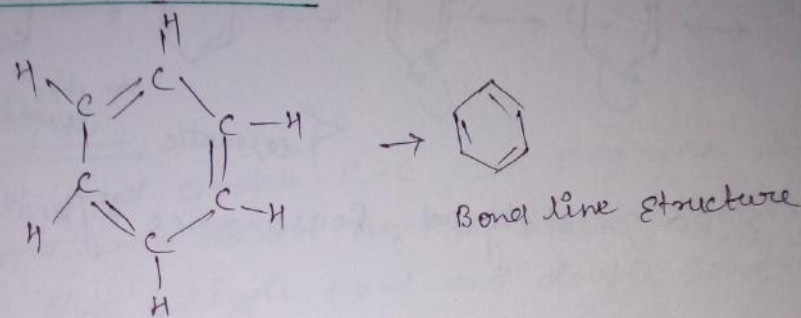




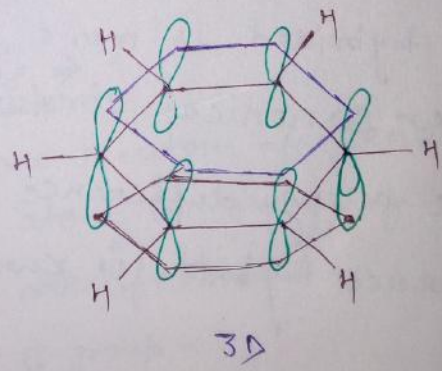
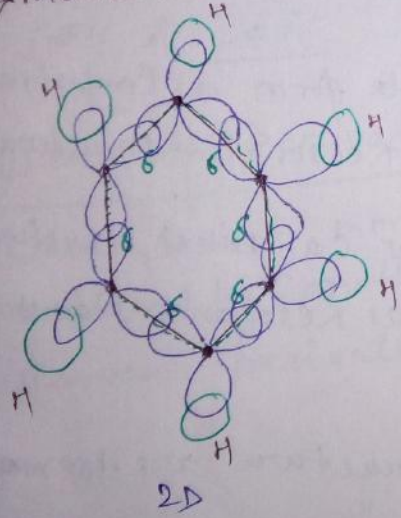
BENZENE

ARENES AND AROMATICITY :-

Structure of BENZENE :-



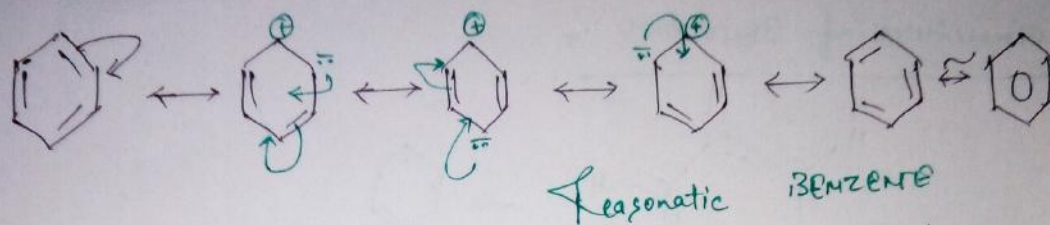
→ molecular orbital Diagram →



Resonance Benzene

Structure of Benzene \rightarrow

Since there are three π -bonds present in Benzene in alternate position due to which the process of conjugation takes place and delocalisation of π -e⁻ occurs.



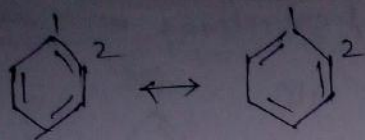
Since π -e⁻ delocalised, resonance hybrid is formed



Resonance hybrid is more stable form as compared to another canonical structure (resonating structure) hence the energy difference between canonical structure and resonance hybrid is known as resonance energy.

Bond order

Since in Benzene resonance structures are formed, the C-C bond order is not perfectly single or not perfectly double. Hence the bond order in C-C in Benzene will be



$$B.O = \frac{\text{No. of bond b/w bonded atoms}}{\text{Resonating structure}}$$

$$B.O = \frac{= + -}{2} = \frac{3}{2} = 1.5$$

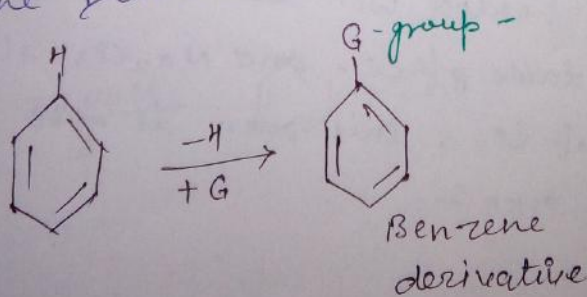
Bond length

Since the bond order C-C in Benzene lies b/w single bond and double bond, therefore bond length also lies b/w single bond and double bond.

