Beckfoot

Subject: Chemistry	Topic: Alkanes 3.3.2	Year Group: 12

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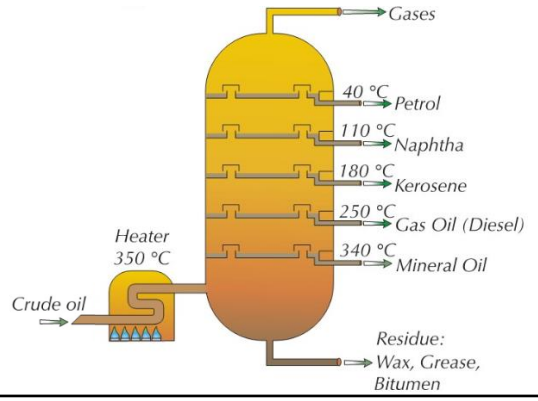
Fractional Distillation

1	Crude oil is separated into more useful fractions using fractional distillation. This separates the hydrocarbons by their boiling points. The shorter hydrocarbons with the lowest boiling points are collected at the top of the column and the longer hydrocarbons with higher boiling points are collected at the top,
2	

Cracking

1	Long chain alkanes are broken into smaller hydrocarbons (including alkenes) by breaking the C-C bond.
2	Thermal cracking takes place at high temperature (up to 1000°C) and high pressure (up to 70atm). It produces a large number of alkenes.
3	Catalytic cracking uses a zeolite catalyst at slight pressure and around 500°C. It produces aromatic hydrocarbons.

Combustion

1	Complete combustion occurs when hydrocarbons are burnt with plenty of oxygen. $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)}$
2	Incomplete combustion occurs when there is limited oxygen. This produces carbon and carbon monoxide instead of, or as well as, carbon dioxide and water. $C_3H_{8(g)} + 3½O_{2(g)} \rightarrow 3CO_{(g)} + 4H_2O_{(g)}$

Pollutants from Combustion

1	Carbon dioxide is a greenhouse gas which causes global warming.
2	Carbon monoxide is poisonous because it binds to haemoglobin stopping oxygen from binding.
3	Carbon (soot) causes breathing problems.
4	The internal combustion engine produces a number of pollutants including NO_x, CO, carbon and unburned hydrocarbons. These gaseous pollutants can be removed using catalytic converters.
5	Combustion of hydrocarbons containing sulfur leads to sulfur dioxide which dissolves in rain water producing sulphuric acid that causes acid rain. Sulphur dioxide can be removed from power station flue gases when it is mixed with an alkaline slurry (calcium carbonate or calcium oxide mixed with water).

Key Vocabulary

1	Hydrocarbon	Molecule that only contains carbon and hydrogen
2	Saturated	Molecule that only has single carbon-carbon bonds
3	Free radical	A particle with an unpaired electron.

Chlorination of Alkanes

1	Chloroalkanes have one or more hydrogen atoms substituted with a chlorine atom.
2	Halogens react with alkanes in photochemical reactions to form halogenoalkanes. The overall equation for the reaction of methane with chlorine is $CH_4 + Cl_2 \xrightarrow{UV} CH_3Cl + HCl$
3	The reaction mechanism has 3 stages. Initiation – Free radicals are produced. Sunlight provides the energy to break the Cl-Cl bonds. This is photodissociation. $Cl_2 \xrightarrow{UV} 2Cl\bullet$ Propagation – Free radicals are used up and created in a chain reaction. First the Cl radical attacks a methane forming a methyl radical which can then attack another Cl_2. $Cl\bullet + CH_4 \rightarrow \bullet CH_3 + HCl$ $\bullet CH_3 + Cl_2 \rightarrow CH_3Cl + Cl\bullet$ Termination – two free radicals join together to form a stable molecule. This terminates the chain reaction. $\bullet CH_3 + Cl\bullet \rightarrow CH_3Cl$ $\bullet CH_3 + CH_3\bullet \rightarrow C_2H_6$ $Cl\bullet + Cl\bullet \rightarrow Cl_2$