

Chemistry Topic C9: Crude Oil and Fuels

1. Crude Oil

Crude oil is...

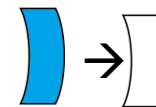
- a **fossil fuel**.
- a mixture of **hydrocarbons**.
- formed over millions of years from remains of animals and plants.
- **finite** (it cannot be replaced as fast as it is being used)

Key Terms – Part A

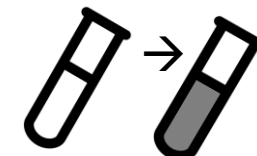
Crude Oil	A natural mixture of hydrocarbons
Hydrocarbon	A compound of only hydrogen and carbon
Fractional Distillation	Using boiling points to separate a mixture
Viscosity	The thickness of a liquid
Flammability	The ease of setting a substance on fire
Boiling Point	The temperature of a liquid turning into a gas

4. Testing Combustion Products

Test for H₂O: Cobalt chloride paper. Starts blue, turns white/pink

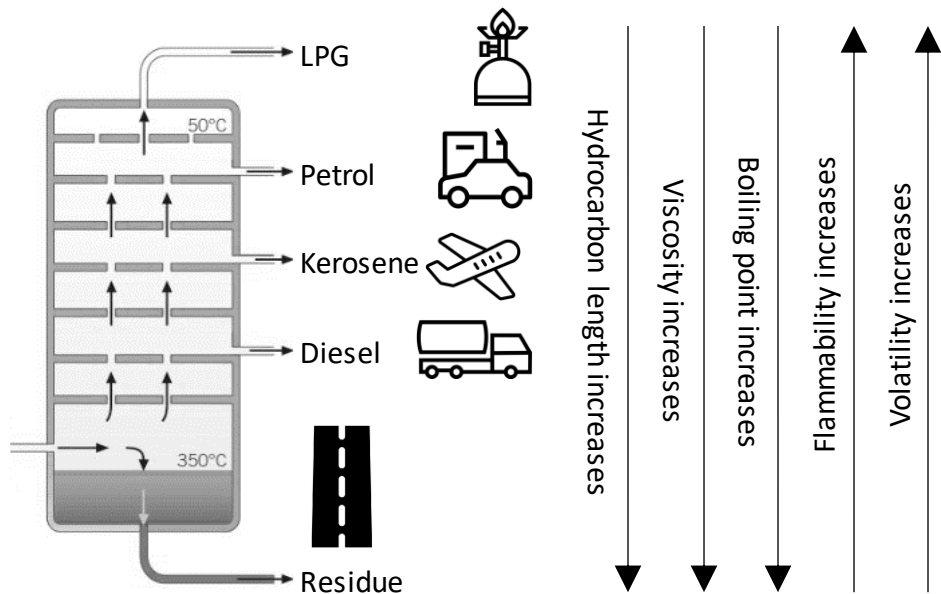


Test for CO₂: Limewater. Starts clear, turns milky



2. Fractional Distillation

Crude oil is **vaporised** (l → g). The gas goes into a fractionating column which is hot at the bottom and cool at the top. The hot gas mixture rises, loses energy and cools on the way up. Different length hydrocarbons will condense (g → l) at different temperatures (at different heights). The liquid fractions are pumped away at these heights.



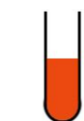
3. Combustion

	Complete Combustion	Incomplete Combustion
Conditions	Plentiful Oxygen	Limited Oxygen
Flame		
Products	Water Carbon dioxide	Water and a mixture of Carbon Dioxide, Carbon Monoxide and Carbon
Example equation	Methane + Oxygen → Water + Carbon Dioxide $\text{CH}_4 + 2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{CO}_2$	Methane + Oxygen → Water + Carbon Monoxide $2\text{CH}_4 + 3\text{O}_2 \rightarrow 4\text{H}_2\text{O} + 2\text{CO}$
Impacts	CO ₂ → Global warming	CO ₂ → Global warming CO → Toxic C → Global dimming, breathing difficulties, property damage

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5. Hydrocarbons

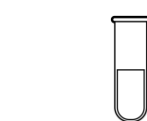
Number of C	Alkanes Single C-C bonds C_nH_{2n+2}		Alkenes 1+ C=C double bond C_nH_{2n}	
1	Methane CH_4		NA	NA
2	Ethane C_2H_6		Ethene C_2H_4	
3	Propane C_3H_8		Propene C_3H_6	
4	Butane C_4H_{10}		Butene C_4H_8	



Bromine Water



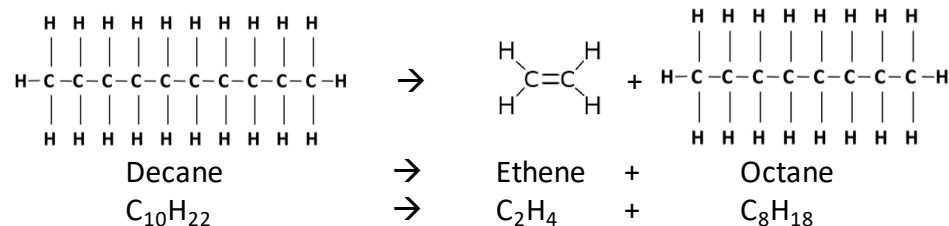
Bromine Water + Alkane



Bromine Water + Alkene

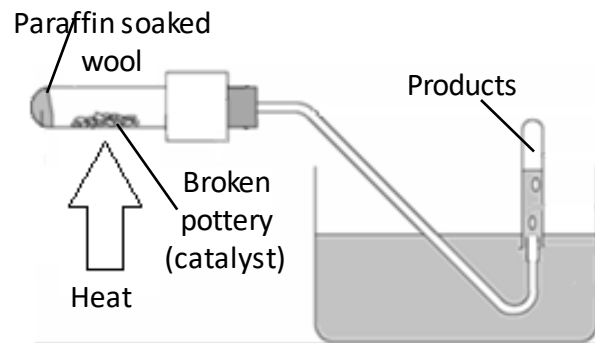
6. Cracking

More long chain hydrocarbons are obtained from crude oil than are useful. The chemical industry makes the "extra" useful through cracking. Long alkane is "cracked" into a small alkene e.g. ethene, and a shorter alkane.

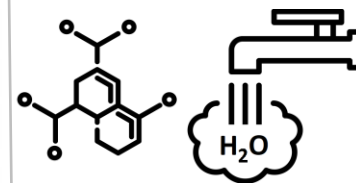


High temperatures and a catalyst are needed for cracking

Cracking in a lab



Industrial Cracking

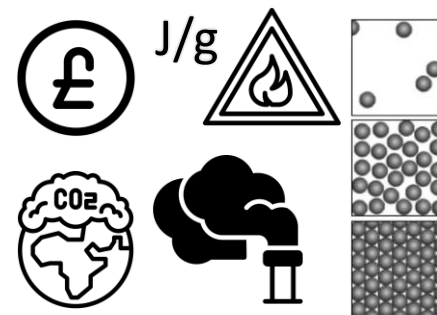


Two methods:
Catalytic cracking
Steam cracking

Key Terms – Part B

Fuel	A substance that can be burnt to release energy
Combustion	Burning
Cracking	Splitting a long alkane in to a shorter alkane and an alkene
Alkane	A hydrocarbon with only single covalent bonds
Alkene	A hydrocarbon with a carbon to carbon double bond

7. Comparing fuels



To decide which fuel is best – consider what it is being used for. Compare...

- Cost
- Energy per gram
- Flammability
- Volume of CO_2 released
- Particulates released
- Ease of use (state of matter)