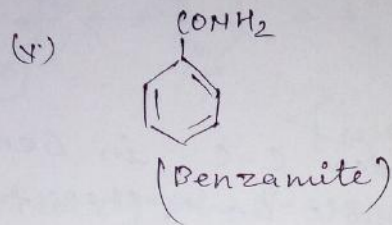
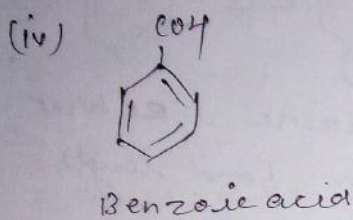
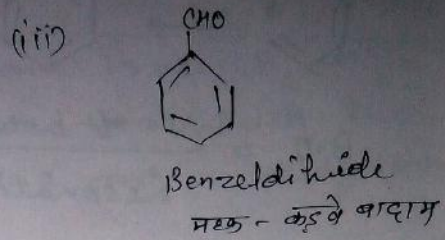
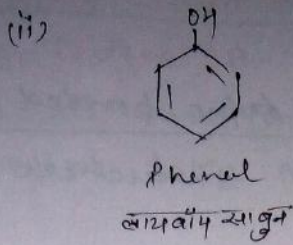
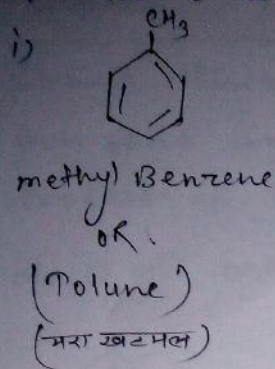
Hence the bond length b/w C-C in Benzene is 1.04 \AA 1.4 \AA .

Benzene Derivatives

When one or more H-atom of Benzene is replaced by another atom or group of atoms, Benzene Derivatives are formed.

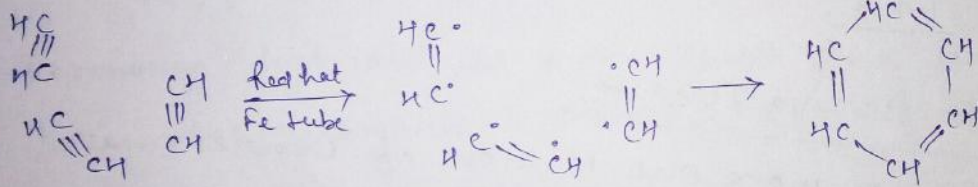


The most important Benzene Derivatives are,



⇒ Methods of Preparation of Benzene ⇒

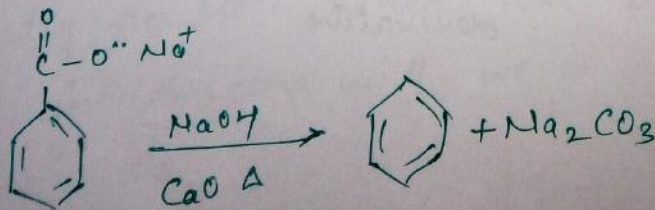
i) From ethyne →



ii) method - II

⇒ From Sodium Benzoate :-

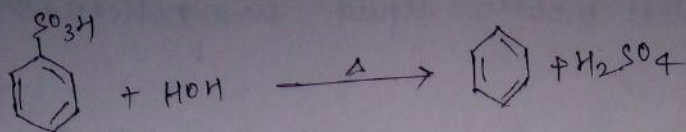
When Sod-Benzoate heated with Soda lime, the formation of Benzene will take place. and Na_2CO_3 also form. Due to removal of CO_2 , this rxn is also known as decarboxylation rxn -



