* CHEMICAL BONDING

Page No.
Date: / /

Structure and reactivity → Carbon forms a large no. of compounds due to the following reason:-

(i) Tetra-valency → The ability of the C-atom to form 4 covalent bond is called its tetra valency.

(ii) Catnation property → The self linking property of C-atom is called its catnation property. This is due to the very high bond energy (84 — 86 k cal per mole of C-C.

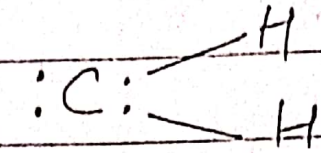
(iii) Its smaller size and high electronegativity favours multiples bond with heteroatoms and also with other C-atoms i.e

$>C=C<$
$>C=O$
$>C=N$
$-C=C-$
$-C\equiv N$
$>C=S$

* Explanation of Tetra valency of Carbon →

Acc. the valency bond theory carbon should form only two Co-valent bonds because it has only two unpaired electrons in its valence shell, so its smallest compound

should be methylene (CH_2), which is highly unstable.



But none of the Compound is known in which carbon atom is not tetravalent it means the paired electrons of the valence shell all takes parts in bonding which can be explained by the Concept hybridisation.

* **Hybridisation :** →

The phenomenon of mixing atomic Orbitals having different energy levels to give the new orbitals (hybrid orbitals) having equivalent energy level is known as hybridisation. The no. of hybrid orbitals remains the same as the participating atomic orbitals.

* **Types :** →

Depends upon the participating orbitals, it is of the following kinds :-

(i) sp (ii) sp^2
(iii) sp^3 (iv) sp^3d
(v) sp^3d^2 (vi) sp^3d^3

* Application :→

By the concept of hybridisation the tetra valency of carbon as well as structure of its compound can be explained as under.

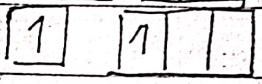
(i) * sp → 1S + 1p → two hybridised orbitals

e.g. $BeCl_2$, C_2H_2, CO_2

$BeCl_2$

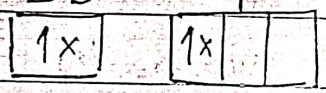
Be atom in ground state → $2S^2\ 2p$

Be atom in excited state



sp hybridised

Be atom in $BeCl_2$ molecule



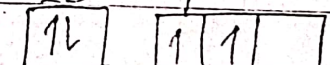
sp hybrid'd

Cl – Be – Cl

Str. A shape is linear (Cl-Be-Cl) = 180°

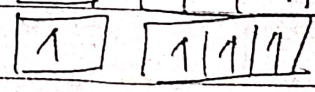
* CO_2

C atom in ground state → $2S^2\ 2p^2$



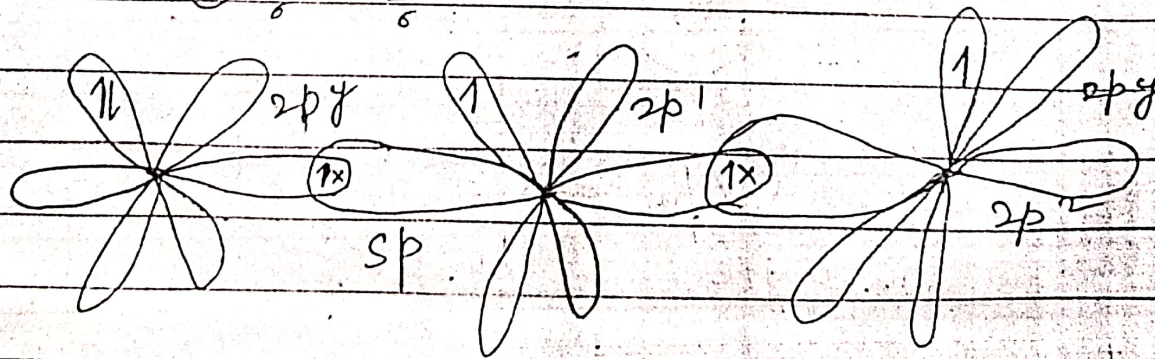
" " " excited state →

" " " CO_2 molecules →



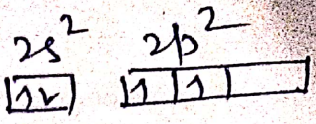
O ⩵ C ⩵ O

(σ) (σ)

