

AROMATIC COMPOUNDS

- Aroma (Fragrance)
- **1825** - **Michael Faraday** - destructive distillation of vegetable oil.
- Include benzene and compounds resembling benzene.
- Low Hydrogen to carbon ratio
- Extra stability
- Mol. mass = 78.108 g/mol (vapour density method)

Sources:

1. **Coal tar** :- contain more than 200 compounds.

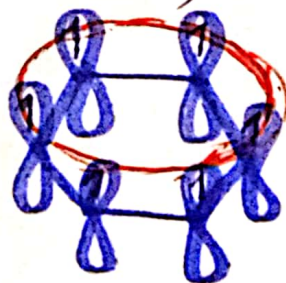
↳ fractional distillation → aromatic compounds.

2. **Petroleum** :- catalytic reforming (Hydroreforming)

(Catalyst $\text{CrO}_3 + \text{Al}_2\text{O}_3$, $500-550^\circ\text{C}$, \uparrow Pressure) → Aromatic hydrocarbons

Structure of Benzene:

- cyclic
- planar, all C → sp^2 hybridized
- $6\pi\text{e}^-$ follow " $4n+2$ " Rule.



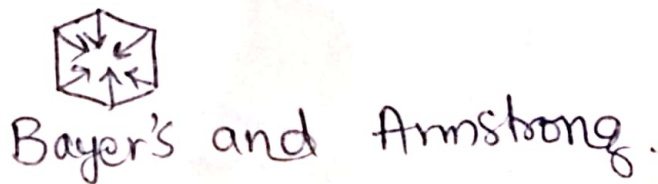
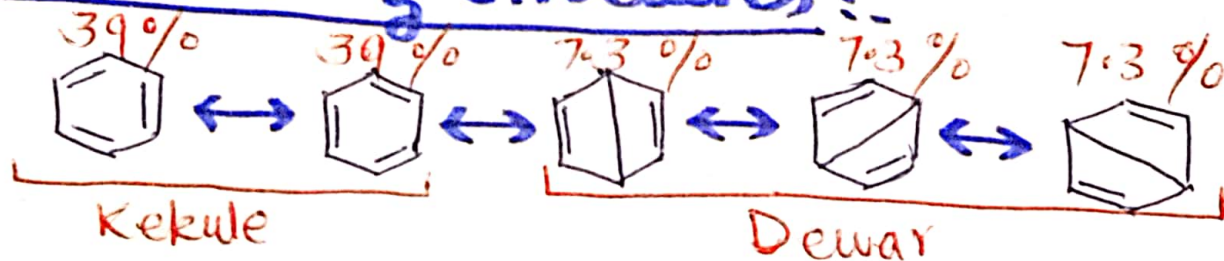
- Do not decolorizes KMnO_4 soln. or Br_2/CCl_4 .
- Give electrophilic substitution reaction and addition reactions.

• Resonance Energy:  - 

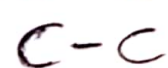
$$3(119.5) - 208 = \boxed{150 \text{ kJmol}^{-1}}$$