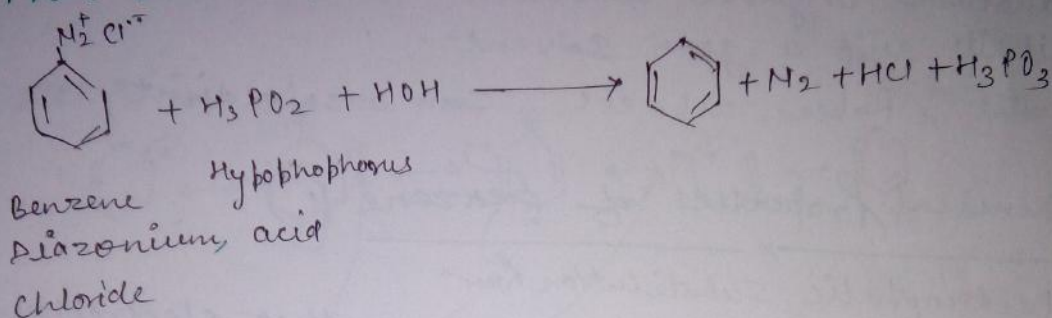
Methanol - III

imp

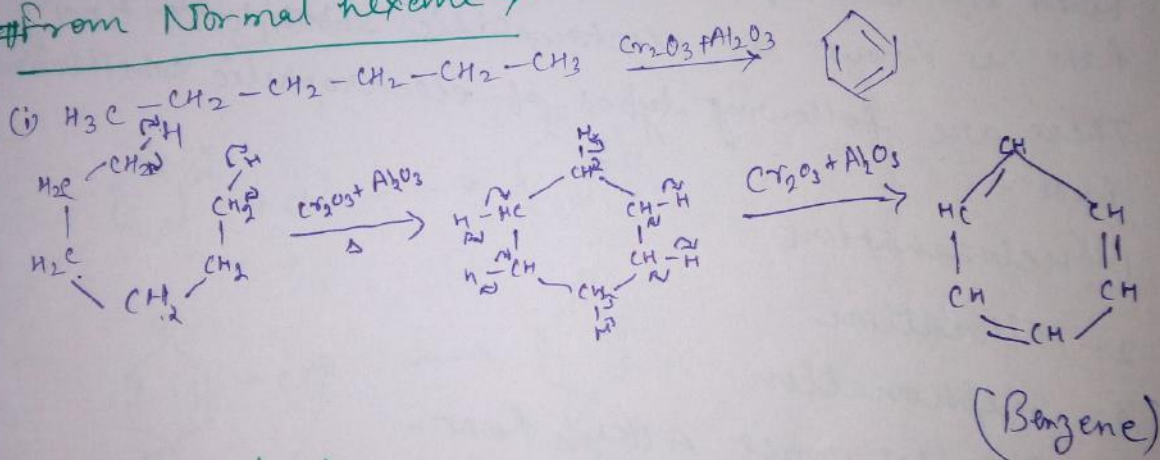
* From Benzene Sulphonic Acid \Rightarrow



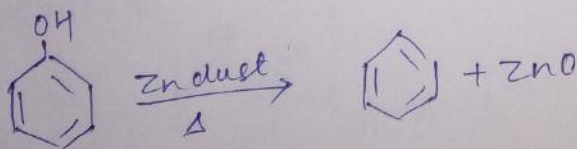
From Benzene Diazonium chloride \Rightarrow



From Normal hexene \Rightarrow



From phenol \Rightarrow



Physical properties of BENZENE

- i) it is a colourless mobile liquid having pleasant ~~odour~~ odour.
 - ii) it is insoluble in water. highly soluble in another organic solvent.
it is itself a good solvent.
- # fat, paper, oil etc. can dissolve in it

Chemical Properties of Benzene

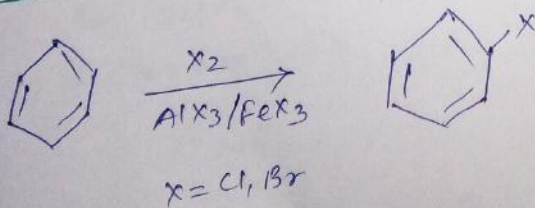
Electrophilic Substitution Rxn

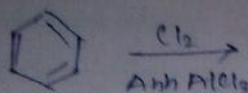
When one electrophile replaces another electrophyl, Rxn is known as electrophilic substitution Rxn

There are following types of electrophilic substitution Rxn -

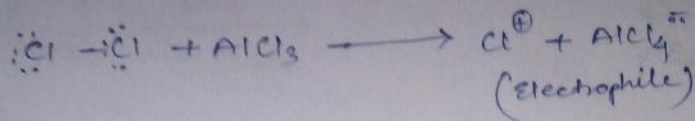
- 1- Halogenation -
- 2- Nitration
- 3- Sulphonation
- 4- Friedel Craft Alkyl Rxn -
- 5- Friedel Craft Acylation Rxn -

1- Halogenation

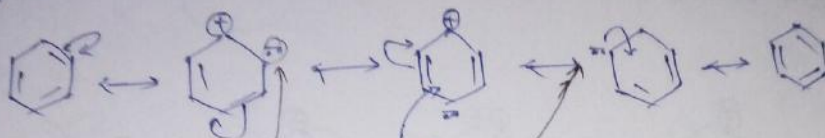




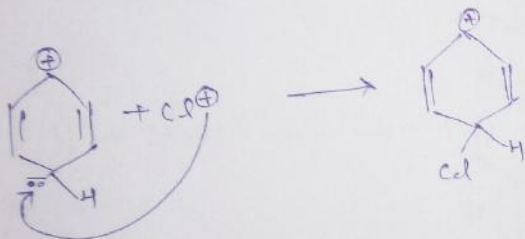
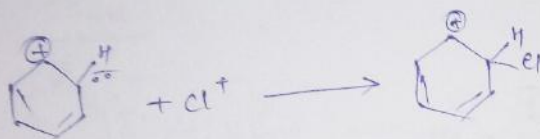
STEP-1



