



Lesmahagow High School

National 5 Chemistry: Unit 2



Fuels

Learning Statement	Red	Amber	Green															
A fuel is a substance that can be burned to release energy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>															
The burning of a fuel is called combustion . Combustion is the reaction of a substance with oxygen, giving out energy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>															
The burning of a fuel releases energy to the surroundings, so the burning of a fuel is an example of an exothermic reaction.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>															
When a fuel burns oxygen is used up. <ul style="list-style-type: none"> ○ The chemical test for oxygen is that it relights a glowing splint. 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>															
A fossil fuel is a fuel which is formed over millions of years from the remains of living things. <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <td colspan="3">Fossil Fuels</td> </tr> <tr> <td>Coal</td> <td>Oil</td> <td>Gas</td> </tr> </table>	Fossil Fuels			Coal	Oil	Gas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>									
Fossil Fuels																		
Coal	Oil	Gas																
How Coal is Made																		
Tree and plant materials die, fall to the bottom of a swamp and get covered in mud.																		
How Oil & Gas are Made																		
Sea organisms die and fall to the bottom of the sea and get covered in sand.																		
Dead materials get compressed by heavier and heavier layers of rock.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>															
Over millions of years , dead materials turn into coal, oil or gas (depending on the starting material)																		
Coal is then mined out of the ground.																		
Fuel companies drill for oil and gas.																		
Pollution problems which are associated with the burning of coal, oil and gas are:																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Pollutant Gas</th> <th style="text-align: center;">Reason for Formation</th> <th style="text-align: center;">Environmental Issue</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">sulfur dioxide</td> <td>Formed from the burning of sulfur impurities in coal.</td> <td>Dissolves in atmospheric moisture to form acid rain.</td> </tr> <tr> <td style="text-align: center;">carbon dioxide</td> <td>Formed from burning any carbon-based fossil fuel.</td> <td>Contributes to Global Warming (The Greenhouse Effect).</td> </tr> <tr> <td style="text-align: center;">carbon monoxide</td> <td>Formed by incomplete combustion (where the supply of oxygen is limited).</td> <td>Carbon monoxide is a poisonous gas.</td> </tr> <tr> <td style="text-align: center;">nitrogen dioxide</td> <td>Produced by the spark in a car engine reacting with nitrogen and oxygen in the air.</td> <td>Dissolves in atmospheric moisture to form acid rain.</td> </tr> </tbody> </table>	Pollutant Gas	Reason for Formation	Environmental Issue	sulfur dioxide	Formed from the burning of sulfur impurities in coal.	Dissolves in atmospheric moisture to form acid rain.	carbon dioxide	Formed from burning any carbon-based fossil fuel.	Contributes to Global Warming (The Greenhouse Effect).	carbon monoxide	Formed by incomplete combustion (where the supply of oxygen is limited).	Carbon monoxide is a poisonous gas.	nitrogen dioxide	Produced by the spark in a car engine reacting with nitrogen and oxygen in the air.	Dissolves in atmospheric moisture to form acid rain.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Crude oil is a mixture of compounds called hydrocarbons .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>															
Fractional distillation is used to separate crude oil into fractions according to their boiling point. <ul style="list-style-type: none"> ○ A fraction is group of compounds with a similar boiling point. ○ Each fraction separated by fractional distillation has a different boiling point range. 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>															
<p>The diagram shows a large black cloud labeled 'Crude Oil' on the left. An arrow labeled 'Fractional Distillation' points to the right, where three smaller clouds are shown: a red one at the top, a blue one in the middle, and a yellow one at the bottom. Each of these three clouds is labeled 'Fraction'.</p>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>															

Fractions obtained from the fractional distillation of crude oil have a variety of uses.						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Petroleum Gas	Naphtha	Kerosene	Light Gas Oil	Heavy Gas Oil	Residue	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
bottled gases, Calor gas	petrol, making plastics	aircraft fuel, paraffin	diesel	ship fuel, lubrication oil	bitumen, tar			
Viscosity is the measure of the thickness of a liquid.						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> The more viscous a substance is, the thicker it is and the less easily it flows. 						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flammability means how easily a substance catches fire.						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> The bigger a molecule is, the less flammable it is. 						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CH₄ Fractions with Smaller Molecules	As the molecular size increases: → Evaporation becomes more difficult The flammability decreases The viscosity (thickness) increases The boiling point increases			C₂₀H₄₂ Fractions with larger Molecules	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Complete combustion of a fuel is when it is burned in a plentiful supply of oxygen.						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incomplete combustion of a fuel is when it is burned in a limited supply of oxygen.						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> In carbon based fuels this can lead to the formation of poisonous carbon monoxide. 						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A hydrocarbon is a compound which contains only carbon and hydrogen.						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Complete combustion of a hydrocarbon results in the formation of carbon dioxide and water. <ul style="list-style-type: none"> Hydrogen burns in oxygen to form hydrogen oxide (water) Carbon burns in oxygen to form carbon dioxide. 						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hydrocarbon + Oxygen → Carbon dioxide + Water								
The following apparatus could be used to examine the products of combustion of a hydrocarbon.								
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air pollution from the burning of hydrocarbons can be reduced by adding catalytic converters to car exhausts which contain platinum catalysts. Catalytic converters convert harmful gases into harmless gases.						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The energy produced by a fuel can be calculated using the following formula:						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
$E_h = cm\Delta T$						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
where:								
<ul style="list-style-type: none"> E_h = the energy given out in the reaction, measured in kilojoules (kJ) c = the specific heat capacity of water, $4.18 \text{ kJ kg}^{-1} \text{ }^\circ\text{C}^{-1}$ (in data booklet) m = mass of water being heated, which must be in kg (e.g. 75 cm^3 water = $75/1000 \text{ kg}$) ΔT = the change in temperature of the water ($^\circ\text{C}$) 						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>