358.5

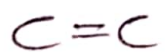
• Resonating Structures :-



• Bond lengths :-



1.54 Å



1.34 Å



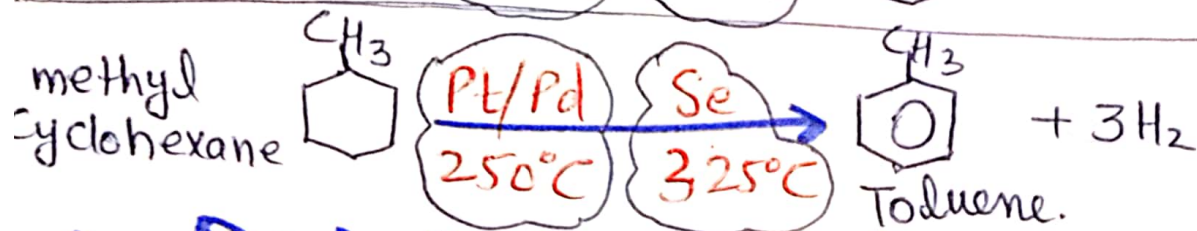
1.20 Å

$\text{C}=\text{C}$ (Benzene) 1.397 Å

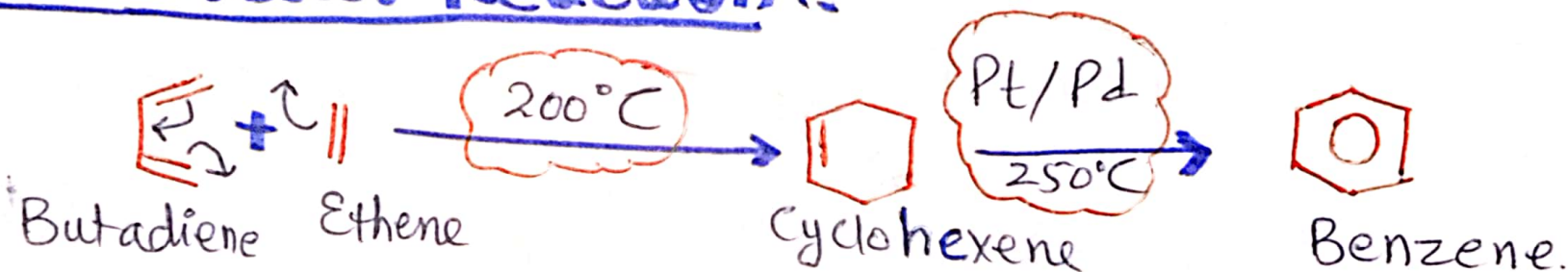
$\text{C}-\text{H}$ (Benzene) 1.09 Å

METHODS OF PREPARATION

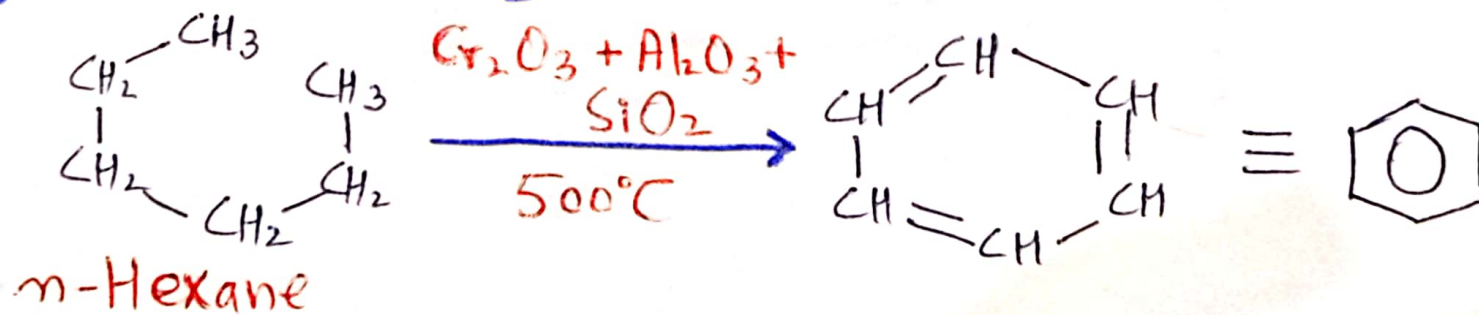
1. Aromatization :: Dehydrogenation.



