Your notes

GCSE Chemistry: revision notes

Crude oil, hydrocarbons and cracking

Contents

1. Crude oil and alkanes
2. Fractional distillation
3. Properties of hydrocarbons
4. Cracking
5. Key terms
6. Quick questions
7. What to do next

Crude oil and alkanes

- **Crude oil** is a finite resource found in rocks. It is the remains of ancient biomass, mainly plankton, that was buried in mud millions of years ago.
- **Crude oil** is a mixture of a very large number of compounds. Most of them are **hydrocarbons**: compounds of hydrogen and carbon only.
- Most **hydrocarbons** in **crude oil** are **alkanes**, with the general formula C_nH_{2n+2}.
- The first four **alkanes** are methane (CH_4), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}).

Fractional distillation

- The **hydrocarbons** are separated into **fractions** by **fractional distillation**. Each fraction contains molecules with a similar number of carbon atoms.
- The **crude oil** is heated until it evaporates, and the vapour enters a column that is hot at the bottom and cooler at the top.
- Each **fraction** condenses at the level where the temperature is just below its boiling point. Large molecules condense near the bottom; small ones rise to the top.
- **Fractions** are used as fuels (liquefied petroleum gases, petrol, kerosene, diesel oil and heavy fuel oil) and as **feedstock** for the petrochemical industry, which makes solvents, lubricants, polymers and detergents.

Properties of hydrocarbons

- As **hydrocarbon** molecules get bigger: the boiling point increases, the **viscosity** increases (they flow less easily), and the **flammability** decreases.
- Complete combustion of a **hydrocarbon** releases energy and produces carbon dioxide and water: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$.

- Propane: $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$.

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Cracking

- **Cracking** breaks long **hydrocarbon** molecules into smaller, more useful molecules.
- Catalytic **cracking**: the vapour is passed over a hot catalyst. Steam **cracking**: the vapour is mixed with steam at a very high temperature.
- The products are shorter **alkanes** and **alkenes**, for example $C_{10}H_{22} \rightarrow C_8H_{18} + C_2H_4$.
- **Cracking** is needed because there is more demand for short-chain fuels such as petrol than **crude oil** supplies. **Alkenes** are used to make polymers and other chemicals.
- **Alkenes** are more reactive than **alkanes**. Bromine water turns from orange to colourless with **alkenes**, but not with alkanes.

Key terms

Crude oil	A finite mixture of hydrocarbons formed from ancient plankton buried in mud.
Hydrocarbon	A compound made of hydrogen and carbon atoms only.
Alkane	A saturated hydrocarbon with the general formula C_nH_{2n+2}.
Fraction	A group of hydrocarbons with a similar number of carbon atoms and similar boiling points.
Fractional distillation	Separating crude oil into fractions using differences in boiling point.
Viscosity	How thick a liquid is, or how easily it flows.
Flammability	How easily a substance catches fire.
Cracking	Breaking large hydrocarbon molecules into smaller, more useful ones.
Alkene	An unsaturated hydrocarbon with a C=C double bond.
Feedstock	A raw material used to make other chemicals.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is crude oil formed from?
2. What is a hydrocarbon?
3. What is the general formula of the alkanes?
4. What is the formula of butane?
5. Where in the fractionating column do the largest molecules condense?
6. How does viscosity change as hydrocarbon chains get longer?

7. What are the products of complete combustion of a hydrocarbon?
8. Why is cracking needed?

Answers

1. The remains of ancient plankton buried in mud
2. A compound of hydrogen and carbon only
3. C_nH_{2n+2}
4. C_4H_{10}
5. At the bottom
6. It increases
7. Carbon dioxide and water
8. There is more demand for short-chain hydrocarbons than supply

What to do next

Practise 11 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

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