3.2 ALKANES

Fractional Distillation

- Crude oil
  - 1. Crude oil is vaporised
  - 2. Gases enter the fractionating column
  - 3. Gases condense at different fractions due to their different boiling points
- Petroleum
  - Mixture of hydrocarbons (mostly alkanes)
  - Hydrocarbons are compounds containing only carbon and hydrogen atoms
  - Alkanes are saturated hydrocarbons
  - Only contain single C–C bonds

Combustion

- Internal combustion engines in cars
  - Catalytic converters remove unburnt hydrocarbons, oxides of nitrogen and carbon monoxide from exhausts
  - Produce oxides of nitrogen (NO_x) and unburnt hydrocarbons
- Incomplete combustion
  - Insufficient oxygen
  - Produces carbon monoxide and carbon particulates (soot)
    - Health problems
  - E.g. $4CH_4 + 5O_2 \rightarrow 2CO + 2C + 8H_2O$
- Complete combustion
  - Sufficient oxygen
  - Produces water and carbon dioxide
  - E.g. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
- Alkanes are used as fuels
  - Produce a lot of energy when burned
- Sulfur dioxide gas released when fossil fuels containing sulfur are burnt
  - Causes acid rain
  - Flue gas desulphurisation
    - Removes SO2 using CaO or CaCO3

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3.2 ALKANES

Chlorination

- Free radicals are particles with an unpaired electron
  - Indicated by a dot next to the chemical symbol, e.g. Cl ·
- Halogens react with alkanes in photochemical reactions
  - Require ultraviolet light
  - Free radical substitution reactions
    - 1. Initiation
    - 2. Propagation
    - 3. Termination
    - E.g. Reaction of chlorine with methane

Cracking

- Breaks the C–C bonds in alkanes
  - Produces more useful hydrocarbons which are more in demand
    - E.g. $C_{10}H_{22} \rightarrow C_2H_4 + C_8H_{18}$
- Thermal cracking
  - Produces a high percentage of alkenes
  - High pressures and high temperatures
- Catalytic cracking
  - Slight pressure
  - High temperature
  - Zeolite catalyst
  - Produces aromatic hydrocarbons and motor fuels

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