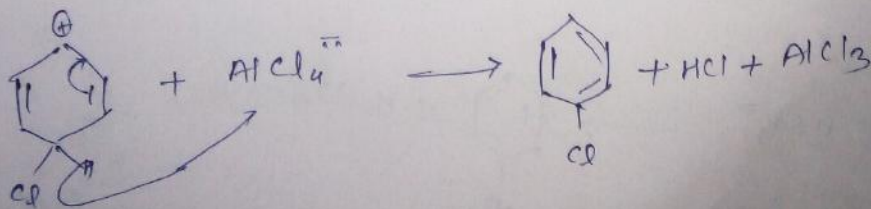
STEP-2



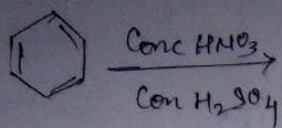
STEP-3



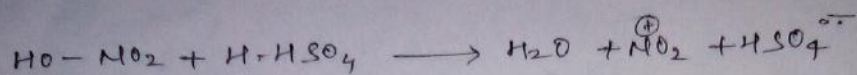
STEP-4



ii) Nitration \Rightarrow



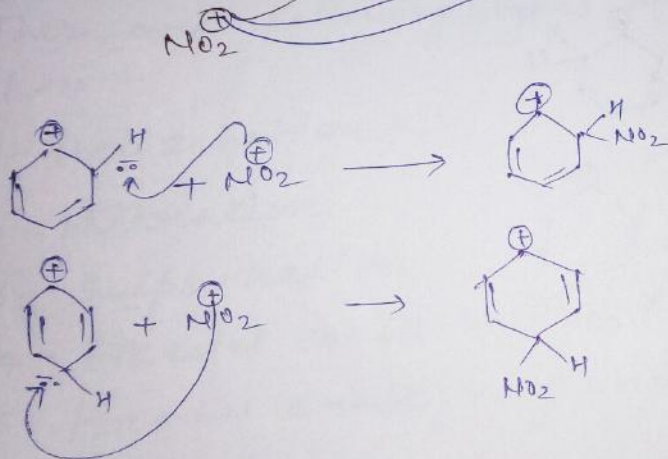
STEP-1



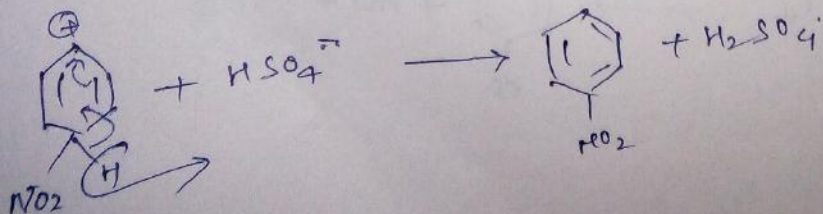
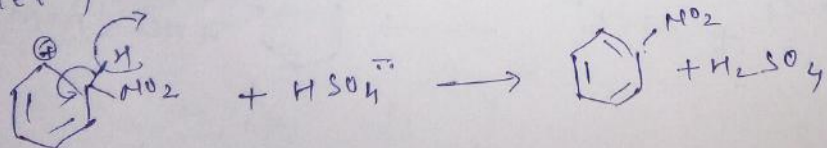
STEP-2



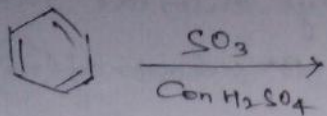
STEP-3



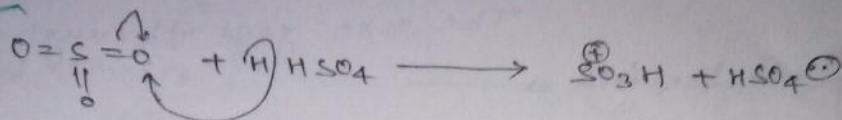
STEP-4



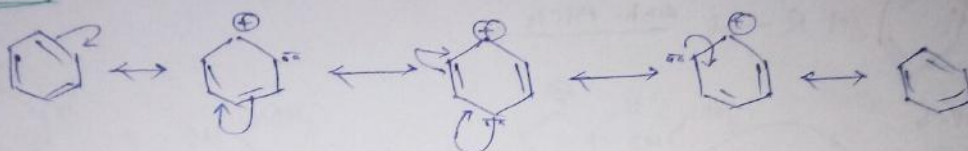
Sulphonation of $\text{C}_6\text{H}_6 \rightarrow$



