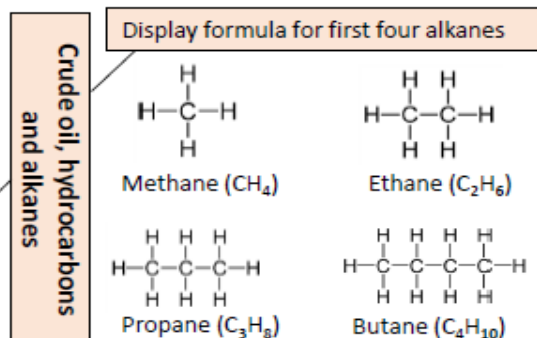


|                             |                                                                 |                                                                                                        |
|-----------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Crude oil                   | <i>A finite resource</i>                                        | Consisting mainly of plankton that was buried in the mud, crude oil is the remains of ancient biomass. |
| Hydrocarbons                | <i>These make up the majority of the compounds in crude oil</i> | Most of these hydrocarbons are called alkanes.                                                         |
| General formula for alkanes | $C_nH_{2n+2}$                                                   | For example:<br>$C_2H_6$<br>$C_6H_{14}$                                                                |

|                       |                                                                                                                                                         |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alkanes to alkenes    | <i>Long chain alkanes are cracked into short chain alkenes.</i>                                                                                         |
| Alkenes               | <i>Alkenes are hydrocarbons with a double bond (some are formed during the cracking process).</i>                                                       |
| Properties of alkenes | <i>Alkenes are more reactive than alkanes and react with bromine water. Bromine water changes from orange to colourless in the presence of alkenes.</i> |

|                    |                                                                         |                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Cracking           | <i>The breaking down of long chain hydrocarbons into smaller chains</i> | The smaller chains are more useful. Cracking can be done by various methods including catalytic cracking and steam cracking.        |
| Catalytic cracking | <i>The heavy fraction is heated until vaporised</i>                     | After vaporisation, the vapour is passed over a hot catalyst forming smaller, more useful hydrocarbons.                             |
| Steam cracking     | <i>The heavy fraction is heated until vaporised</i>                     | After vaporisation, the vapour is mixed with steam and heated to a very high temperature forming smaller, more useful hydrocarbons. |



### Carbon compounds as fuels and feedstock

#### AQA Trilogy

C7: Organic Chemistry

### Carbon compounds as fuels and feedstock

#### Cracking and alkenes

#### Fractional distillation and petrochemicals

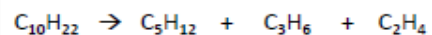
|                    |        |                                                                                                                                                     |
|--------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Hydrocarbon chains | In oil | Hydrocarbon chains in crude oil come in lots of different lengths.                                                                                  |
| Boiling points     |        | The boiling point of the chain depends on its length. During fractional distillation, they boil and separate at different temperatures due to this. |

#### Properties of hydrocarbons

#### Combustion

During the complete combustion of hydrocarbons, the carbon and hydrogen in the fuels are oxidised, releasing carbon dioxide, water and energy.

Decane  $\rightarrow$  pentane + propene + ethane



Complete combustion of methane:  
Methane + oxygen  $\rightarrow$  carbon dioxide + water + energy  
 $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$

Alkenes and uses as polymers

*Used to produce polymers. They are also used as the starting materials of many other chemicals, such as alcohol, plastics and detergents.*

Why do we crack long chains?

*Without cracking, many of the long hydrocarbons would be wasted as there is not much demand for these as for the shorter chains.*

Boiling point (temperature at which liquid boils)

*As the hydrocarbon chain length increases, boiling point increases.*

Viscosity (how easily it flows)

*As the hydrocarbon chain length increases, viscosity increases.*

Flammability (how easily it burns)

*As the hydrocarbon chain length increases, flammability decreases.*

|                 |                                                                                             |                                                                                                                                                                        |
|-----------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fractions       | <i>The hydrocarbons in crude oil can be split into fractions</i>                            | Each fraction contains molecules with a similar number of carbon atoms in them. The process used to do this is called fractional distillation.                         |
| Using fractions | <i>Fractions can be processed to produce fuels and feedstock for petrochemical industry</i> | We depend on many of these fuels; petrol, diesel and kerosene.<br><br>Many useful materials are made by the petrochemical industry; solvents, lubricants and polymers. |