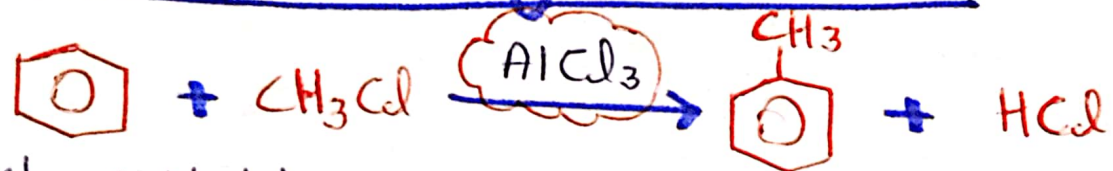
2. Diel-Alder Reaction ::



3. Cyclization of alkane ::

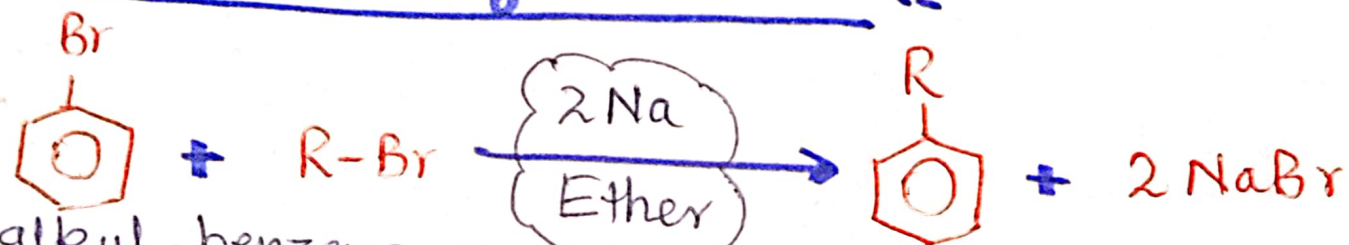


4. Friedel Craft Reaction :- (For Alkyl benzene)



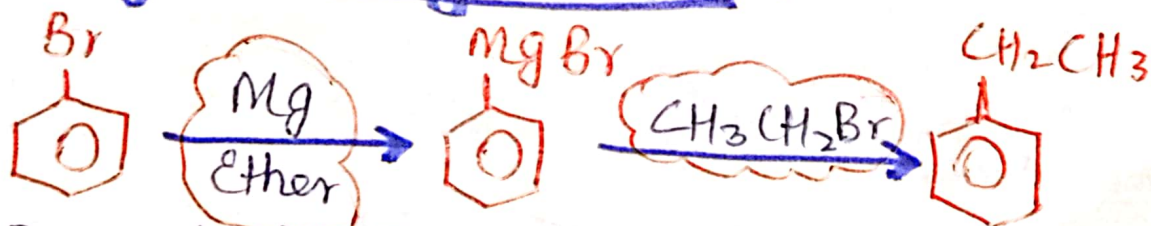
- most suitable for 2°-alkyl and 3°-alkyl substitution.

5. Wurtz Fittig Reaction :-



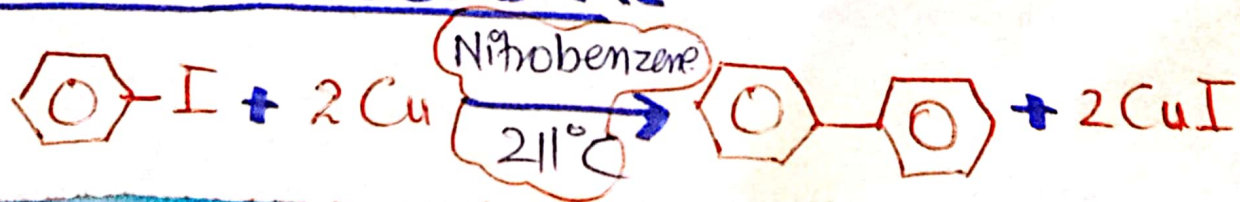
- 1°-alkyl benzene can be prepared.

