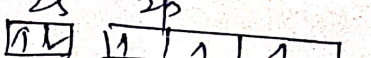
If the molecule consist of lone pair, then shape becomes distorted, due to repulsive interactions as per VSEPR-theory. Higher the repulsion, higher is the deformation, which has the order :-

L.P - L.P > L.P - B.P > B.P - B.P. (L.P = Lone pair, B.P = Bond ")

e.g. The shape of NH_3 is pyramidal, H_2O is angular as shown below :-

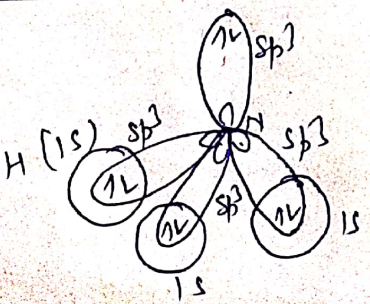
NH_3

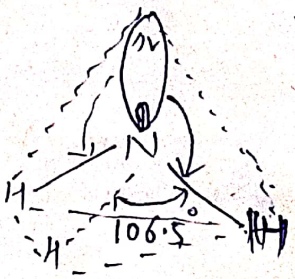
N-atom in excited state → $2s^2$ $2p^3$



sp^3-hybrid.

Orbital Pict.





Struct → Tetrahedral
Shape - Pyramidal
B.A = 106.5°