OCR (B) Chemistry A-Level

CD3 - Organic Reactions

Flashcards

How does benzene undergo nitration?

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Benzene reacts with conc. nitric acid at a temperature of 50℃ - 60℃ with a conc. sulfuric acid catalyst to from nitrobenzene and water:

$$C_6H_6 + HNO_3 \rightarrow C_6H_5NO_2 + H_2O$$

What is the mechanism for the nitration of benzene?

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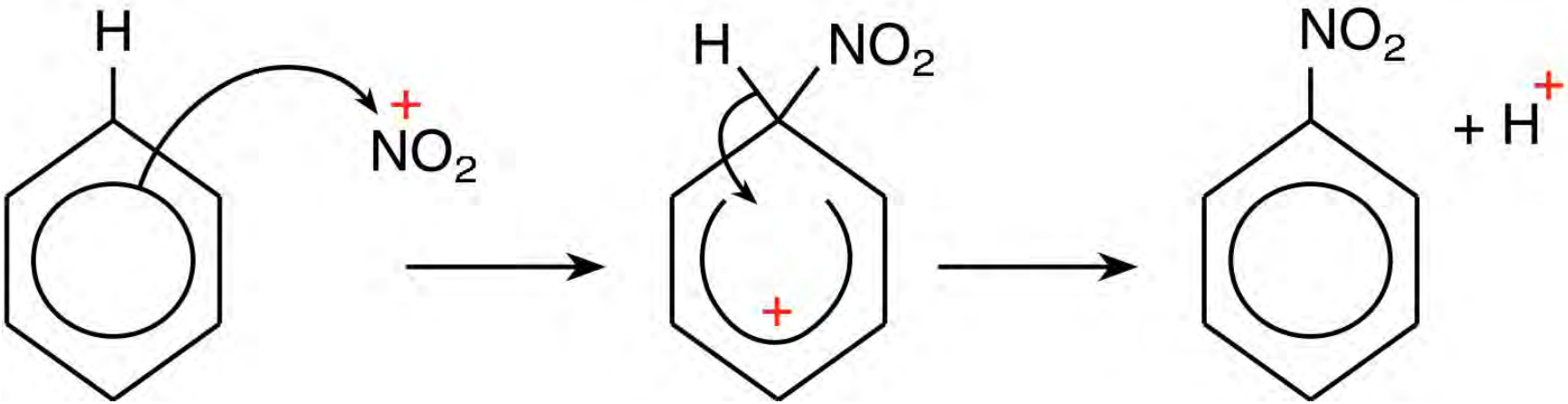

How is sulfuric acid acting as a catalyst?

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- Generation of electrophile:

  $H_2SO_4 + HNO_3 \rightarrow NO_2^+ + HSO_4^- + H_2O$

- Sulfuric acid is regenerated by the hydrogensulfate ion reacting with the proton expelled from the intermediate:

  $HSO_4^- + H^+ \rightarrow H_2SO_4$

How does benzene undergo halogenation?

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- E.g. Bromination:
- Benzene only reacts with bromine if a halogen carrier i.e. $FeBr_3$ (or $AlCl_3$ if chlorine is being used) is present.
- This forms bromobenzene and hydrogen bromide.

$C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$

What is the role of the halogen carrier?

What is the role of the halogen carrier?

- To generate the electrophile:

  $Br_2 + FeBr_3 \rightarrow FeBr_4^- + Br^+$

- $FeBr_4^-$ then reacts with the proton expelled from the intermediate to regenerate the halogen carrier:

  $FeBr_4^- + H^+ \rightarrow FeBr_3 + HBr$

How does benzene undergo an alkylation reaction?

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React benzene with a haloalkane in the presence of a halogen carrier (i.e. $AlCl_3$):

$$C_6H_6 + C_2H_5Cl \rightarrow C_6H_5(C_2H_5) + HCl$$

How does the halogen carrier generate the electrophile?

How does the halogen carrier generate the electrophile?

- Halogen carrier reacts with haloalkane to generate electrophile:

  $AlCl_3 + C_2H_5Cl \rightarrow AlCl_4^- + C_2H_5^+$

- $AlCl_4^-$ reacts with the proton expelled from the intermediate to regenerate the halogen carrier:

  $AlCl_4^- + H^+ \rightarrow AlCl_3 + HCl$

How does benzene undergo an acetylation reaction?