6. Grignard Synthesis :-



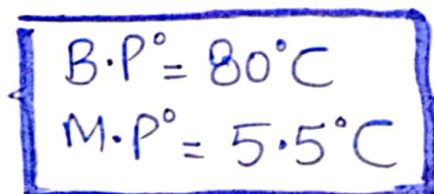
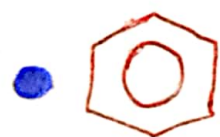
- Ar-Br and Ar-I react with Mg but Ar-Cl do not react

7. Ullmann Reaction :-



Physical Properties :-

- Water insoluble.
- Soluble in non-polar solvent like CCl_4 , CS_2 etc.
- Less dense than water.
- More dense than corresponding cycloalkanes.
- B.P° increases with molecular weight.
- Symmetry also affects B.P°.

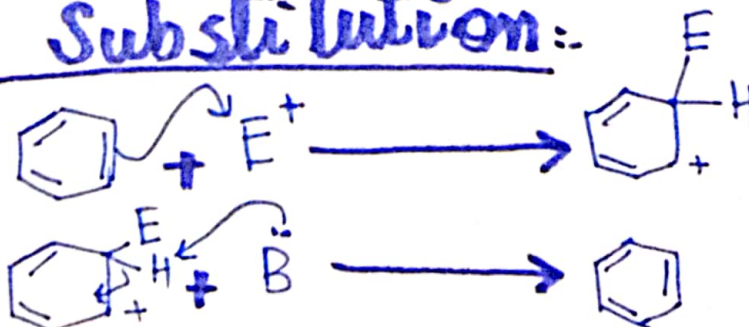


- Burn with luminous smoky flame.

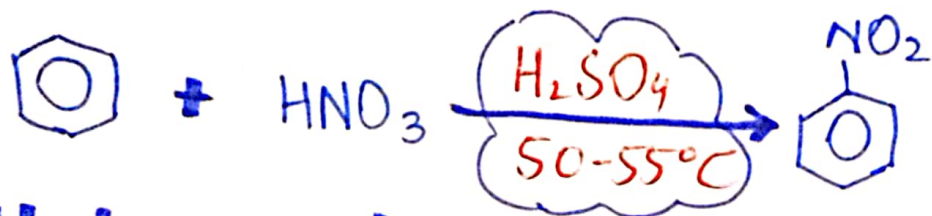
Chemical Reactions :-

1. Electrophilic Substitution :-

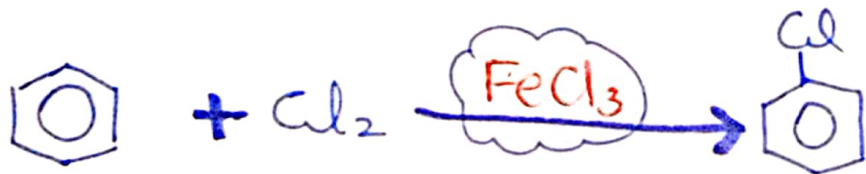
MC $\left\{ \begin{array}{l} \text{Attack of } \text{E}^+ \\ \text{Attack of Base} \end{array} \right.$



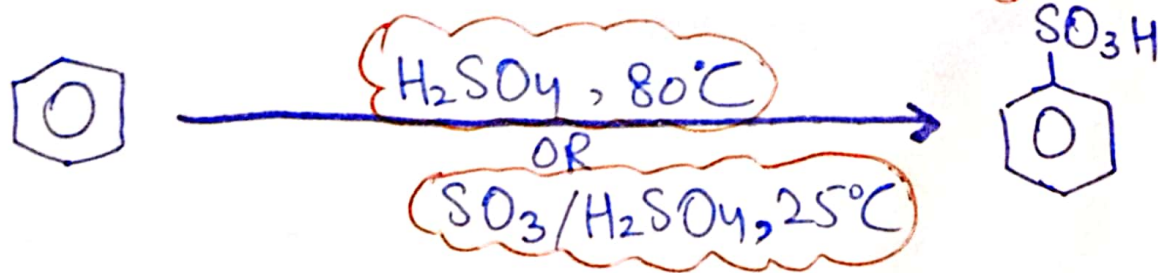
A. Nitration: $\text{HNO}_3 + \text{H}_2\text{SO}_4$ (1:1)



