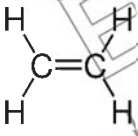


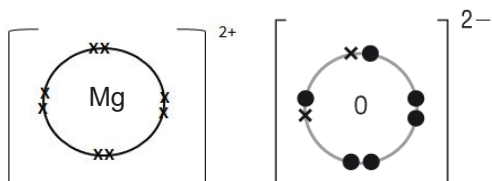
**Paper 4**

Qn	Solutions	Mark Allocation
<b>Section A</b>		
1a	burette	1
1b	Titration	1
1c	$2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$	1
1di	The pH value decreases as more sulfuric acid is added.	1
1dii	Refer to plotted graph on page 15.  All points plotted correctly. Best fit curve drawn, connecting to printed parts of the graph.	1 1
1e	25.00 cm <sup>3</sup> (student should identify from pH 7 on the graph to obtain the volume) <i>Accept if students do not follow the decimal places but units must be present.</i> <i>If graph is wrong but working is shown on the graph to obtain the acid volume and the volume is written correctly with units, 1 mark is still awarded.</i>	1
2a	Cracking is important to obtain <b>more smaller molecules</b> from large hydrocarbon molecules which are <b>higher in demand</b> . (WTTE)	1
2b	$\text{C}_7\text{H}_{14}$	1
2c		1
2d	1kg = 1000 g of undecane No. of moles of undecane = $1000 \text{ g} \div (12(11) + 24) = \underline{\underline{6.4102564 \text{ mol}}}$ No. of moles of ethene produced = $6.4102564 \text{ mol} \times 2 = 12.8205 \text{ mol}$ Mass of ethene = $12.8205 \text{ mol} \times (12(2) + 4) = 358.97 \text{ g} \approx \underline{\underline{359 \text{ g (3s.f.)}}}$	1 1
2e	Test: Place a lighted splint in the region of the gas.  Observation: The lighted splint will be extinguished with a 'pop' sound.	1 1



Section B		
3a	Any soluble colourless metal bromide (e.g. sodium bromide, potassium bromide)	1
3b	<p>Displacement occurred only in test tubes A and D and so, chlorine and fluorine are both more reactive than the halogen element present in solution X, which can be potassium bromide or iodide. [1]</p> <p>However, no displacement occurred in test tube B, suggesting that bromine is not more reactive than the halogen element present in solution X and so cannot be an iodide. [1]</p> <p>Thus, aqueous solution X must be [any soluble] bromide.</p>	2
3c	<p>1m for correct diagram 1m for key</p>	2
3di	R is the most reactive. Metal R reacted the <b>most quickly</b> / took the <b>shortest time</b> as it only took <b>17 seconds</b> to complete.	1
3dii	$\text{AlCl}_3$	1
3e	Addition reaction	1
4ai		1
4aii		1



4bi	 <p>1m for diagram, 1m for key.</p>	2
4bii	<p>Magnesium oxide has a very <b>high melting point</b>. It has <b>strong electrostatic forces of attraction between magnesium and oxide ions</b> in a <b>giant ionic crystal lattice structure</b>. <b>Large amount of heat energy is needed to overcome</b> these strong ionic bonds and so, it is suitable to be used as a refractory material.</p>	2 [Any 2 points 1m]
4ci	<p>Magnesium / zinc. Magnesium / zinc is <b>more reactive than iron</b> and hence will <b>corrode in place of iron</b>, preventing the iron from rusting.</p>	1
4cii	<p>Painting, greasing, plastic coating, metal plating</p> <p>Reject: galvanising</p>	1
5a	<p>No I do not agree as there are <b>3 impure substances [1]</b>, which is <b>P, Q and S</b> as they have <b>more than 1 spot [1]</b> on the chromatogram.</p> <p>OR</p> <p>No I do not agree as there are <b>only 1 pure substance which is R [1]</b>, as <b>the other three substances</b> show <b>more than 1 spot [1]</b> on the chromatogram.</p>	2
5b	<p>P, R and S are from the same manufacturer.</p>	1
5ci	<p><math>C + O_2 \rightarrow CO_2</math>  <math>CO_2 + C \rightarrow 2CO</math> [1]</p>	1
5cii	<p>Oxides of nitrogen / nitrogen oxides / nitrogen dioxide / nitrogen monoxide / carbon monoxide / carbon dioxide</p> <p>Reject: sulfur dioxide</p>	1
5ciii	<p>For oxides of nitrogen:  It causes <b>acid rain</b> which will <b>corrode limestone and metal buildings and sculptures</b>.  OR  <b>leaches nutrients from the soil, destroying vegetation</b>.  OR</p>	1



	<p><b>acidifies lakes and streams, harming aquatic life.</b></p> <p>For carbon monoxide: It <b>combines strongly</b> with haemoglobin in blood to form <b>carboxyhaemoglobin</b>, causing the red blood cells to be <b>not able to transport oxygen</b>, eventually causing <b>death at high amounts</b>.</p> <p>For carbon dioxide: Carbon dioxide is a greenhouse gas which at high amounts would <b>lead to increase in greenhouse effect</b> and eventually <b>global warming</b> where there is an <b>increase in global temperatures / climate change / melting of polar ice caps</b>.</p>	
5di	$\text{Zn} + \text{H}_2\text{O} \rightarrow \text{ZnO} + \text{H}_2$	1
5dii	<p>The flame will not be present as <b>silver does not react with steam</b> since it is too unreactive. So, <b>no hydrogen gas will be produced</b>.</p> <p>OR</p> <p>No visible / observable change as <b>silver does not react with steam</b>.</p>	1