How does benzene undergo an acetylation reaction?

Reflux benzene with an acyl chloride in the presence of a halogen carrier (i.e. $AlCl_3$):

$$C_6H_6 + CH_3COCl \rightarrow C_6H_5COCH_3 + HCl$$

How does the halogen carrier generate the electrophile?

How does the halogen carrier generate the electrophile?

- Halogen carrier reacts with acyl chloride to generate electrophile:
  $AlCl_3 + CH_3COCl \rightarrow AlCl_4^- + CH_3CO^+$
- $AlCl_4^-$ reacts with the proton expelled from the intermediate to regenerate the halogen carrier:
  $AlCl_4^- + H^+ \rightarrow AlCl_3 + HCl$

How does benzene undergo sulfonation?

How does benzene undergo sulfonation?

Heat benzene under reflux with (fuming) concentrated H_2SO_4:

$$C_6H_6 + SO_3 \rightarrow C_6H_5SO_3H$$

How is a diazonium compound formed?

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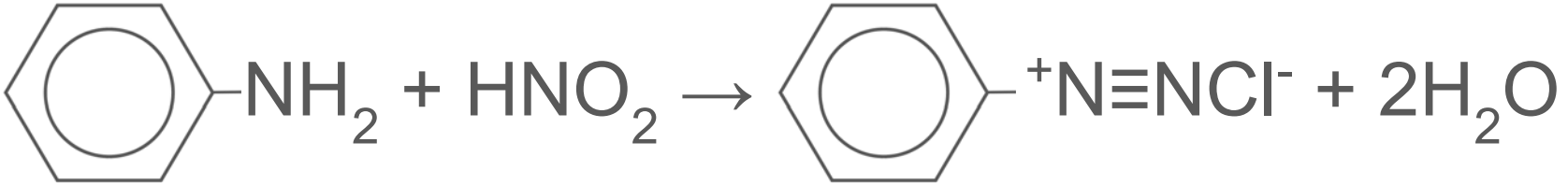
- Hydrochloric acid reacts with sodium nitrate to form an unstable nitrous acid:

  $NaNO_2 + HCl \rightarrow HNO_2 + NaCl$

- Nitrous acid then reacts with aminobenzene:



How do diazonium compounds form azo dyes?

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- In a coupling reaction: The diazonium salt reacts with the coupling agent (which is another arene).
- The diazonium salt reacts with the benzene ring of the arene (coupling agent) as it is acting as an electrophile.

What can diazonium salts react with to form different dyes?

What can diazonium salts react with to form different dyes?

- When reacted with a phenol, a yellow/orange azo compound is formed.
- A red azo compound is formed when the salt reacts with an alkaline solution of 2-Naphthol.
- A yellow dye is often formed when a diazonium salt is reacted with phenylamines.

How can an aldehyde form a carboxylic acid?

How can an aldehyde form a carboxylic acid?

- By heating under reflux with acidified potassium dichromate (VI).
- The aldehyde is oxidised into a carboxylic acid: $CH_3CHO + [O] \rightarrow CH_3COOH$.
- There will be a colour change from orange to green.

What are the two tests for an aldehyde?

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1. Fehling's solution.
2. Tollen's reagent.

How do you test for an aldehyde with Tollens' reagent?

How do you test for an aldehyde with Tollens' reagent?

Warm the sample with Tollens' reagent. If an aldehyde is present, a silver mirror will form.

How do you test for an aldehyde with Fehling's solution?

How do you test for an aldehyde with Fehling's solution?

Warm the sample with Fehling's solution. If an aldehyde is present, a red precipitate will form.

How do aldehydes react with cyanide ions to form cyanohydrin?

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They are reduced by nucleophilic addition.

$CH_3CHO + HCN \rightarrow CH_3CH(OH)CN$

How do ketones react with cyanide ions to form a cyanohydrin?

How do ketones react with cyanide ions to form a cyanohydrin?

They are reduced by nucleophilic addition.

$CH_3COCH_3 + HCN \rightarrow CH_3CN(OH)CH_3$