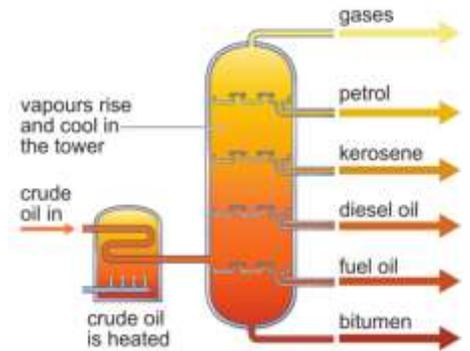


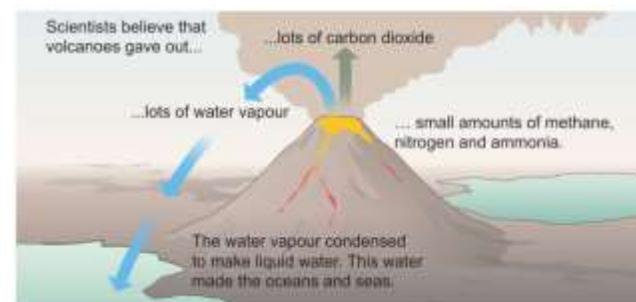
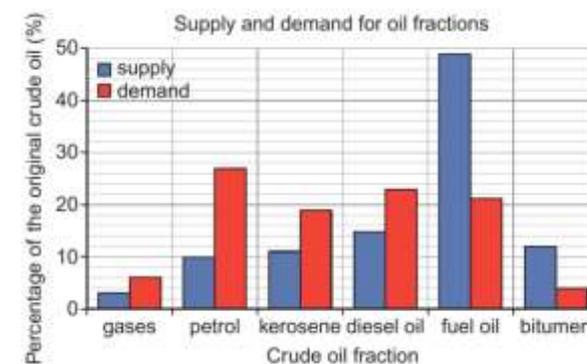
Fuels and the atmosphere: Autumn Term

Section A: Vocabulary		Section B:	Section C:
crude oil	A fossil fuel, in the liquid state, formed from the remains of microscopic dead plants and animals that lived in the sea.	<p>Hydrocarbons Hydrocarbons are compounds containing hydrogen and carbon atoms only. Crude oil is a mixture of these hydrocarbons which has formed over millions of years from dead microscopic plants and sea creatures that were trapped by sediment. Coal, oil and natural gas are all fossil fuels which are finite (not being made any more) and non-renewable (being used faster than it can be created).</p> <p>Carbon can form 4 covalent bonds allowing hydrocarbons to form in chain and ring structures.</p> <p>Fraction distillation The different fractions of crude oil are separated by fractional distillation. The crude oil is heated in a fractionating column and separates the different hydrocarbons by their boiling points; those with the lowest boiling points being collected at the top.</p> <p>The properties of the fractions change with increasing number of carbons in the chain.</p> <p>Uses of hydrocarbons From lowest to highest boiling points:</p> <ul style="list-style-type: none"> - Gases – domestic heating and cooking - Petrol – fuel for cars - Kerosene – fuel for aircraft - Diesel – fuel for lorries, trains and some cars - Fuel oil – fuel for ships and power stations - Bitumen – road surfacing 	 <p>methane, CH₄ ethane, C₂H₆ propane, C₃H₈ butane, C₄H₁₀</p> <p>methylbutane, C₅H₁₂ cyclohexane, C₆H₁₂</p>  <p>gases</p> <p>petrol</p> <p>kerosene</p> <p>diesel oil</p> <p>fuel oil</p> <p>bitumen</p> <p>crude oil in</p> <p>crude oil is heated</p> <p>vapours rise and cool in the tower</p>
alkane	A hydrocarbon in which all the bonds between the carbon atoms are single bonds.		
alkene	A hydrocarbon in which there are one or more double bonds between carbon atoms.		
carbon monoxide	A poisonous gas produced from carbon burning without enough oxygen.		
climate change	Changes that happen to the global weather patterns as a result of global warming.		
complete combustion	Combustion of hydrocarbons with enough oxygen present to convert all the fuel into carbon dioxide and water.		
cracking	A chemical reaction in which large alkane molecules are split into two or more smaller alkanes and alkenes.		
feedstock	Raw material, a substance used to make other substances.		

