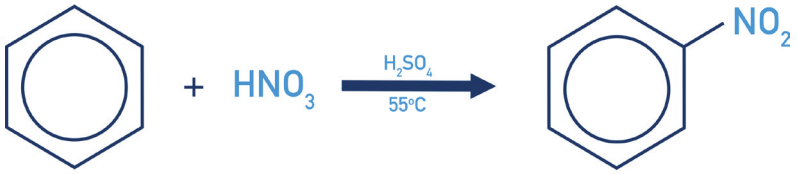
Organic Chemistry Revision Sheets
Benzene | Electrophilic Subsititution, (Nitration, with HNO_3)

Reaction

REACTANTS: Benzene and Nitric Acid
CONDITIONS: 55°C and conc. sulfuric acid (H_2SO_4)
PRODUCT: Nitrobenzene
REACTION TYPE: Electrophilic Substitution, *Nitration*

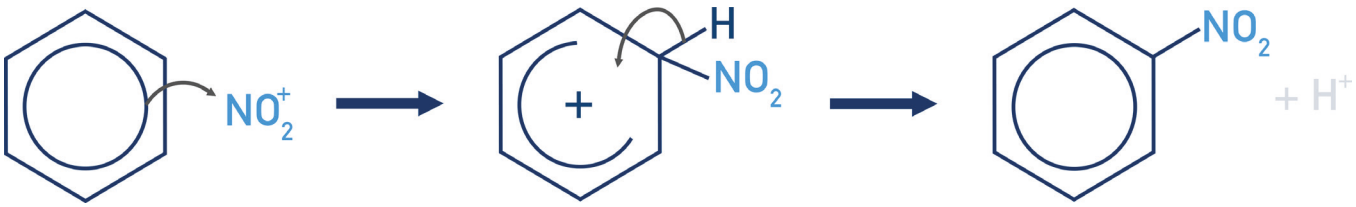
REACTION: (example of benzene)



Benzene Nitrobenzene

Mechanism

Nitronium (NO_2^+) ion **acts as an electrophile due to its positively charged nitrogen atom accepting an electron pair** from the delocalised ring of electrons in the benzene ring. A Carbon-nitrogen bond forms. The carbon-hydrogen bond breaks to give electron pair back to delocalised ring of electrons. NO_2^+ ion replaces H on benzene ring - ***substitution reaction***.



Notes:

- Nitronium ion is formed by the reaction of concentrated nitric acid with concentrated sulfuric acid

$$HNO_3 + H_2SO_4 \longrightarrow H_2NO_3^+ + HSO_4^-$$

$$H_2NO_3^+ \longrightarrow NO_2^+ + H_2O$$

Nitronium Ion

- H^+ ion removed from benzene ring combines with hydrogen sulfate (HSO_4^-) ion to reform catalyst H_2SO_4:

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