$CH_3CH_2OH \xrightarrow{KMnO_4} CH_3CHO \underset{LiAlH_4}{\rightleftharpoons} CH_3COOH$.

* Polymerisation : $n(CH_2=CH_2) \xrightarrow[\text{High pressure}]{\text{High temp}} (-CH_2-CH_2-)_n$
polythene.

## :- Alkyne :-

General Formula. $C_nH_{2n-2}$ → $1\sigma, 2\pi$

$n=2$ $C_2H_2$ $H-C\equiv C-H$

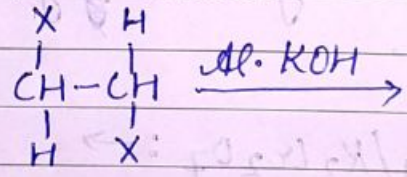
Acetylene gas bond angle $180^\circ$

Preparation :-

1) From calcium carbide :→

$CaC_2 + H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

2) From Vic Dihalide :→




chemical Properties :→

① ACIDIC CHARACTER.
② ADDITION Rxn.
③ Reduction
④ Oxidation → ⓐ ozonolysis
ⓑ combustion
ⓒ with strong oxidising agent.

1) Acidic character :→

$CH\equiv CH$ ✓ $CH_3-C\equiv CH$ ✓ $CH_3-C\equiv C-CH_3$ ✗
terminal Hydrogen not present.

$CaC_2 = \overset{C}{\underset{C}{|||}} > Ca \; [1\sigma, 2\pi] \; \left(\overset{C}{\underset{C}{|||}}\right)^{2-} Ca^{+2}$

$H-C\equiv C-H + Na \longrightarrow H-C\equiv C-Na \; (2\sigma, 2\pi)$
sod. acetylide

$H-C\equiv C-H \xrightarrow[\text{Ammonical silver nitrate sol}^n]{[Ag(NH_3)_2]OH^-} Ag-C\equiv C-Ag$
(Tollent reagent) white ppt.

Note: this rxn is used for test of alkyne

$R-C\equiv C-H + RMgX \longrightarrow R-H + Mg\overset{X}{<}C\equiv C-R$

② Addition Rxn :→

ⓐ Bromination :→

$R-C\equiv C-H + Br_2 \xrightarrow{CCl_4} R-\overset{Br}{\underset{Br}{C}}=\overset{Br}{C}-H \rightarrow R-\overset{Br}{\underset{Br}{C}}-\overset{Br}{\underset{Br}{C}}-H$

Brown → colourless.

ⓑ Rxn with Hydrogen Halide :→

$R-C\equiv C-H + H^+-X^- \longrightarrow R-\overset{H}{\underset{X}{C}}=\overset{}{C}-H \xrightarrow{+HX}$

$R-\overset{X}{\underset{X}{C}}-\overset{H}{\underset{H}{C}}-H$ gym di Halide

Amb

ⓒ Addition of water :→

$R-C\equiv C-H + H^+-OH \xrightarrow[H_2SO_4]{HgSO_4} R-\overset{OH}{C}=CH_2 \rightarrow R-\overset{O}{C}-CH_3$

enol (show tautomerism)

$H-C\equiv C-H + H^+-OH \xrightarrow{HgSO_4/H_2SO_4} H-\overset{OH}{C}=CH_2 \rightleftharpoons CH_3CHO$

③ Reduction (Addition of Hydrogen) :→
From Alkene

④ Oxidation :-

ⓐ combustion :→ burn with yellow sooty flame

$$CH \equiv CH + O_2 \longrightarrow CO_2 + H_2O$$

ⓑ Ozonolysis :→

$$R-C\equiv C-R \xrightarrow[(II)\ H_2O/Zn]{(I)\ O_3} R-\underset{\underset{O-O}{|}}{\overset{O}{\overset{\wedge}{C}}}-\underset{\underset{O-O}{|}}{\overset{O}{\overset{\wedge}{C}}}-R \longrightarrow RCOOH + RCOOH$$

ozonide

$$R-C\equiv C-H \xrightarrow[H_2O]{O_3} R-COOH + CO_2 + H_2O$$

$$CH_3-C\equiv C-CH_3 \xrightarrow[(II)\ H_2O/Zn]{(I)\ O_3} CH_3-\underset{\underset{O-O}{|}}{\overset{O}{\overset{\wedge}{C}}}-\underset{\underset{O-O}{|}}{\overset{O}{\overset{\wedge}{C}}}-CH_3 \longrightarrow CH_3-\underset{\underset{O}{||}}{C}-\underset{\underset{O}{||}}{C}-CH_3$$

$$CH_3-C\equiv C-CH_3 \xrightarrow[II\ (H_2O)]{I\ (IO_3)} CH_3-\underset{\underset{O-O}{|}}{\overset{O}{\overset{\wedge}{C}}}-\underset{\underset{O-O}{|}}{\overset{O}{\overset{\wedge}{C}}}-CH_3 \longrightarrow CH_3COOH + CH_3COOH$$

