

# Exemplar problems and solutions

1. Suggest a route for the preparation of nitrobenzene starting from acetylene?

**Solution:**

(i) By intermolecular condensation method, we can cyclize acetylene and then treated at high temperature in a red hot iron tube.

(ii) The aliphatic compound thus converted into benzene is treated with con. HNO<sub>3</sub> and Conc. H<sub>2</sub>SO<sub>4</sub> which undergoes nitration to give nitrobenzene.

2. Match the following reactants in Column I with the corresponding reaction products in Column II.

Column I		Column II
(i) Benzene + Cl <sub>2</sub>	$\xrightarrow{\text{AlCl}_3}$	(a) Benzoic acid
(ii) Benzene + CH <sub>3</sub> Cl	$\xrightarrow{\text{AlCl}_3}$	(b) Methyl phenyl ketone
(iii) Benzene + CH <sub>3</sub> COCl	$\xrightarrow{\text{AlCl}_3}$	(c) Toluene
(iv) Toluene	$\xrightarrow{\text{KMnO}_3 / \text{NaOH}}$	(d) Chlorobenzene
		(e) Benzene hexachloride

**Solution:**

(i) is d

(ii) is c

(iii) is b

(iv) is a

3. Assertion (A): Nitration of benzene with nitric acid requires the use of concentrated sulphuric acid.

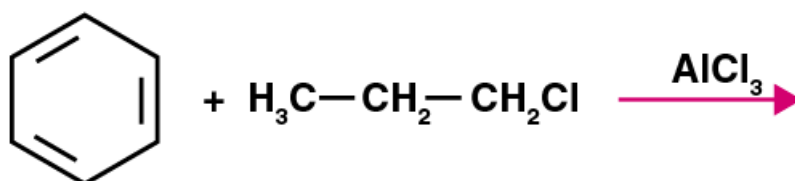
Reason (R): The mixture of concentrated sulphuric acid and concentrated nitric acid produces the electrophile, NO<sub>2</sub><sup>+</sup>.

- (i) Both A and R are correct and R is the correct explanation of A.
- (ii) Both A and R are correct but R is not the correct explanation of A.
- (iii) Both A and R are not correct.
- (iv) A is not correct but R is correct.

**Solution:**

Option (i) is correct

**4. What will be the product obtained as a result of the following reaction and why?**



**Solution:**

This reaction is an example of Friedel Crafts alkylation using a lewis acid.

In the first step, there will be a formation of the carbocation, then a secondary carbocation will be formed which is more stable. There will be a hydride shift. At last nucleophilic attack will happen to the benzene ring which forms the major product cumene and a minor product of primary carbocation.

**5. How will you convert benzene into**

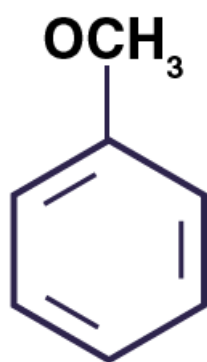
- (i) p – nitrobromobenzene
- (ii) m – nitrobromobenzene

**Solution:**

(i) when bromine is treated with Br<sub>2</sub> in presence anhydrous FeBr<sub>3</sub> it undergoes electrophilic substitution to give bromobenzene. Again treated with conc. HNO<sub>3</sub> and Conc. H<sub>2</sub>SO<sub>4</sub> at 323K we get a p-nitrobromobenzene

(ii) We need to deactivate the benzene by the introduction of a nitro group using conc. HNO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub> and then treat with Br<sub>2</sub> in presence of FeBr<sub>3</sub> we will get m-nitrobromobenzene.

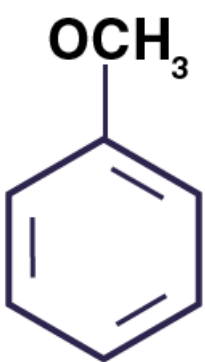
**27. Arrange the following set of compounds in the order of their decreasing relative reactivity with an electrophile. Give reason.**



Solution:



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