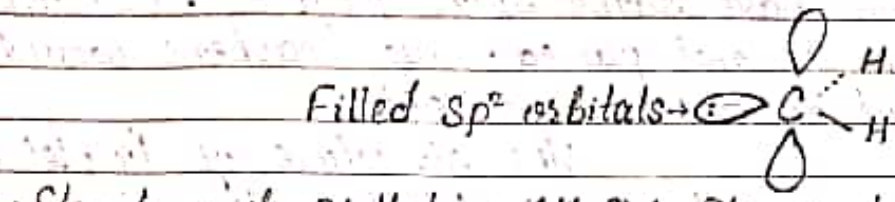
CARBENES

Carbenes are neutral species having a C-atom w two bonds and two electrons.

$-\ddot{C}-$ for example : Methylene ($H_2C:$)

Carbenes are highly reactive. They act as strong electro iles because they can accept a pair of electrons to com lete their outer shell.



Structure of Methylene ($H_2C:$). The C-atom is Sp^2 hybrid ed.

Carbenes may be generated in a number of ways :

(1) By reaction of chloroform in the presence of a stron alkali (for example alkoxides)

$$CHCl_3 + RO^- \longrightarrow ROH + :\bar{C}Cl_3$$

$$:\bar{C}Cl_3 \longrightarrow :CCl_2 + :\bar{C}l$$

(2) By decomposition of diazomethane or ketene in the presence of UV ~~rays~~ light.

$$H_2C=\bar{N}=\bar{N} \xrightarrow{UV} H_2C: + N_2$$

Diazomethane

$$H_2C=C=O \xrightarrow{UV} H_2C: + CO$$

Ketene

An important reaction of carbenes is their additi to a C-C double bond to form a cyclopropane deriv

$$CH_3-CH=CH_2 + CH_2N_2 \xrightarrow{UV} CH_3-\overset{CH_2}{\overset{/\quad\backslash}{CH}}-CH_2 + N_2$$

Propene Diazomethane Methyl cyclopropan

Carbenes are of two types :

(1) Singlet : When both the electrons go into one tal and have opposite spin (antiparallel).

The singlet state is actually fo to have H-C-H bond angle 103° (between 90° to 12

and C-H bond length of 1.12 Å. It is generally considered as the less stable.

$-\ddot{C}- \rightleftharpoons CH_2: \rightleftharpoons {}^{H}_{H}\!>\!C \ (103°) \rightleftharpoons {}^{R}_{R}\!>\!C$ (N)

(ii) Triplet: When the two electrons go into different orbitals and have same spin (parallel), i.e., unshared electrons are not paired. Such carbene would have a permanent magnetic moment.

The structure of triplet carbene is linear with H-C-H bond angle 180° and a C-H bond length of 1.03 Å. It might be considered as a free radical and is more stable.

$-\dot{C}- \rightleftharpoons CH_2: \rightleftharpoons H-\dot{C}-H \ (180°) \rightleftharpoons R-\dot{C}-R$