Nature of Fission of Covalent Bond

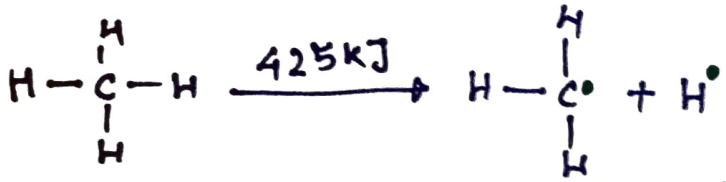
⊛ The covalent bond present in the organic compounds undergoes fission in two ways :-

(i) Homolytic Fission/Cleavage Heterolytic Fission/cleavage.

⊛ Homolytic bond Cleavage :-

If the shared pair of electron is distributed equally between two bonded atoms, then the cleavage is called homolytic cleavage.

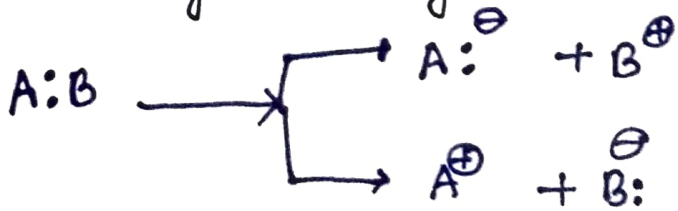
e.g:



Free radicals (neutral)

⊛ Heterolytic Bond Cleavage :-

If the shared pair of electrons is distributed unequally between the two bonded atoms, then the cleavage is called heterolytic cleavage.



Carbo-cation Carbo-anions

⇒ After the heterolytic cleavage, the more electronegative atom forms anion and the less electronegative atom forms cation.

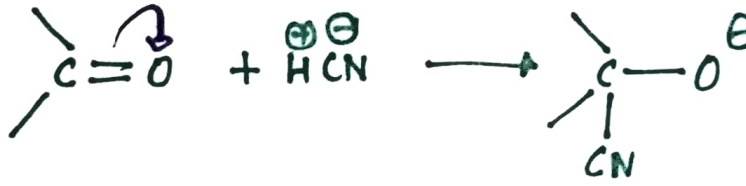
Arrow Notations in Organic Reactions

(a) During a reactions, bonds in the reactant molecules cleave and thus, the electrons undergo a shift in their positions. The transference or shifting of electrons is usually shown by some notations.

(a) Curved arrow notations (i) Full arrow →

In a molecule A=B, if B is more electronegative than A, then in presence of a reagent, the e⁻s can flow as shown above.

e.g.



'O'- is more electronegative than 'C'- atom.

(ii) Half arrow :-

Sometimes, the symbol (↷) is used to indicate the movement of single electron in case of homolytic cleavage.

e.g.

Free Radicals.

(b) Arrow Along the bonds :-

As in inductive effect →. $CH_3 \rightarrow CH_2 \rightarrow Cl$ → -I effect.

(c) Half headed arrow :-

As in reversible reactions → $A \rightleftharpoons B$

(d) Double headed arrow :-

In case of different resonating structures, we use as —

e.g. 

ELECTROPHILES & NUCLEOPHILES

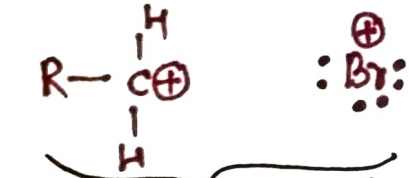
⊛ Electrophiles or Electrophilic reagents (Electron-loving)

These are the reagents having an atom which is deficient in electrons. Therefore they are trying to attack electrons from others.

They are of Two Types –

(i) Positive Electrophile (E+)

These electrophiles carry a positive charge.

e.g.  , $H^{\oplus}$, $H_3O^{\oplus}$, $NO_2^{\oplus}$, $NO^{\oplus}$, $C_6H_5N_2^{\oplus}$ etc.

Both have 6-e$^{\ominus}$s in the outershell.

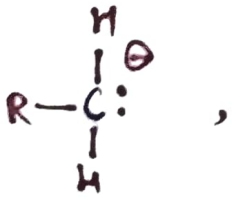
(ii) Neutral Electrophile (E)

These donot carry any charge but are electron deficient, e.g. BF_3, $AlCl_3$, SO_3, $FeCl_3$.

⊛ Nucleophiles or Nucleophilic reagents (Nucleus loving)

Nucleophiles are negatively charged or electron rich species. They are nucleus loving or positive charge loving. These are Two Types –

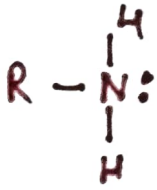
(a) Negative nucleophiles :– ($Nu^{\ominus}$)

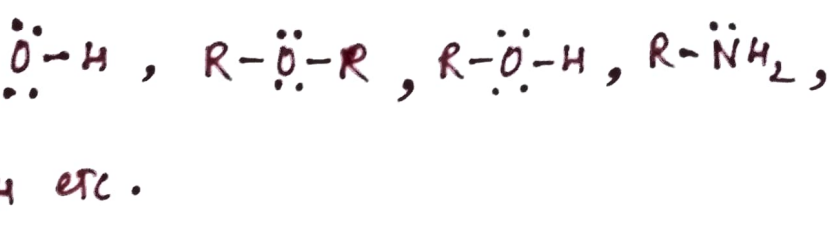
 , , $OH^{\ominus}$, $SH^{\ominus}$, $CN^{\ominus}$, $X^{\ominus}$, $OR^{\ominus}$, $RCOO^{\ominus}$ etc.

They have an excess electron pair and carry a $\ominus$ve charge.

⊙ Neutral Nucleophiles (Nu)

These have an unshared pair of electrons but carry no charge, e.g. water and ammonia.





A nucleophiles attacks a reactant at a position of the lowest electron density and contributes its lone pair of $e^{\ominus}$s to it.

⊛ Electrophilic reactions :-

The reactions which are initiated by an electrophile are called electrophilic reactions. Such reactions include

(i) Electrophilic addition reactions -

(ii) Electrophilic substitution reactions -

⊛ Nucleophilic Reactions :-

The reactions which are initiated by a nucleophile are called nucleophilic reactions. Such reactions include -

(i) Nucleophilic addition reactions -

(ii) Nucleophilic substitution reactions -