

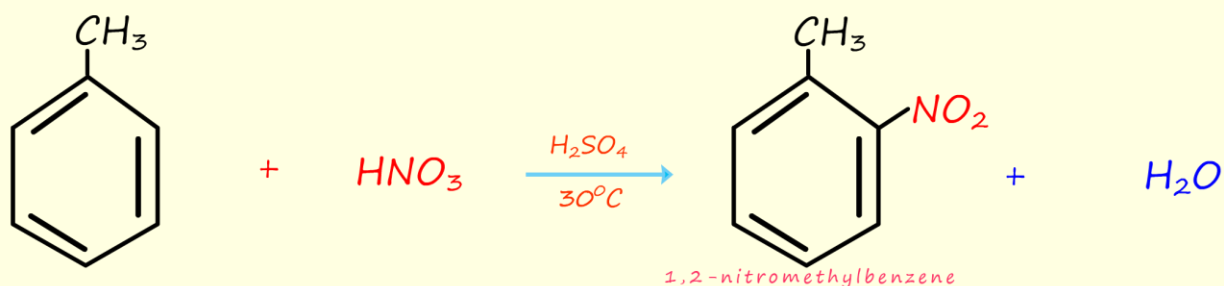
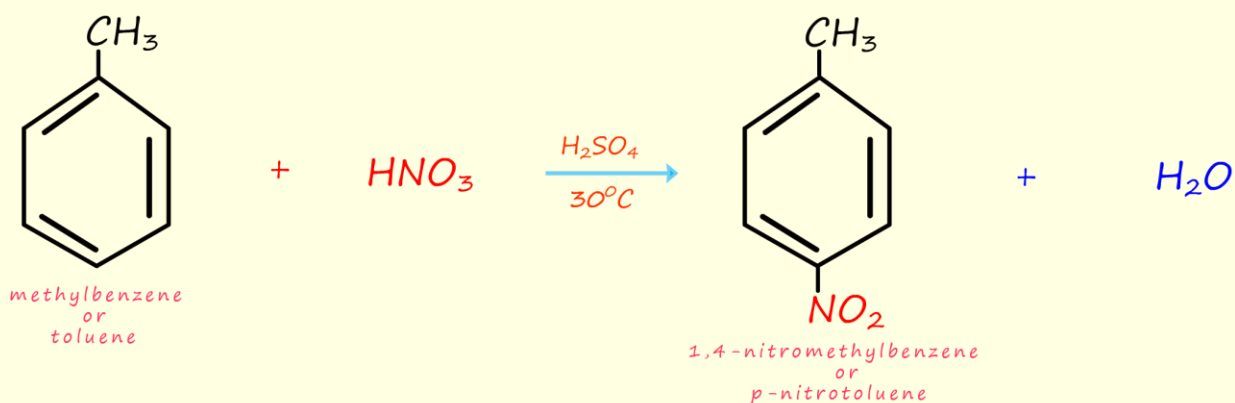
Nitration of aromatic rings

Answer all the questions below as fully as you can then check your answers

1. What type of reaction would you expect from aromatic compounds?
2. What is the electrophile used to nitrate aromatic rings?
3. What is the name of the catalyst is used in nitrating benzene rings?
4. Write an equation to show how the nitronium ion electrophile is produced by reacting together concentrated sulfuric and nitric acids.
5. Describe the conditions needed to nitrate benzene.
6. Methylbenzene is more reactive to electrophilic substitution than benzene, the main reason for this is that the methyl group activates the aromatic ring by releasing electron density into it, this makes it a better nucleophile and more attractive to the electrophilic nitronium ion.
 - a. The main products of the nitration of methylbenzene are 1,2-nitromethylbenzene and 1,4-nitromethylbenzene. Write equations to show how both of these compounds are formed.
 - b. Since methylbenzene is more reactive than benzene suggest how to change the reaction conditions to reduce the chance of adding more nitro groups to the aromatic ring.

Answers

1. What type of reaction would you expect from aromatic compounds?
Aromatic compounds undergo electrophilic substitution reactions.
2. What is the electrophile used to nitrate aromatic rings?
The nitronium ion or nitryl ion (NO_2^+).
3. What is the name of the catalyst is used in nitrating benzene rings?
Concentrated sulfuric acid
4. Write an equation to show how the nitronium ion electrophile is produced by reacting together concentrated sulfuric and nitric acids.
$$2\text{H}_2\text{SO}_4 + \text{HNO}_3 \longrightarrow \text{NO}_2^+ + 2\text{HSO}_4^- + \text{H}_3\text{O}^+$$
5. Describe the conditions needed to nitrate benzene.
The reaction is carried out under reflux with the temperature range of between $50-55^\circ\text{C}$, the concentrated sulfuric and nitric acids are usually mixed in the ratio of 3:1. A higher temperature will result in the addition of more than one nitro group onto the benzene ring.
6. Methylbenzene is more reactive to electrophilic substitution than benzene, the main reason for this is that the methyl group activates the aromatic ring by releasing electron density into it, this makes it a better nucleophile and more attractive to the electrophilic nitronium ion.



- a. The main products of the nitration of methylbenzene are 1,2-nitromethylbenzene and 1,4-nitromethylbenzene. Write equations to show how both of these compounds are formed.
- b. Since methylbenzene is more reactive than benzene suggest how to change the reaction conditions to reduce the chance of adding more nitro groups to the aromatic ring.
- Use a lower temperature to prevent the addition of multiple nitro groups onto the methylbenzene.