Edexcel IGCSE Chemistry

Topic 4: Organic chemistry

Crude oil

Notes

4.7 know that crude oil is a mixture of hydrocarbons

- Crude oil is a complex mixture of hydrocarbons
- It contains molecules in which carbon atoms are in chains or rings (names, formulae and structures of specific ring molecules not required)
- An important source of useful substances (fuels and feedstock for the petrochemical industry)
- A finite resource

4.8 describe how the industrial process of fractional distillation separates crude oil into fractions

- The oil is heated in the fractionating column and the oil evaporates and condenses at a number of different temperatures.
- The many hydrocarbons in crude oil can be separated into fractions each of which contains molecules with a similar number of carbon atoms
- The fractionating column works continuously, heated crude oil is piped in at the bottom. The vaporised oil rises up the column and the various fractions are constantly tapped off at the different levels where they condense.
- The fractions can be processed to produce fuels and feedstock for the petrochemical industry.

4.9 know the names and uses of the main fractions obtained from crude oil:

- Refinery gases
    - Domestic heating and cooking
- Gasoline / Petrol
    - Fuel for cars
- Kerosene
    - Fuel for aircraft
- Diesel
    - Fuel for some cars and trains
- Fuel oil
    - Fuel for large ships and in some power stations
- Bitumen
    - Surface roads and roofs

4.10 know the trend in colour, boiling point and viscosity of the main fractions

- Some properties of hydrocarbons depend on the size of their molecules. These properties influence their use as fuels.
- The shorter the molecules, the lower the temperature at which that fraction vaporises or condenses – and the lower its boiling point.
- Shorter the molecules, the less viscous it is. (more runny)
- Colours are darker at the bottom fractions – longer molecules

4.11 know that a fuel is a substance that, when burned, releases heat energy

- Fuel: substance that releases heat energy when burned

4.12 know the possible products of complete and incomplete combustion of hydrocarbons with oxygen in the air

- Complete combustion
  - CO_2 and H_2O are produced
- Incomplete combustion
  - If there's not enough oxygen, some of the fuel doesn't burn – this is partial combustion. Here, solid particles of soot (carbons) and unburnt fuel are released. Carbon monoxide is also released.

4.13 understand why carbon monoxide is poisonous, in terms of its effect on the capacity of blood to transport oxygen; references to haemoglobin are not required

- Carbon monoxide prevents red blood cells carrying oxygen around the body. This is carbon monoxide poisoning, which can lead to breathing difficulties and eventually death.

4.14 know that, in car engines, the temperature reached is high enough to allow nitrogen and oxygen from air to react, forming oxides of nitrogen

- Temperature reached in car engines is high enough to allow nitrogen and oxygen from air to react forming oxides of nitrogen e.g. nitrogen monoxide NO or nitrogen dioxide NO_2

4.15 explain how the combustion of some impurities in hydrocarbon fuels results in the formation of sulfur dioxide

- Most fuels, including coal, contain carbon and/or hydrogen and may also contain some sulfur. This means when the fuels are burnt the sulfur is oxidised to produce sulfur dioxide

4.16 understand how sulfur dioxide and oxides of nitrogen contribute to acid rain

- When sulfur dioxide and oxides of nitrogen are emitted into the atmosphere they react with rain water to create H^+ ions
- When the rain falls the acid can corrode rocks and buildings
- The acid can also alter the pH in soil or rivers which can affect an ecosystem
- Acid rain corrodes limestone, which damages buildings and statues etc

4.17 describe how long-chain alkanes are converted to alkenes and shorter-chain alkanes by catalytic cracking (using silica or alumina as the catalyst and a temperature in the range of 600-700˚C)

- Hydrocarbons can be cracked to produce smaller, more useful molecules. This process involved heating the hydrocarbons to vaporise them.
- The vapours are:
    - Either passed over a hot catalyst (silica or alumina)
    - Mixed with steam and heated to a very high temperature (temperature in the range of 600-700˚C) so that thermal decomposition reactions can occur.
- The products of cracking include alkanes and unsaturated hydrocarbons called alkenes. Alkenes have the general formula C_nH_{2n}

4.18 explain why cracking is necessary, in terms of the balance between supply and demand for different fractions

- Demand for smaller chained alkanes is much greater than that for longer chained alkanes – however, supply for longer chained alkanes is greater than that for smaller chained alkanes, therefore an alternative to produce smaller chained alkanes is required (i.e. cracking)