

Attacking reagents.

Most of the attacking reagents carry either a positive or a negative charge. The positively charged reagents attack the regions of high electron density in the substrate molecule while the negatively charged reagents will attack the regions of low electron density in the substrate molecule. The fission of the substrate molecule to create centers of high or low electron density is influenced by attacking reagents. Most of the attacking reagents can be classified into two main groups.

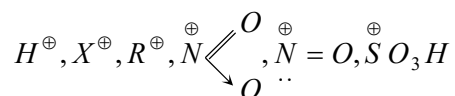
- (1) Electrophiles or electrophilic reagents.
- (2) Nucleophiles or nucleophilic reagents.

(1) **Electrophiles:** Electron deficient species or electron acceptor is electrophile.

It can be classified into two categories:

(i) Charged electrophiles (E^{\oplus}), (ii) Neutral electrophiles (E)

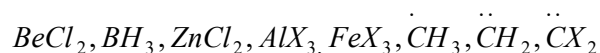
(i) **Charged electrophiles:** Positively charged species in which central atom has incomplete octet is charged electrophile.



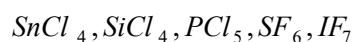
Note: All cations are charged electrophiles except cations of IA, IIA group elements, Al^{+++} and NH_4^{\oplus}

(ii) **Neutral electrophiles:** It can be classified into three categories,

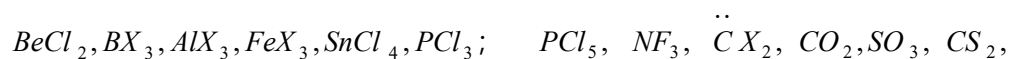
(a) Neutral covalent compound in which central atom has incomplete octet is neutral electrophile,



(b) Neutral covalent compound in which central atom has complete or expanded octet and central atom has unfilled -d-sub-shell is neutral electrophile,



(c) Neutral covalent compound in which central atom is bonded only with two or more than two electronegative atoms is neutral electrophile.



Note: Cl_2, Br_2 and I_2 also behave as neutral electrophiles.

Electrophiles are Lewis acids.

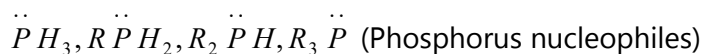
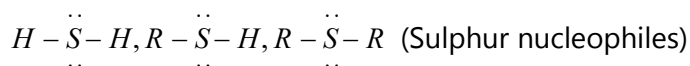
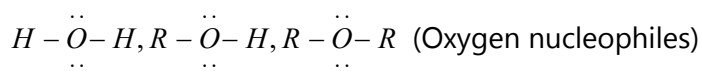
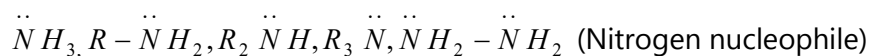
(2) **Nucleophiles:** Electron rich species or electron donor is nucleophiles. Nucleophiles can be classified into three categories:

(i) **Charged nucleophiles:** Negatively charged species are charged nucleophiles.



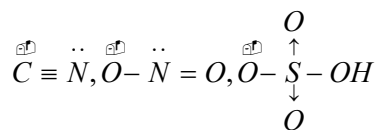
(ii) **Neutral nucleophiles:** It can be classified into two categories:

(a) Neutral covalent compound, in which central atom has complete octet, has at least one lone pair of electrons and all atoms present on central atom should not be electronegative, is neutral nucleophile.



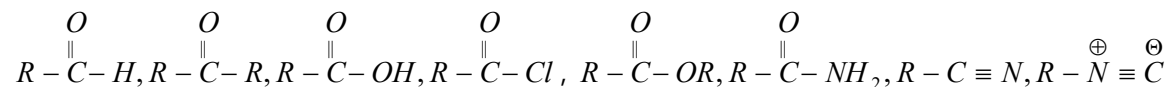
(b) Organic compound containing carbon, carbon multiple bond/ bonds behaves as nucleophile. Alkenes, Alkynes, Benzene, $CH_2=CH-CH=CH_2$, $CH_2=CH-C\equiv CH$

(iii) **Ambident nucleophiles:** Species having two nucleophilic centers, one is neutral (complete octet and has at least one lone pair of electrons) and other is charged (negative charge) behaves as ambident nucleophile



Note: Organometallic compounds are nucleophiles. Nucleophiles are Lewis bases.

Organic compounds which behave as electrophile as well as nucleophile: Organic compound in which carbon is bonded with electronegative atom (O, N, S) by multiple bond/bonds behaves as electrophile as well as nucleophile:



Note: During the course of chemical reaction electrophile reacts with nucleophile.

Strong Lewis acids stronger is electronophile $CO_2 < \overset{\oplus}{N}O_2 < \overset{\oplus}{S}O_3H$. Stronger is an acid weaker is its conjugated base or weaker is nucleophile.

Examples: $HF > H_2O > NH_3 > CH_4$

$F^- < OH^- < NH_2^- < CH_2^-$
Increasing order of nucleophilicity.