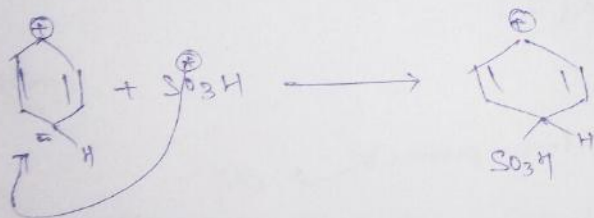
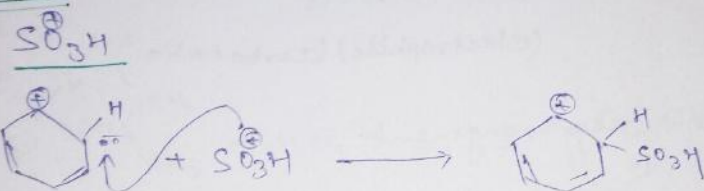
STEP-1



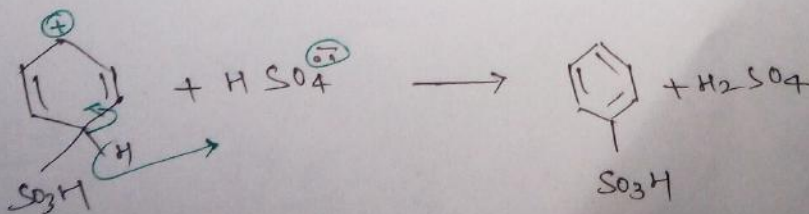
STEP-2



STEP-3




STEP-4



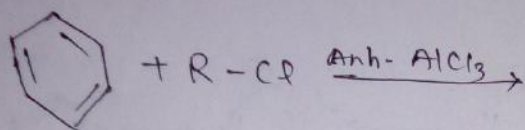
Benzene Sulphonic

Friedel Craft Alkylation Rxn

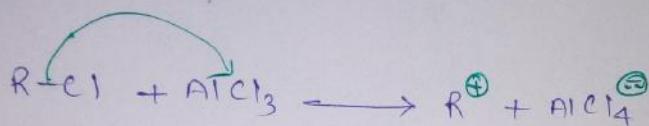
When Benzene react with alkyl chloride in the presence of anhydrous $AlCl_3$, the formation of alkyl  take place.

The rxn goes through

following mechanism \Rightarrow



STEP-1




(electrophile) (carbocation)

STEP-2

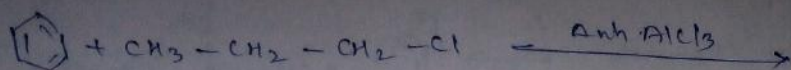
Carbocation rearrangement

STEP-3

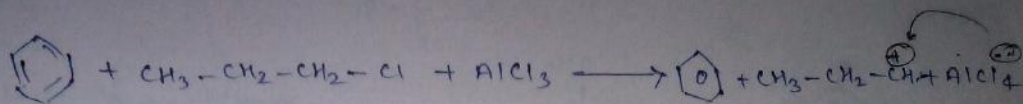
Resonance of 

STEP-4

Stable Carbocation Attack.



