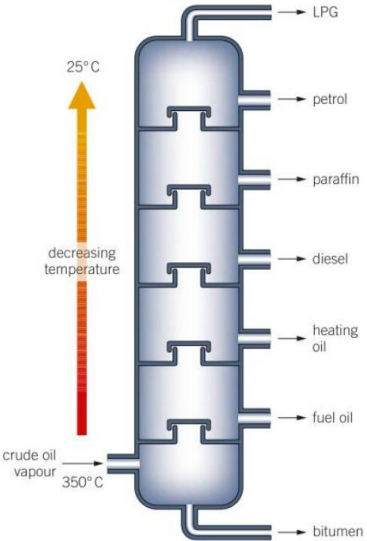


Year 9 Knowledge organiser

9F where do our fuels come from?

Alkanes and cracking crude oil			
Learning Objectives	Key Information		
Name the first four straight chain alkanes and draw their displayed formulae	Methane	CH ₄	$ \begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} - \text{H} \\ \\ \text{H} \end{array} $
	Ethane	C ₂ H ₆	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H} - \text{C} - \text{C} - \text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $
	Propane	C ₃ H ₈	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H} - \text{C} - \text{C} - \text{C} - \text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} $
	Butane	C ₄ H ₁₀	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H} - \text{C} - \text{C} - \text{C} - \text{C} - \text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $
Explain why alkanes form a homologous series	<p>A homologous series is a group of organic compounds which have the same functional group and the same general formula. The functional group of an alkane is a C-C single bond.</p> <p>All alkanes are saturated which means they only contain C-C single bonds.</p> <p>All alkanes end in -ane.</p> <p>The general formula of an alkane is C_nH_{2n+2}.</p>		
Predict the products of reactions of the alkanes	<p>Alkanes combust. This means that they react with the oxygen in air by burning.</p> <p>Complete combustion is when there is enough oxygen for all of the carbon atoms to be converted to carbon dioxide. The products of complete combustion of an alkane are always carbon dioxide and water.</p> <p>Incomplete combustion occurs when there is not enough oxygen. The products of incomplete combustion are water, carbon monoxide and carbon (soot).</p>		
Explain why crude oil is a finite resource	<p>Crude oil is a finite resource, which means that it will run out. This is because it is being remade very slowly and we are using it up faster than it is being remade.</p>		

<p>Describe and explain the separation of crude oil by fractional distillation into fractions</p>	<p>Different alkanes have different boiling points and can therefore be separated by fractional distillation.</p> <p>Larger alkanes have stronger forces between the molecules (intermolecular forces) and therefore have higher boiling points.</p> <p>Crude oil is heated at the bottom of a fractionating column which is hot at the bottom and cold at the top. The different fractions will condense into liquid in different sections of the column.</p> <p>The order of the fractions from top (coolest) to bottom (hottest):</p> <p>LPG, petrol, paraffin, diesel, heating oil, fuel oil, bitumen.</p> 
<p>Explain why cracking is carried out</p>	<p>Once crude oil is separated into its fractions, we find that we have a larger supply of the larger alkanes than we need and a smaller supply of the small molecules than we need. To solve this we can break some of the larger alkanes into smaller alkanes and alkenes. This process is called cracking.</p>
<p>Describe the cracking of crude oil fractions</p>	<p>The conditions used are:</p> <p>A high temperature (600 to 700°C)</p> <p>A hot catalyst of alumina or silica</p> <p>When cracking is done, a C-C covalent bond in the large alkane molecule is broken to form an alkene and an alkane.</p>