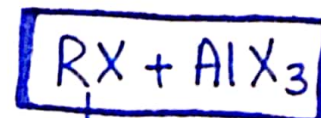
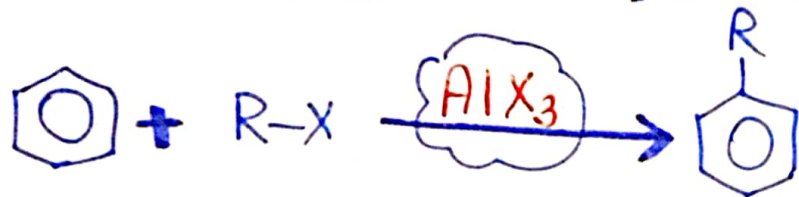
B. Halogenation: $\text{X}_2 / \text{FeX}_3$



C. Sulphonation: conc. H_2SO_4



D. Friedal craft Alkylation:

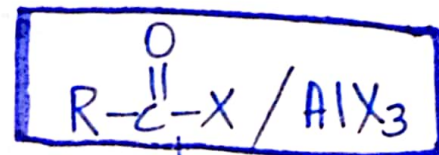
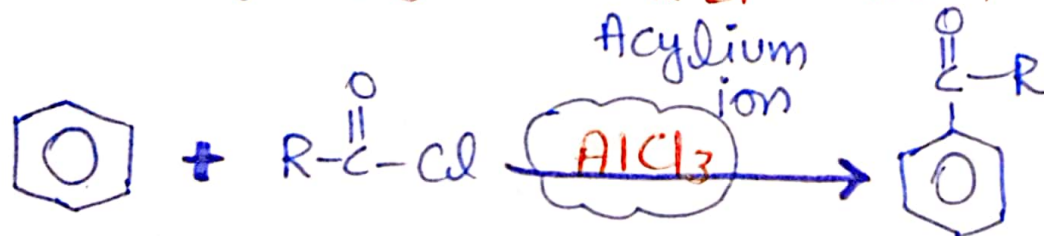


Alkene / R-OH

Drawback

- Polyalkylation
- Rearrangement

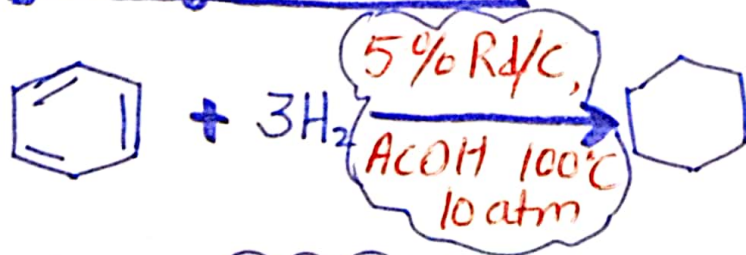
E. Friedal craft Acylation:



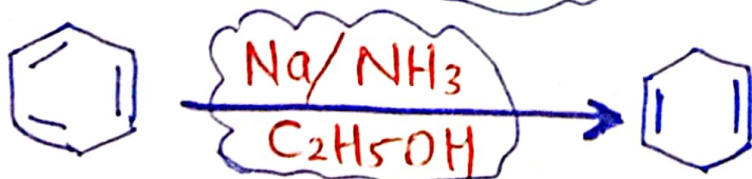
OR
Acid Anhydride

2. ADDITION REACTION:

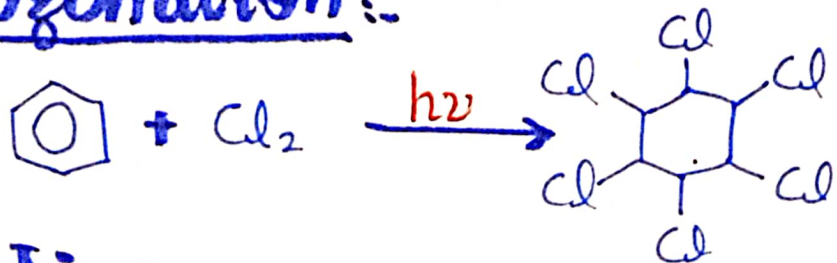
A. Hydrogenation:



