3.3 HALOGENOALKANES

Chlorofluorocarbons

- CFCs are halogenoalkanes with only carbon, chlorine and fluorine atoms
  - Legislation to ban use of CFCs
    - Alternatives to CFCs include HFCs and hydrocarbons

Depletion of Ozone

- Ozone formed from oxygen free radicals
  - $O_2 \rightarrow O\cdot + O\cdot$
    $O_2 + O\cdot \rightarrow O_3$
  - Ozone, O_3, prevents a lot of UV radiation from the sun from reaching Earth
    - UV radiation causes sunburn and skin cancer
- Chlorine free radicals are formed in the atmosphere
  - This happens when UV light breaks C–Cl bonds in CFCs
  - Chlorine atoms catalyse the decomposition of ozone
    - $Cl\cdot + O_3 \rightarrow ClO\cdot + O_2$
      $ClO\cdot + O_3 \rightarrow 2O_2 + Cl\cdot$
      Overall: $2O_3 \rightarrow 3O_2$
    - Leads to holes in the ozone layer

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3.3 HALOGENOALKANES

Elimination Reactions

- Formation of an alkene from a halogenoalkane
- Reflux
- Elimination – the hydroxide ions must be dissolved in ethanol
  - Anhydrous conditions
- Hydroxide ions act as a base
  - Accept a proton from the carbon atom
  - E.g. potassium hydroxide

Nucleophilic Substitution Reactions

- Formation of nitriles
  - Reagent: ethanolic potassium cyanide
- Formation of amines
  - The amine group has a lone pair of electrons
    - Acts as a nucleophile
  - Reagent: excess ethanolic ammonia
  - Hydrolysis
- Formation of alcohols
  - Reagent: warm aqueous potassium or sodium hydroxide
- Nucleophiles are electron-pair donors
  - A nucleophile replaces a halogen atom
  - The carbon–halogen bond is polar so the δ+ carbon attracts nucleophiles
    - Carbon–halogen bond strength determines reactivity
      - C–F bond is the strongest so has the highest bond enthalpy
      - C–I bond has the lowest bond enthalpy
      - Rate of reaction increases from fluoroalkanes to iodoalkanes

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