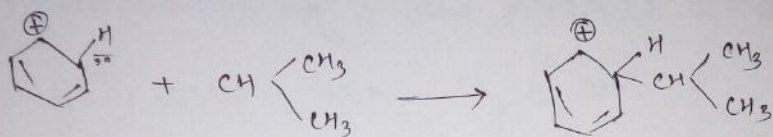
STEP-1



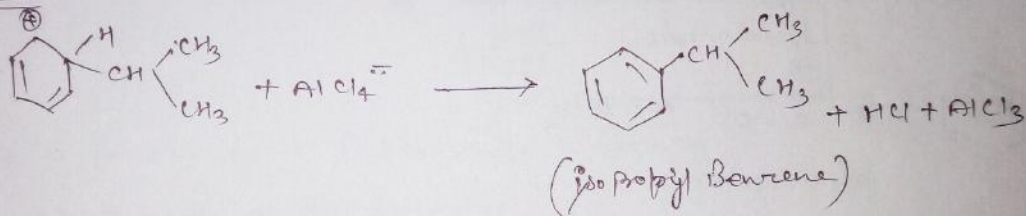
STEP-2



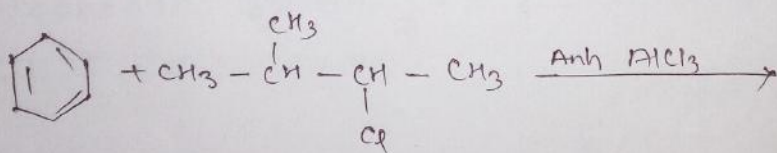
STEP-3



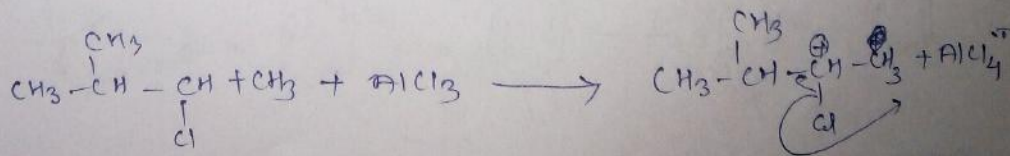
STEP-4



Question



STEP-1

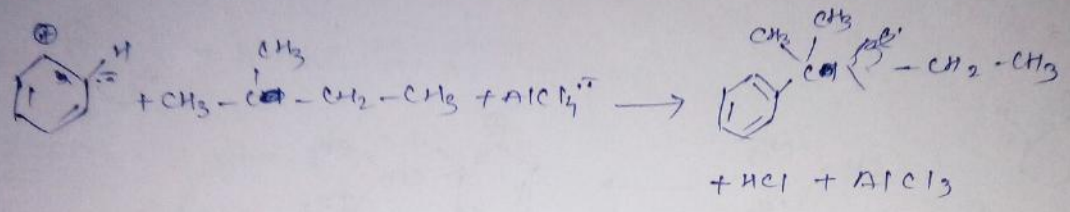
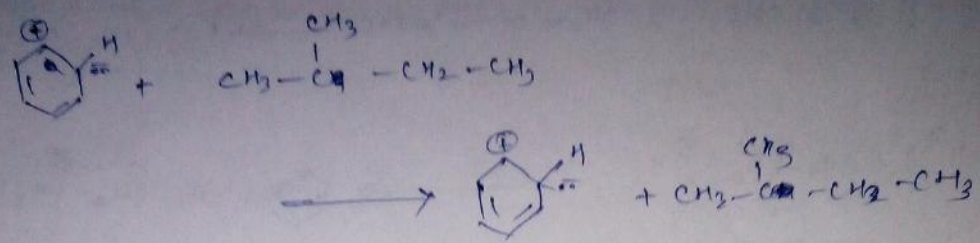


STEP-2

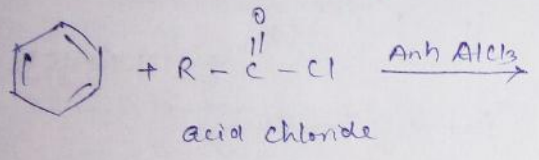




STEP-4



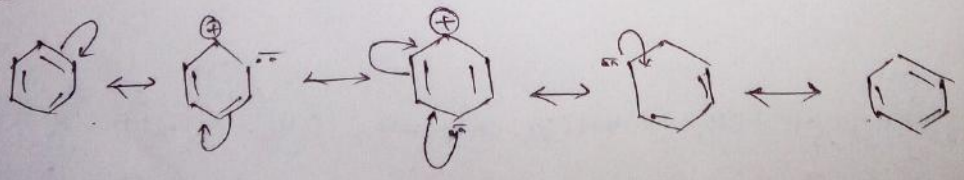
Friedel craft Acylation Rxn →



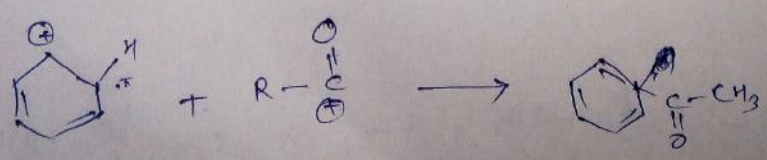
STEP-1

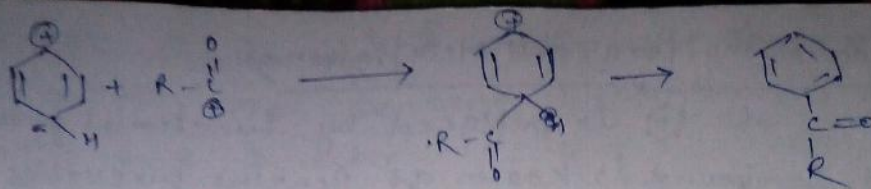


STEP-2



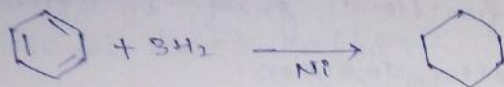
STEP-3



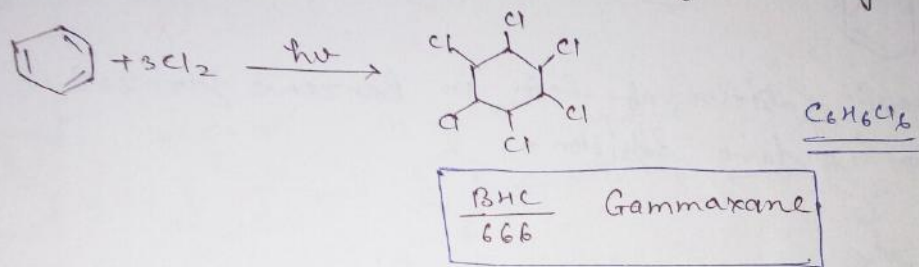


Additions Reaction →

i) Hydrozination of .