ⓒ Oxidation with strong oxidising agent :→

$$HC\equiv CH \xrightarrow{\text{acidic } KMnO_4} H-\underset{\underset{O}{||}}{C}-\underset{\underset{O}{||}}{C}-H \longrightarrow HCOOH + HCOOH$$

glyoxal

$CO_2 + H_2O$ $CO_2 + H_2O$

$$CH_3-C\equiv CH \longrightarrow CH_3-\underset{\underset{O}{||}}{C}-\underset{\underset{O}{||}}{C}-H \longrightarrow CH_3COOH + HCOOH$$

$HCOOH \rightarrow H_2O + CO_2$

⑤ Polymerisation :→

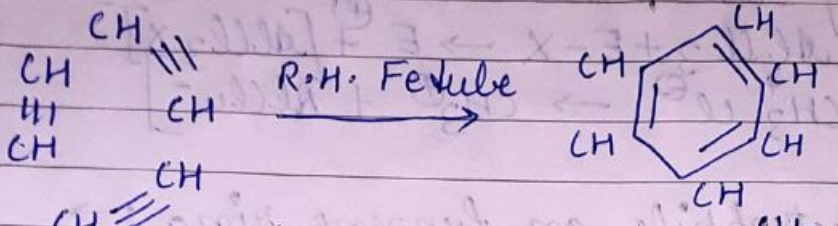
ⓐ Linear polymerisation :→

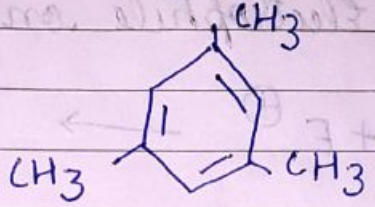
$$n(CH\equiv CH) \xrightarrow{\text{high temp or pressure}} (-CH=CH-CH=CH-)_n$$

poly ethyne or poly acetylene

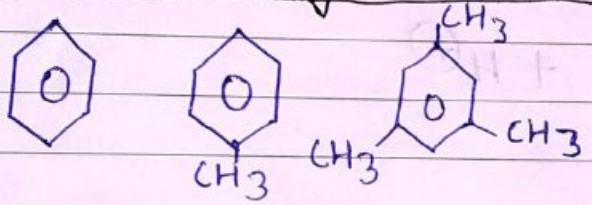
⑤ Cylic polymerisation :→

$3\,CH \equiv CH \xrightarrow[\text{iron tube}]{\text{Red Hot}}$  or $C_6H_6$



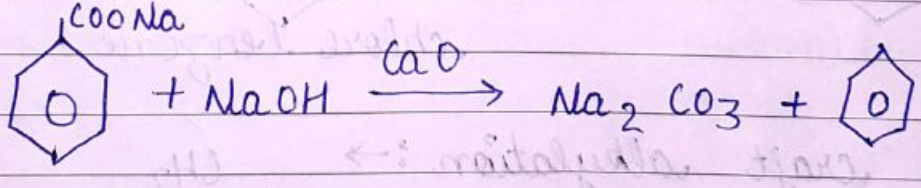

$CH_3 - C \equiv CH \xrightarrow[\text{tube}]{\text{Red Hot Fe}}$  Mesitylene

* Aromatic Hydrocarbon :→

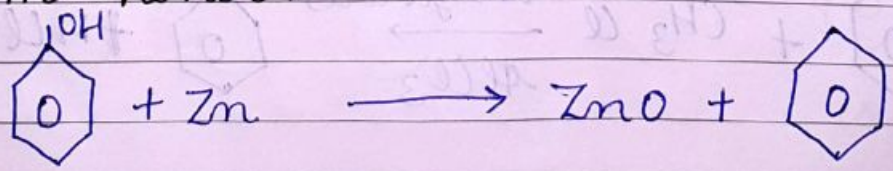


structure of benzene given by Kacule

① From alkane :
② From Alkyne
③ From soda lime




④ From Phenol




Physical properties :→

→ Non-polar solvent
→ insoluble in water
→ miscible in organic solvent
→ Burn with sooty flame

chemical properties :→

① Electrophilic substitution Rxn:

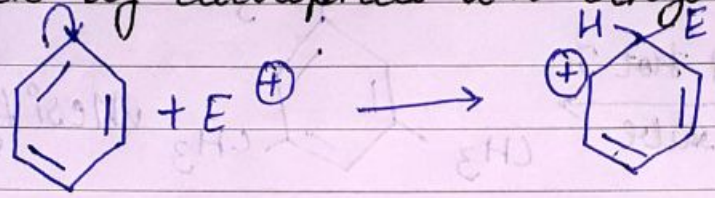
Mechanism

① Formation of electrophile :→

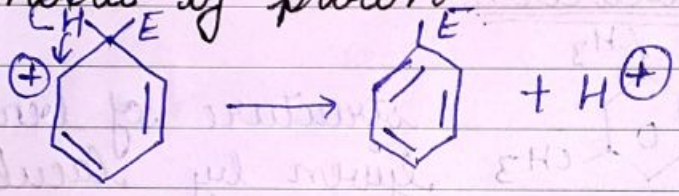
$$AlCl_3 + E-X \rightarrow E^{\oplus} + [AlCl_3X]^{-}$$

$$[AlCl_3 + CH_3^{+}Cl^{\ominus} \rightarrow CH_3^{\oplus} + AlCl_4^{-}]$$

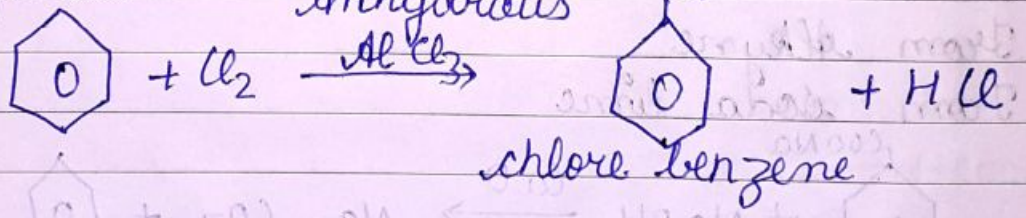
② Attack of Electrophile on benzene ring :→