Birch Reduction

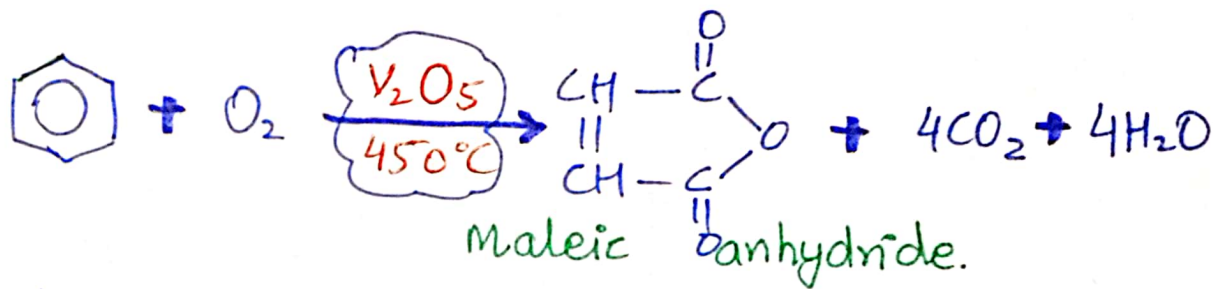


B. Halogenation :-

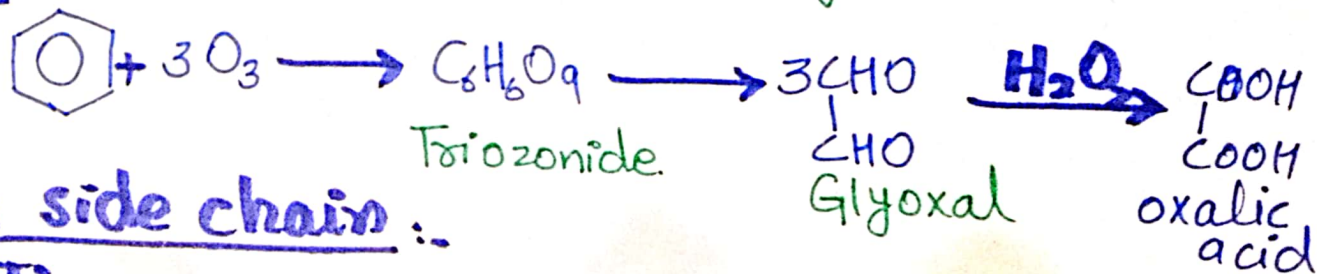


3 Oxidation :-

A. Catalytic

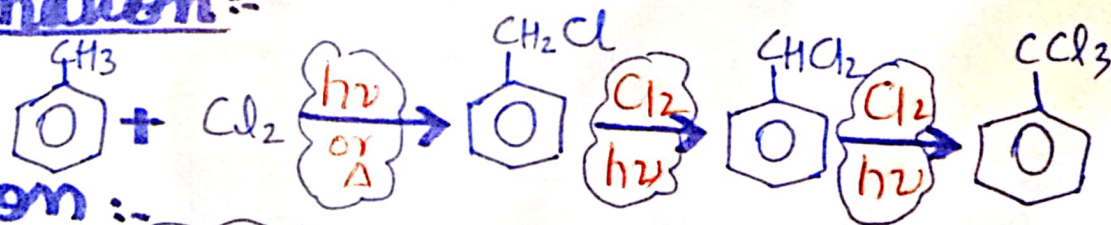


B. Ozonolysis



