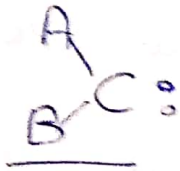


9. Carbenes - * Carbenes are neutral intermediates

having bivalent Carbon, in which a Carbon atom is covalently bonded to two other groups and has two valency electrons distributed between two non-bonding orbitals.

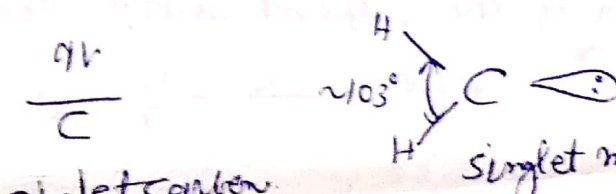
Carbenes are of two types ① Singlet ② Triplet



Two electrons are spin paired
↓
Sins of the electron are parallel.

Structure - A singlet carbene has bent sp^2 hybridisation in which the paired electrons occupy the vacant sp^2 orbital.

* In singlet both ^{↑↓} electrons go into one orbital.

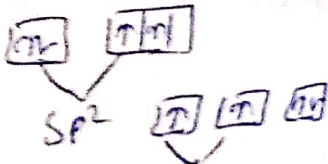


singlet methylene.

This configuration is resemble with Carbocation

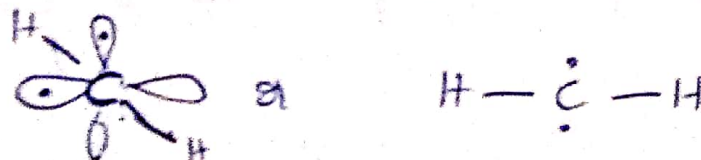
$1s^2 2s^2 2p^2$

singlet carbon



Triplet - A triplet carbene can be either bent sp^2 hybrid
In triplet carbene Carbon atom is sp hybridized and it is linear or nearly linear species.

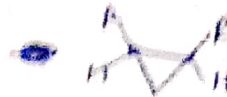
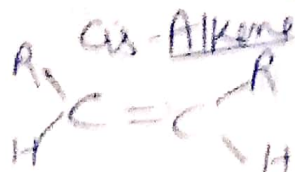
* The two sp hybrid orbitals are used in bond formation. The pure p -orbitals p_y and p_z lying perpendicular to each other have one electron each. bond angle = 180°



* In triplet electrons are unpaired, it might be considered as diradical.

addition of Carbenes to alkenes

(2)



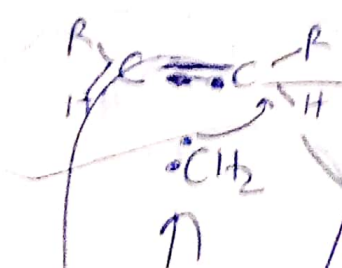
$\downarrow +CH_2$

Singlet methylene

one step addition

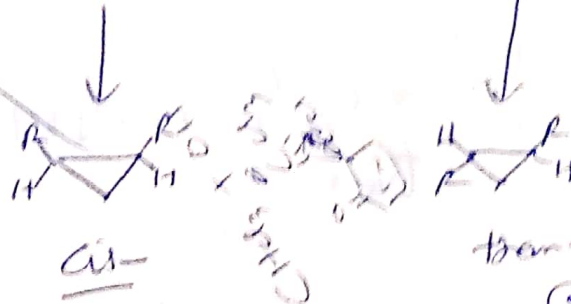
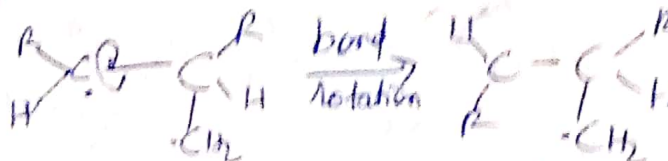
Cis-Dialkylcyclopropane

Where Carbene is Triplet $\rightarrow$



Triplet electrons are unpaired.

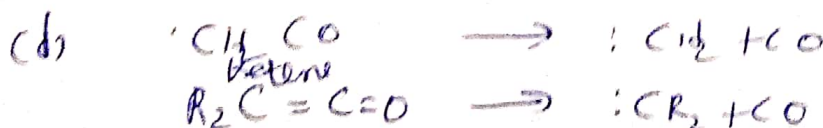
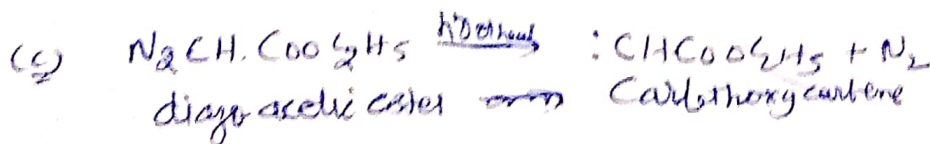
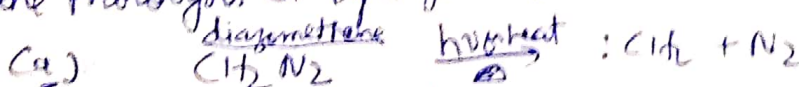
Consequently it reacts with an alkene in a stepwise process.



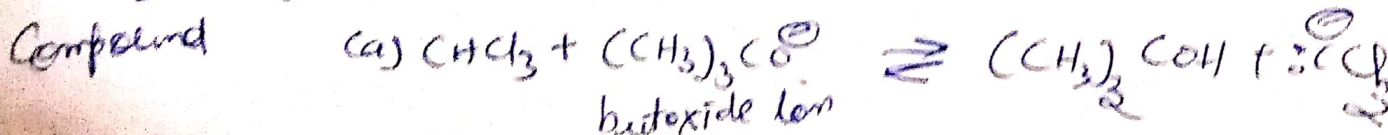
trans-Cyclopropane

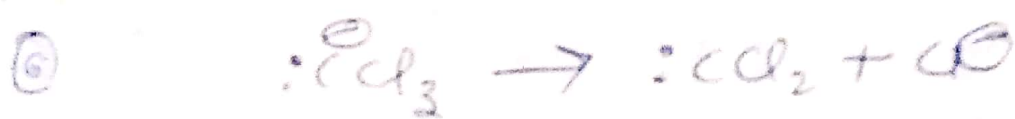
Generation of Carbenes may be generated by the following two methods:-

(I) By the Photolysis or Pyrolysis of the aliphatic diazo compounds or ketones



(II) By the action of a base on a suitable polyhalogen compound





Reactions:- Addition to alkenes:-

