

# C7 – Organic Chemistry

## Crude oil

Crude oil = a mixture of **hydrocarbons**.

- It is a **non-renewable resource (fossil fuel)**
- Made from remains of dead sea creatures **compressed** over millions of years

**Hydrocarbons** - molecules containing **hydrogen** and **carbon only**.

Two types of hydrocarbons are **alkanes** and **alkenes**.  
The hydrocarbons in crude oil are mostly alkanes.

## Alkanes

- Alkanes = **saturated** hydrocarbons.
- Held together by **single covalent bonds**.
- General formula =  $C_nH_{2n+2}$
- Have different boiling points – longer the chain, higher the boiling point

**You need to remember the names, and formulas of the first 4 alkanes.**

Name of Alkane	Structural Formula	Molecular Formula
methane		$CH_4$
ethane		$C_2H_6$
propane		$C_3H_8$
butane		$C_4H_{10}$

## Fractional Distillation

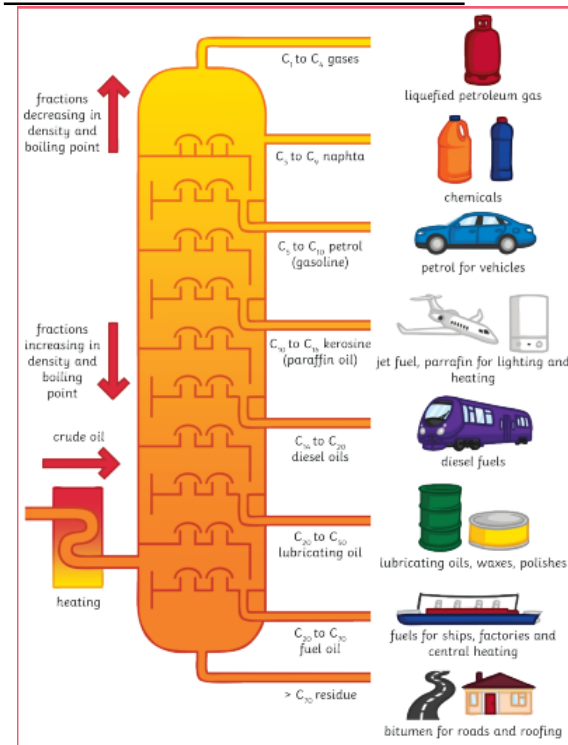
- Used to **separate** the mixtures of hydrocarbons in **crude oil**.

### Steps in Fractional Distillation

1. Crude oil enters **fractioning column** and is heated to boiling point so the hydrocarbons evaporate.
2. It is **cooler** at the **top** of the fractionating column and **hotter** at the **bottom**.
3. Vapours rise up the column and, as they rise, they cool
4. The different hydrocarbons condense at different **boiling points**
5. The different 'fractions' have different properties

Short-Chain Molecules	Increasing Chain Length	Long-Chain Molecules

## Uses of the different fractions



## Supply and demand

Product	Supply in tonnes	Demand in tonnes
petrol	100	300
diesel	200	100
heating oil	250	50

After fractional distillation, we find:

- we have more of the long chain hydrocarbons than we need
- There are not enough short chain hydrocarbons.
- Short chain are more useful as they are more flammable so can be used as fuels.

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## Cracking

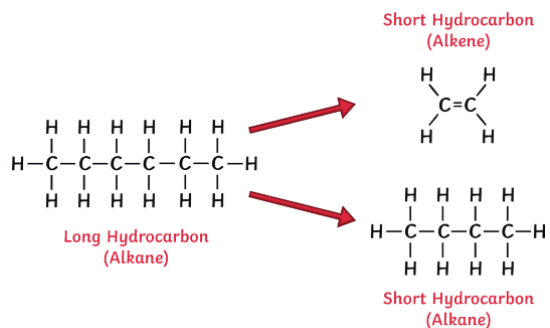
- This is done to solve the problem of having too many long chain hydrocarbons and not enough short ones
- Long hydrocarbons are **broken down** into smaller, more useful hydrocarbons.
- Short chain hydrocarbons are more useful as they are more flammable

**Two types of cracking: catalytic and steam cracking.**

**Catalytic cracking** – needs a **high temperature** and a **catalyst**.

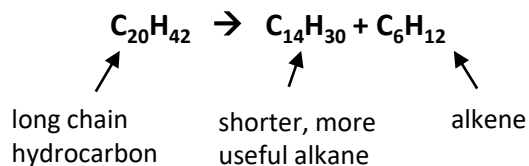
**Steam cracking** – **high temperature and steam**

- Cracking produces a **short-chain alkane** and an **alkene**.



## Cracking equations

Same number of carbon and hydrogen atoms on both sides of the equation:



## Alkenes

- Alkenes are **unsaturated** hydrocarbons.
- Contain carbon-carbon **double bonds**.

## Test for Alkenes

Use bromine water to test for alkenes.

If an alkene is present, the bromine water turns from orange/brown to colourless.

Alkanes do not react with bromine water.

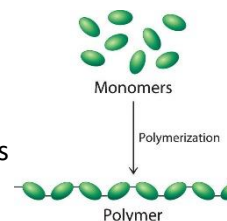


## Uses for alkenes:

- Can be used as fuels
- Can be used as a starting material for other chemicals
- Can be used to make polymers (e.g. plastic)

## Polymers

- Polymers are large molecules made of many repeating units (monomers)
- Alkenes (small molecules) are joined together to make polymers



**Poly(ethene)** – plastic bags/drinks bottles

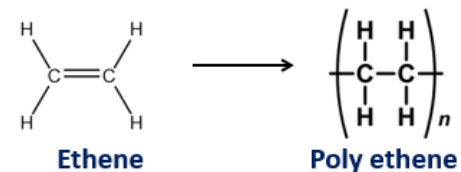
**Poly(propene)** – strong tough plastics

## Drawing and naming polymers

1. Redraw the **monomer given**, but without the double bond. Make sure to copy all other elements exactly.
2. Put brackets around the monomer and extend joining bonds out through the brackets on both sides
3. Add an 'n' at the bottom right of the bracket
4. To name the polymer, you put **poly** in front of the monomer name

E.g.:

Draw and name the polymer made from the monomer ethene:



## Combustion of Hydrocarbons

Combustion means burning.

**Complete combustion** - when there is a good supply of **oxygen** for a fuel to burn.

**Fuel + oxygen  $\rightarrow$  carbon dioxide + water**

**Incomplete combustion** - **not enough oxygen**

Products are **carbon monoxide** and water.

**Carbon monoxide = poisonous gas**