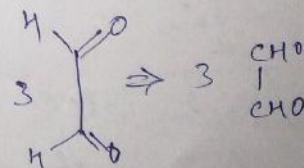
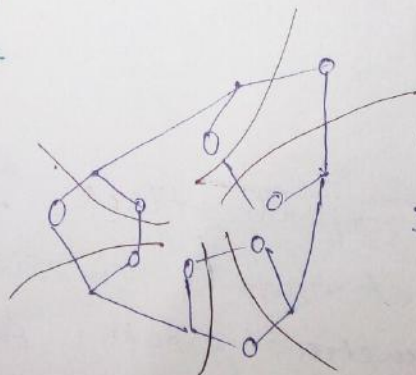
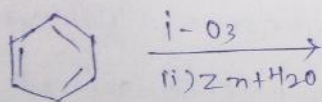
ii) Halozination of in the presence of Sun light →



it is a power full insecticide. कीटनाशक

it is not a ecofriendly.

Ozonolysis of



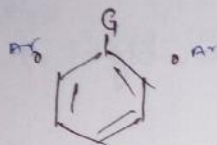
Orientation of Ortho, Para, and Meta Position \Rightarrow

If one H-atom of C_6H_6 is replaced by functional group the formed compound is known as Benzene Derivative.

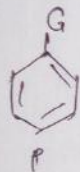
The general representation of Benzene Derivative



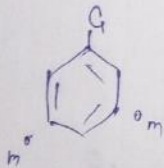
The left, right position of functional group in Benzene Derivative known as Ortho position.



The opposite position of 'G' in Benzene Derivative is known as Para position.



The remaining position decide in Ortho, and Para in Benzene Derivative known as Meta position.



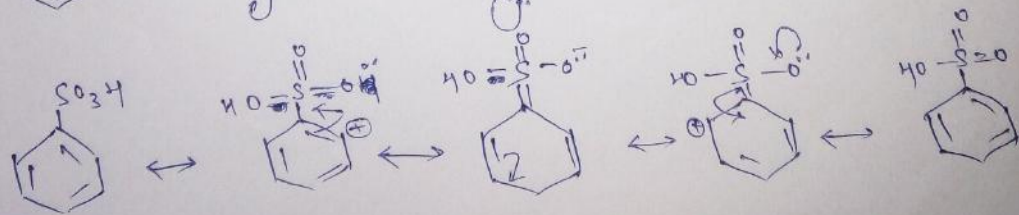
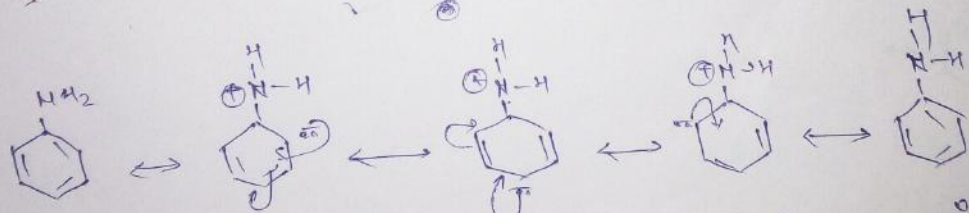
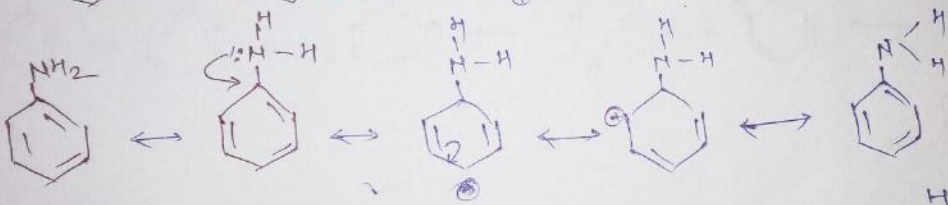
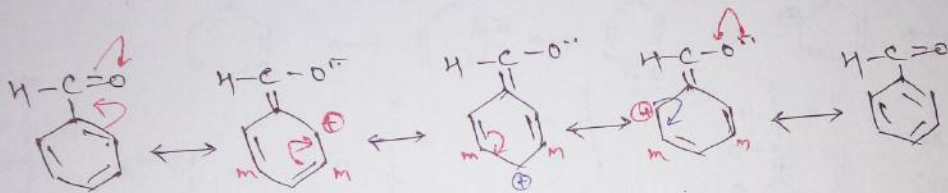
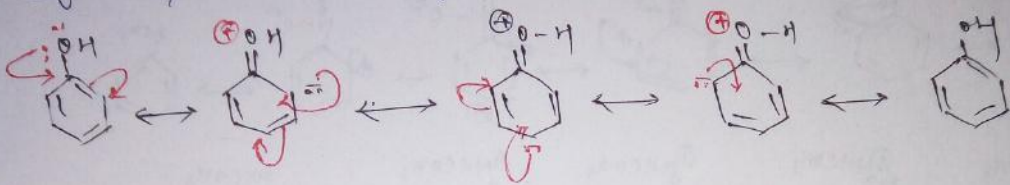
When an electrophile attack in Benzene Derivative the position of electrophile in the Benzene ring decided by functional group - present in Benzene Derivative.