4. Reaction of side chain :-

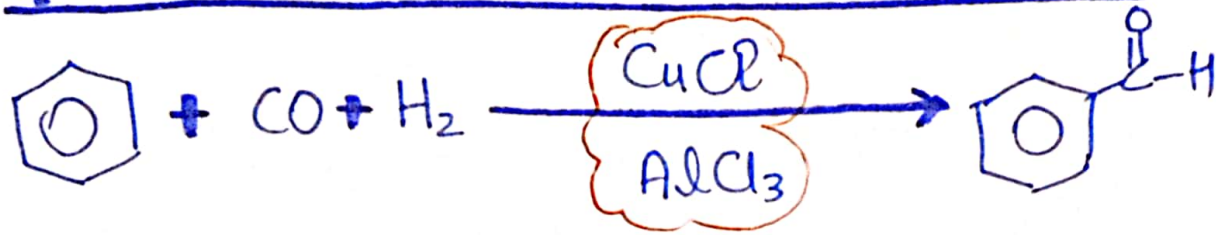
A. Halogenation :-



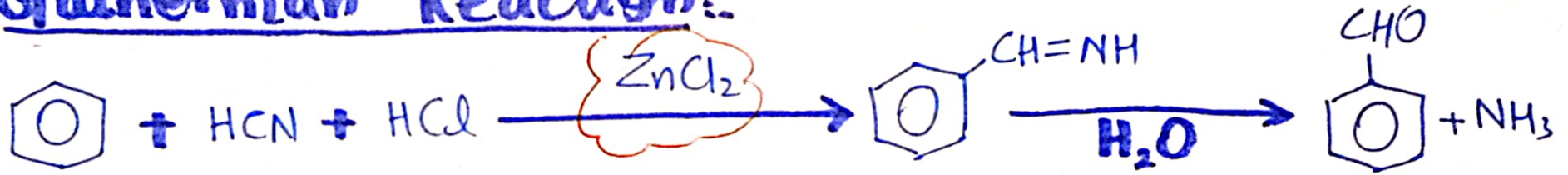
B. Oxidation :-



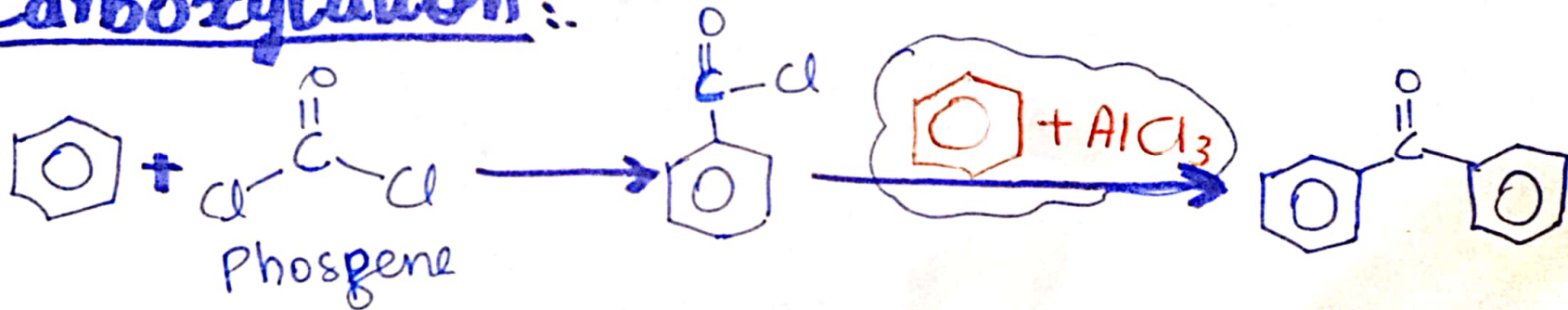
5) Gatterman Koch Reaction :- (Formylation)



