3.5 ALCOHOLS: ALCOHOL PRODUCTION

Fermentation of glucose produces ethanol

- Anaerobic conditions
- 30–40°C temperatures
- Yeast is required to provide an enzyme for the fermentation
- $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$
- Carbon neutral debate
  - Not quite carbon neutral as fossil fuels must be burned
  - This powers machinery and provides transportation
- Fractional distillation required to separate ethanol from the mixture

Ethanol made in this way is a biofuel

- Biofuels are carbon neutral
- Decisions surrounding the use of biofuels
  - Land used for biofuels can't be used for crops
  - All car engines would need modifying to use different fuels

Hydration of alkenes produces alcohols

- Mechanism
- E.g. $C_3H_6 + H_2O \rightleftharpoons C_3H_7OH$
- Requires an acid catalyst and steam
  - Phosphoric acid catalyst

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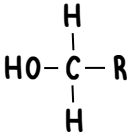
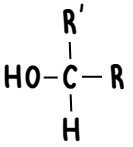
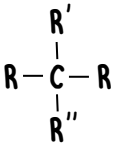
3.5 ALCOHOLS

Elimination

- Alkenes can be formed by the elimination of alcohols
  - Concentrated sulfuric acid catalyst
  - Alkenes produced from a renewable resource
    - Addition polymers can be produced without the need for crude oil
  - E.g. $C_2H_5OH \rightarrow C_2H_4 + H_2O$
  - Product requires distillation
- Mechanism for the elimination of water from alcohols

Classification of Alcohols

- Primary alcohols
- Secondary alcohols
- Tertiary alcohols

Primary alcohol	Secondary alcohol	Tertiary alcohol
		

Oxidation

- Oxidising agent: acidified potassium dichromate(VI)
  - Primary alcohols are oxidised to aldehydes
    - Distillation apparatus required to obtain the aldehyde
    - Aldehydes oxidised to carboxylic acids
      - Reflux apparatus to obtain the carboxylic acid
      - E.g. $CH_3CH_2OH + [O] \rightarrow CH_3CHO + H_2O$
        $CH_3CHO + [O] \rightarrow CH_3COOH$
  - Secondary alcohols are oxidised to ketones
    - Tests to distinguish between aldehydes and ketones
      - Fehling's solution
      - Tollens' reagent
  - Tertiary alcohols are not easily oxidised
    - E.g. $(CH_3)_2CHOH + [O] \rightarrow (CH_3)_2CO + H_2O$
  - Oxidising agent represented as [O] in equations

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