Fraction	Number of atoms in molecules	Boiling point	Ease of ignition	Viscosity				
gases	smallest (1-4 carbon atoms)	lowest (<0°C)	easy to ignite	lowest (flows most easily)				
petrol								
kerosene								
diesel oil								
fuel oil								
bitumen					greatest (>35 carbon atoms)	highest (>350°C)	difficult to ignite	highest (flows with difficulty)

finite resource	Something useful that is no longer made or which is being made very slowly.	<p>Combustion When a hydrocarbon burns in plenty of oxygen, only water and carbon dioxide are produced. We can test for the carbon dioxide by using limewater which turns cloudy if present.</p> <p>Issues with incomplete combustion When hydrocarbons do not burn with enough oxygen, harmful products of carbon monoxide and soot. Carbon monoxide is toxic to us, stopping us getting the oxygen we need. Soot can irritate of respiratory system, especially in those with asthma as well covering areas with a black carbon coating.</p> <p>Combustion and pollution When fuels are burned, waste harmful gases can be produced. Impurities in the fuels are oxidised to sulphur dioxide and vehicles produce oxides of nitrogen, these then form acid rain with water droplets in the atmosphere. The acid rain can weather rocks and cause damage to crops and water life. Nitrogen oxides also cause harm to our lungs.</p> <p>Alkane homologous series Hydrocarbons from crude oil are alkanes, they contain only single covalent bonds between the atoms. They are in the same homologous series, or 'family', because:</p> <ul style="list-style-type: none"> - They change by one CH₂ at a time - They have similar chemical properties - They have a trend in physical properties - They have the same general formula (C_nH_{2n+2}) <p>Cracking hydrocarbons</p>
fossil fuel	A fuel formed from the dead remains of organisms over millions of years (e.g. coal, oil or natural gas).	
fraction	A component of a mixture that has been separated by fractional distillation.	
fractional distillation	A method of separating a mixture of liquids with different boiling points into individual components (fractions).	
global warming	The rise in mean surface temperatures on the Earth, thought to be due to increasing amounts of greenhouse gases such as carbon dioxide.	
greenhouse effect	The 'trapping' of warmth by greenhouse gases in the Earth's atmosphere due to radiation from the atmosphere warming the surface of the planet.	
homologous series	A family of compounds with similar chemical properties and gradual variation in physical properties. They have the same general formula, with successive members differing in their molecular formulae by CH ₂ .	
hydrocarbon	A compound containing hydrogen and carbon only.	

Name	Molecular formula	Structural formula
methane	CH ₄	<pre> H H - C - H H </pre>
ethane	C ₂ H ₆	<pre> H H H - C - C - H H H </pre>
propane	C ₃ H ₈	<pre> H H H H - C - C - C - H H H H </pre>



incomplete combustion	When a substance reacts only partially with oxygen, such as when carbon burns in air producing carbon monoxide and soot (unburnt carbon).	<p>Some fractions of crude oil are in over supply. These are longer chain fractions which can be cracked using heat and a catalyst to produce more of the smaller under-supplied fractions such as petrol. This process produces another type of hydrocarbon: alkene. Alkenes can be used to make polymers.</p> <p>Earth's changing atmosphere Earth's earliest atmosphere is thought to be mainly carbon dioxide with small amounts of other gases and almost no oxygen. Today we have nitrogen (78%), oxygen (21%) argon (0.9%) and carbon dioxide (0.04%). The increase in carbon dioxide came from volcanoes, similar to those we can see on other rock planets e.g., Venus. The oceans formed when the temperature cooled and water vapour condensed. Around 2.5 billion years ago, the first simple plant life started increasing the concentration of oxygen in the atmosphere. From 500 million years ago more complex photosynthesising organisms greatly increased that concentration.</p> <p>Global Climate Change The Earth is warmed by energy transferred from the sun, some of this energy is trapped by gasses in the atmosphere. One of these gasses is carbon dioxide. Since 1850, CO₂ concentration has increased. We can see some correlation with this and average global temperatures but scientists have to consider other factors.</p> <p>Effects of climate change:</p> <ul style="list-style-type: none"> - Rising average global temperatures - Unseasonal weather including flooding - Changes to habitats affecting biodiversity - Lowering of seawater pH
natural gas	A fossil fuel, in the gas state, formed from the remains of microscopic dead plants and animals that lived in the sea.	
non-renewable	Something that is being used up faster than it is being formed, so it will run out one day if we keep using it.	
petrochemical	Substance made from crude oil.	
pollutant	A substance that harms living organisms when released into the environment.	
saturated	A molecule that contains only single bonds between the carbon atoms in a chain.	
soot	A form of carbon, which is produced as very fine particles when hydrocarbon fuels undergo incomplete combustion.	
unsaturated	A molecule that contains one or more double bonds between carbon atoms in a chain.	