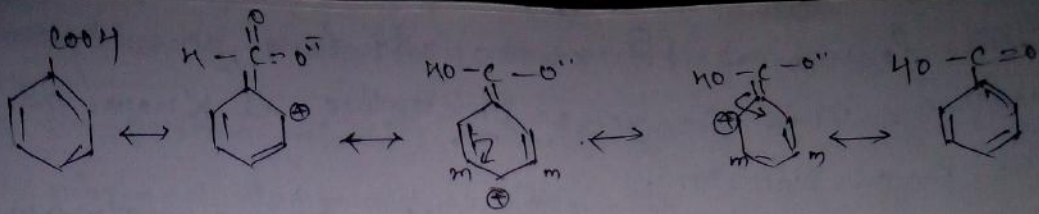
When the position of E^+ ortho and para given by Benzene Derivative, this Benzene Derivative is known as Ortho-para Director.

if electrophile equare meta position

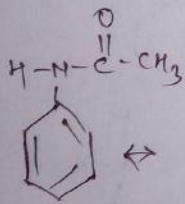
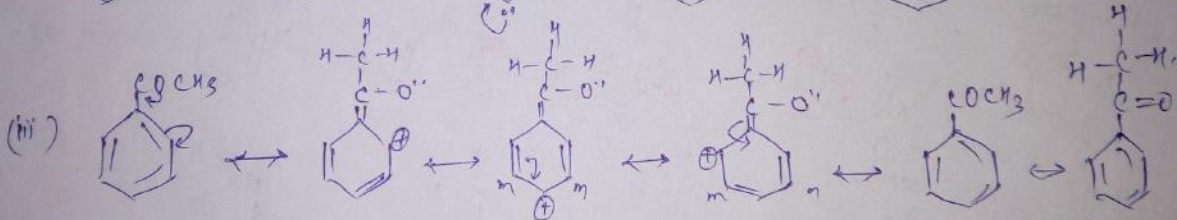
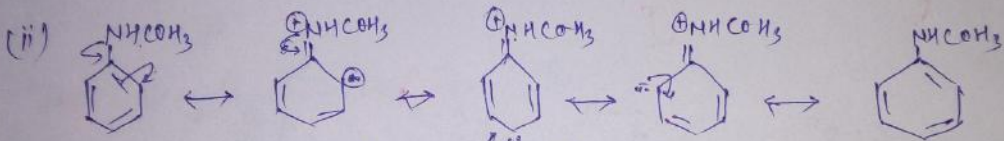
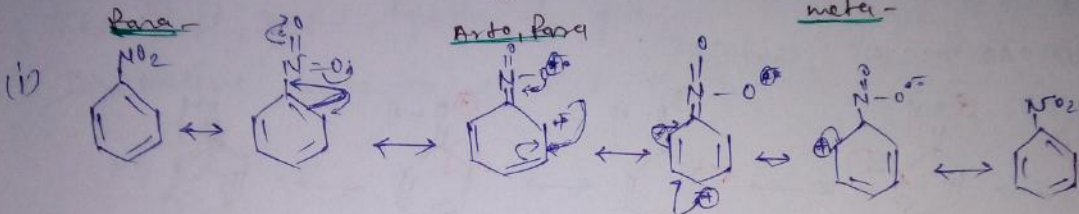
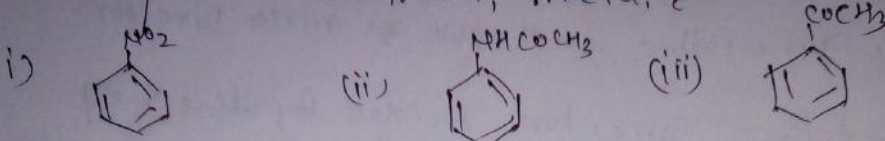
The Benzene Derivative is known as meta Director.

The ortho and para Director Decided by the help of meso metric effect.



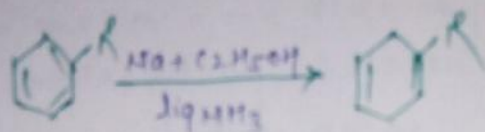


Que
Identify the ortho, para, meta, direction -



Birch Reduction

When C_6H_6 derivative react with $\text{Na}^+\text{C}_2\text{H}_5\text{O}^-$ in the presence of liquid ammonia the formation of cyclic dienes take place.



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