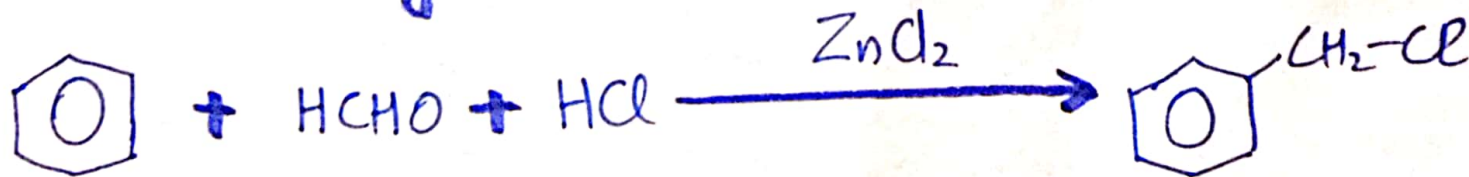
6) Gatterman Reaction :-



7) Carboxylation :-

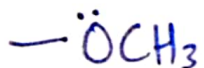
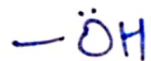
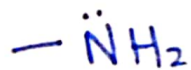
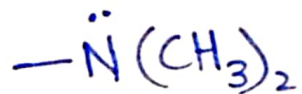


8) Chloromethylation :-

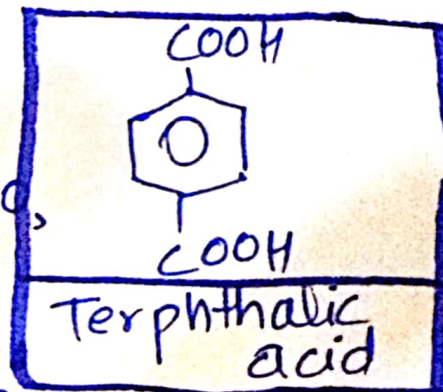
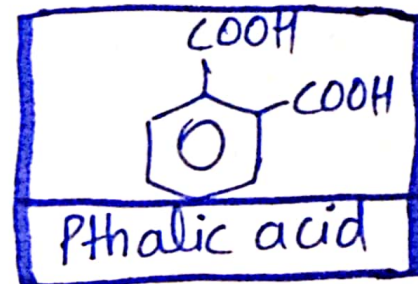
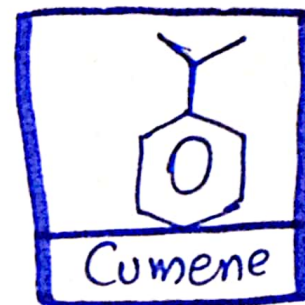
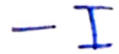
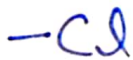


ORIENTATION

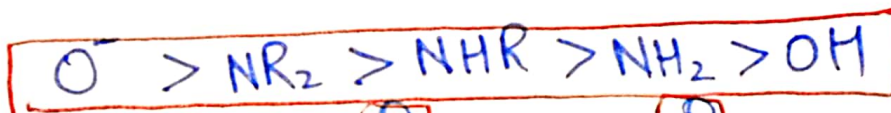
Ortho Para directing groups :-



Deactivating



• Strong activating



• Moderately activating

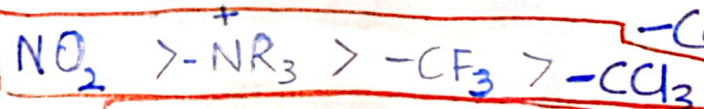


• Mildly activating

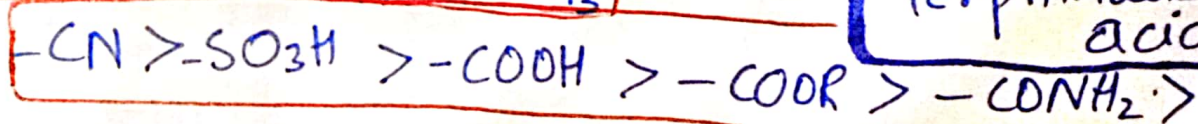


Meta directing groups :- NR_3^+ , $-CN$, $-COOH$, $-CHO$, $-COR$, $-NO_2$.

• Strongly deactivating



• Moderately deactivating



• Mildly deactivating

