



III. Long Answer Type Questions

Question 1. Explain the term aromaticity. What are the necessary conditions for any compound to show aromaticity?

Answer: The aromatic compounds apparently contain alternate double and single bonds in a cyclic structure, and resemble benzene in chemical behaviour. They undergo substitution reactions rather than addition reactions. This characteristic behaviour is called Aromatic character or Aromaticity.

Conditions for Aromaticity:

- An aromatic compound is cyclic and planar.
- Each atom in an aromatic ring has a p-orbital. These p-orbitals must be parallel so that a continuous overlap is possible around a ring.
- The cyclic π -molecular orbital formed by the overlap of p-orbitals must contain $(4n + 2)$ π electrons, where $(n = 0, 1, 2, 3, 4 \text{ etc.})$

Question 2. (a) Define substitution reactions. Why do benzene undergo substitution reactions even though they contain double bonds?

(b) What happens when benzene is treated with

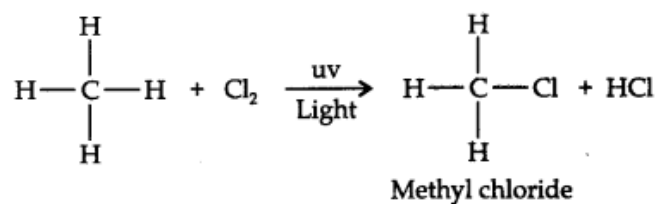
(i) Br_2 in presence of anhydrous AlCl_3

(ii) Cone. H_2SO_4 at 330K

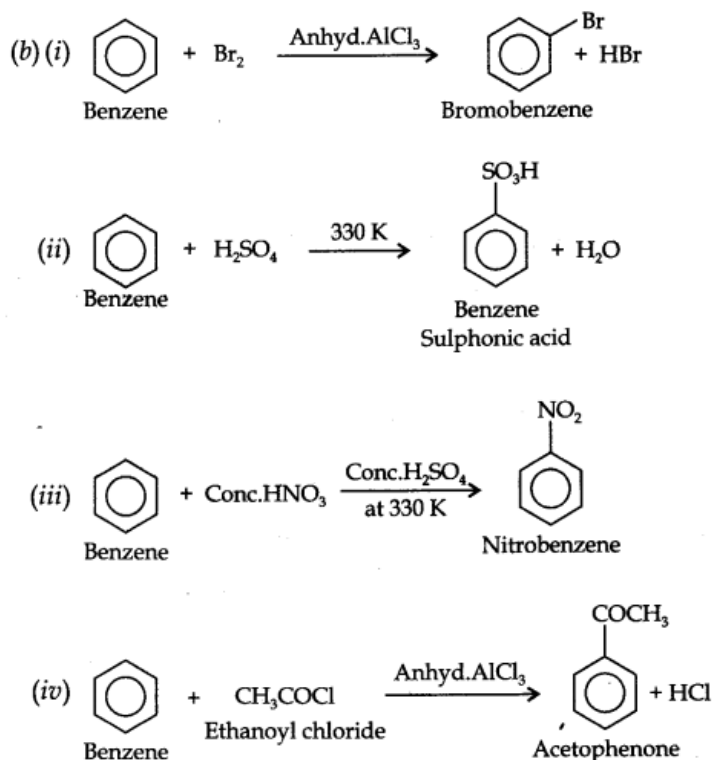
(iii) Mixture of cone. H_2SO_4 and com. HNO_3 at 330 K

(iv) Ethanoyl Chloride in presence of anhydrous AlCl_3

Answer: (a) Substitution reactions are those reactions in which an atom or group of atoms directly attached to carbon in the substrate molecule is replaced by another atom or group of atoms, for example,



A hydrogen atom of the methane molecule is replaced by chlorine atom. Benzene undergoes electrophilic substitution reactions because benzene ring has delocalized electrons and is an electron-rich system. It is attacked by electrophiles giving substitution products.



Question 3. (a) What type of isomerism is shown by methoxymethane and ethanol?

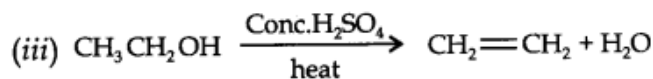
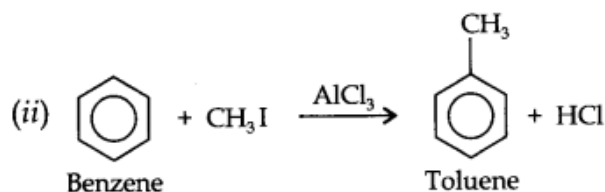
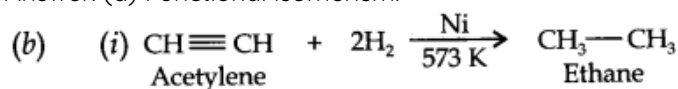
(b) How will you bring out the following conversions.

(i) Acetylene to ethane

(ii) Benzene to Toluene

(iii) Ethanol to ethene?

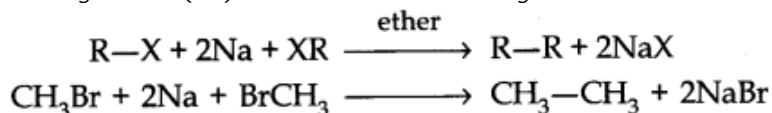
Answer: (a) Functional isomerism.



Question 4. Discuss the preparation of alkanes by Wurtz reaction.

What is the limitation of the reaction?

Answer: Wurtz synthesis: Higher alkanes are prepared by heating an alkyl halide (RX) with sodium metal in dry ether solution.



Limitations: Use of two different alkyl halides in Wurtz reaction always leads to a mixture of alkanes. The separation of these alkanes is difficult because there is only a little difference in their boiling points. Thus only symmetrical alkanes can be prepared by this method.

Question 5. (a) Why are alkenes called unsaturated hydrocarbons?

(b) How will you test the presence of double bond in an alkene?

(c) Name the products formed when propene is subjected to ozonolysis.

Answer:

- (a) Alkenes contain two hydrogen atoms less than alkanes and thus they contain C—C double bond ($C=C$) in their molecule. Thus they are called unsaturated hydrocarbons.
- (b) Alkenes react with cold dilute $KMnO_4$ solution to form glycols. Since bright purple colour of $KMnO_4$ disappears during the reaction it is used as a test for the presence of double bond.
- (c) A mixture of acetaldehyde and formaldehyde is formed.

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