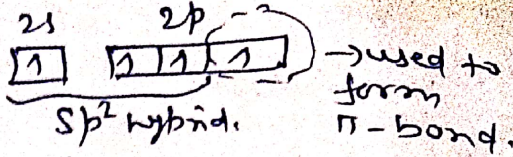


(ii) C_2H_4 (Ethene) (ex. of sp^2 hybridisation)

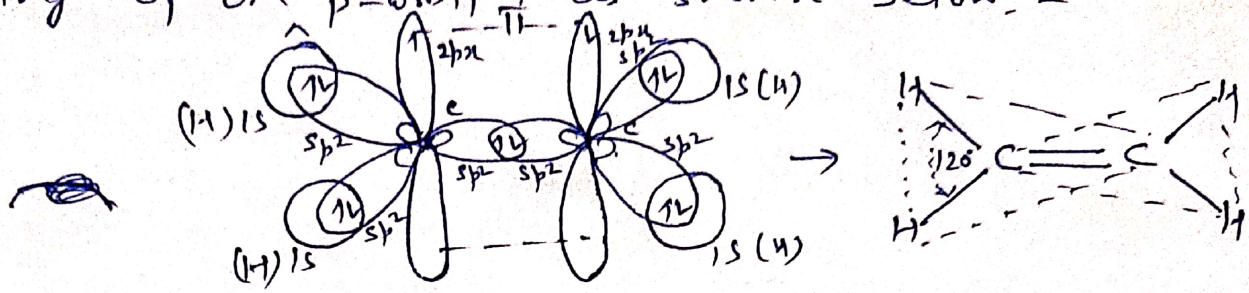
C-atom in the ground state → $2s^2$ $2p^2$



C-atom in ex. state →



So each carbon forms three σ-bonds and one π-bond is formed to complete the octet by lateral overlapping of one half filled p-orbital as shown below:-



Bonding Parameter

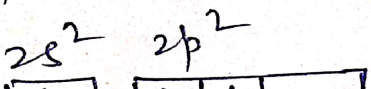
Structure → Traingular planar

Shape → ''

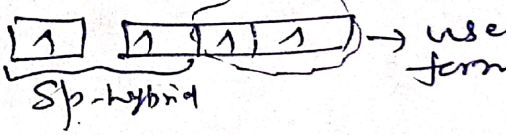
Bond angle → 120°

(iii) C_2H_2 (Ethyne) (ex. of sp-hybridisation)

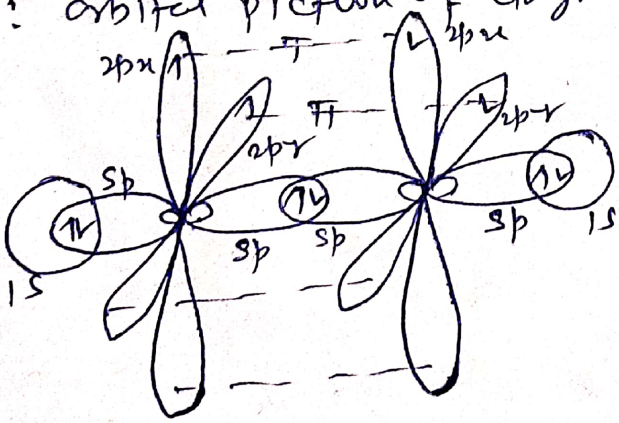
C-atom in gr. state →

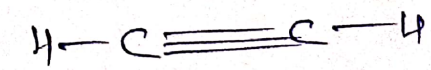


C-atom in ex. state →



∴ orbital picture of ethyne is →



→ 

∴ Structure - Linear

Shape → ''

Bond angle = 180°

So it looks like pineapple as