③ Removal of proton



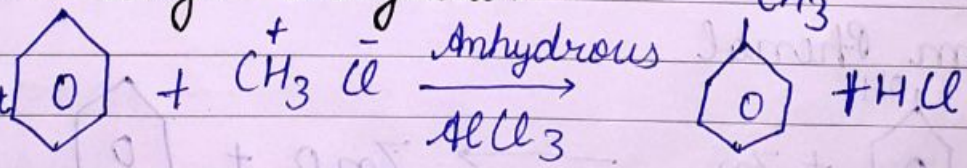
ⓐ Halogenation :→



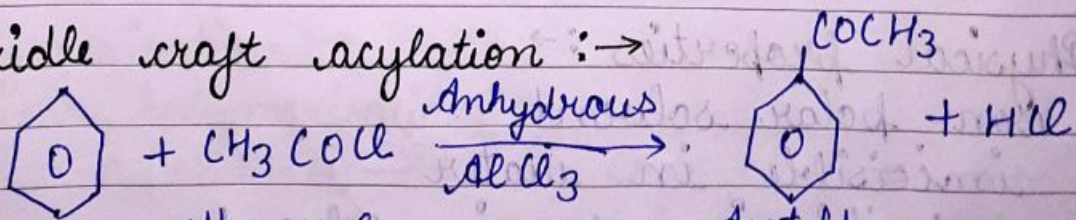

chlorobenzene

ⓑ Fridle craft alkylation :→

carbocation rearrangment possible

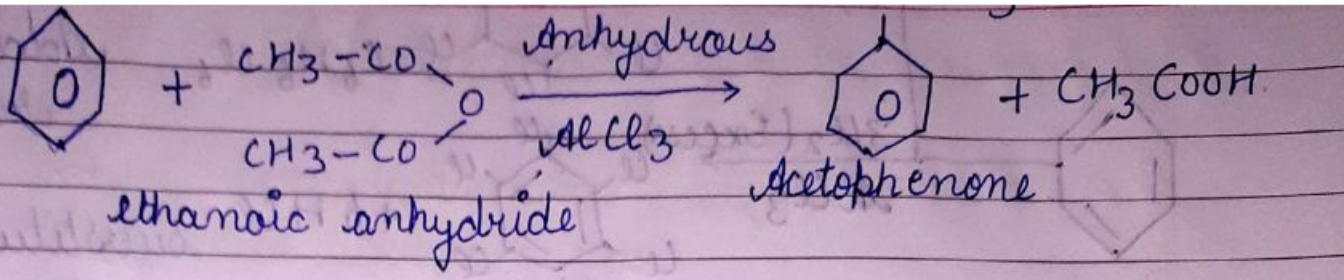



ⓒ Fridle craft acylation :→



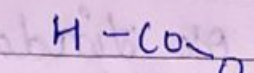

ethanoyl chloride

Acetophenone



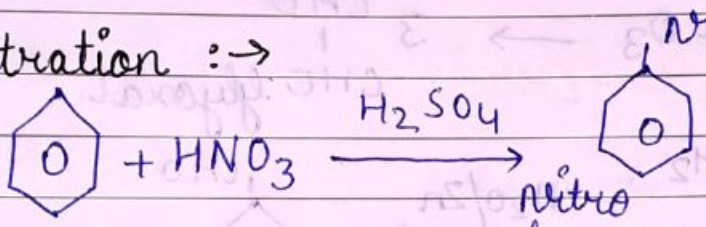

Ethanoic anhydride

Acetophenone




Ethan- Methanoic ~~Ether~~
oic anhydride

ⓐ Nitration :→




Nitro benzene

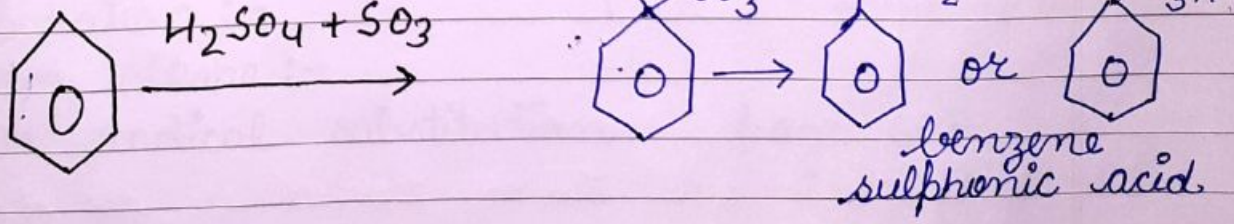
$N_2O^{\oplus}$ (nitronium) act as electrophile

→ In nitration of benzene con. $HNO_3$ act as Lewis base.

ⓑ Sulphonation :→

This rxn is carried out in presence of fuming sulphuric acid (oleum) $H_2S_2O_7$ or $H_2SO_4 + SO_3$.

Here, $SO_3$ act as electrophile.

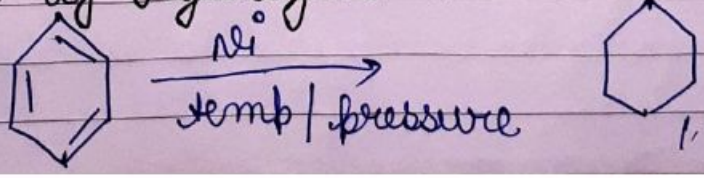



benzene sulphonic acid

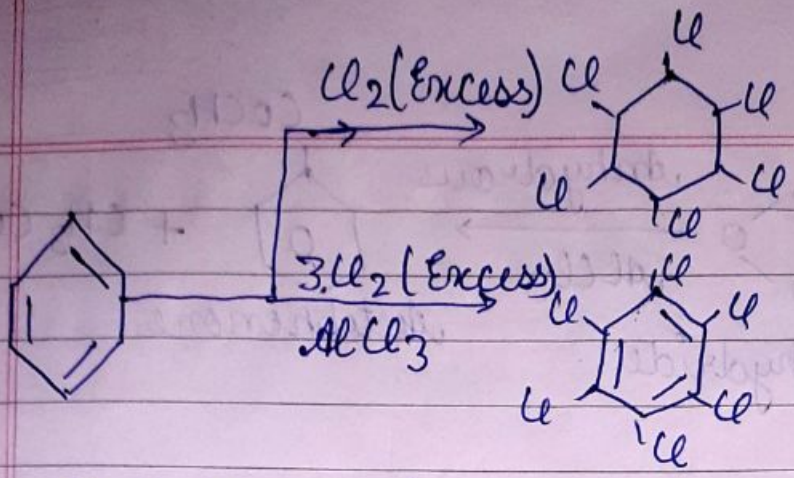
Some other rxn :→

① Addition rxn

② Addition of Hydrogen :→




cyclohexane




$C_6H_6Cl_6$ → Gammaxene or Lindane or BHC (Benzene hexa chloride) it is pesticide

② Ozonolysis :→