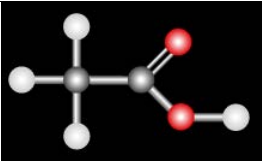


Question	Answers	Notes	Marks	Criterion	
1	a	Fe ₂ O ₃ MnO ₂	Accept MnO ₂ if subscripts are seen somewhere	2	A
	b	Any transition metal identified by name or symbol other than Mn or Fe Any two of the following: <ul style="list-style-type: none"> This is also a transition metal or d block element or group B variable oxidation states or variable valency electrons in the d orbital form coloured compounds or solutions a named typical metallic property eg malleable, ductile, shiny, sonorous, conductor 		3	A
	c	Emulsion it is a mixture of powder/pigments/crushed minerals and in water or oil or heterogenous mixture or immiscible mixture or colloid		2	A
	d	A watercolour paint is very soluble in water Oil paint is not soluble in water so the watercolour paint will be washed away		3	A
	e	A statement about the effect of one type of paint on the environment with a valid reason Any three relevant, further points, for example (3 max) <ul style="list-style-type: none"> water soluble paints can enter rivers (and cause pollution) solvents are not soluble in water so remain in environment oil-based paints can cause pollution Solvents are needed to clean oil-based paints 		4	D
	f	Correct balancing: $2 \text{CrO}_4^{2-} + 10 \text{H}^+ + 6\text{e}^- \rightarrow \text{Cr}_2\text{O}_3 + 5 \text{H}_2\text{O}$ Correct coefficients on one side of the equation All coefficients are correct	Accept 10 H	2	A

	g	<p>Reduction</p> <p>because Cr^{6+}/Cr (VI) gains electrons or because $\text{Cr}^{6+} / \text{Cr}$ (VI) becomes $\text{Cr}^{3+} / \text{Cr}$ (III) or CrO_4^{2-} loses oxygen or gains electrons or the oxidation state/number of chromium decreases</p>	Accept chromium oxide on left hand side	2	A
2	a	 <p>methyl group or carboxyl group correctly displayed</p> <p>correct structure for ethanoic acid</p> <p>carboxyl group correctly named</p>	<p>Remember to scroll down to see the response box for the name of the functional group</p> <p>Only award this mark if there is a reasonable attempt at a correct structure</p> <p>Correct structure scores 2 marks</p> <p>accept carboxylic acid</p>	3	A
	b	Neutralization		1	A
	c	110 (g/mol or amu)	Units not required	1	A
	d	<p>Molar mass of silver = 108</p> <p>Molar mass of AgBr = 188</p> <p>Final mass needed 3481(g)/ 3.48(kg)</p> <p>Any calculated answer to 2 sig figs (3500 (g) 3.5×10^3 (g) or 3.5 (kg))</p>	<p>ECF from points 1 and 2</p> <p>Award the sig fig mark independently</p>	4	A
					D

3	a	Evaporation		1	A
	b	Water loses heat/energy Condensation Or Changes from gas/vapour to liquid		2	A
	c	Two essential items from: filter paper, funnel and container All items selected labelled correctly Arranged correctly for filtration	<i>If all equipment is selected, award maximum 2 marks</i> <i>Items can be incorrect for this mark</i>	3	B
	d	high decreases ions		3	C
	e	between 20–25 cm ³ of NaCl added there is a sharp drop in conductivity because the silver ions are reacting or removed or a precipitate is forming	<i>Accept drop in mV</i>	2	C
	f	Conductivity or water purity or number of microbes or amount of microbes Temperature or same water sample or same equipment	<i>Do not accept references to filter or volume of water as these are given in the question</i>	2	B

g	<ul style="list-style-type: none"> • an attempt at a research question • attempts to plan a method 	1-2		14	B
	<ul style="list-style-type: none"> • research question attempts to link most effective filter with lowest conductivity • plans to measure the conductivity using one purification method • attempt at a method but detail is insufficient for another student to follow 	3-5			
	<ul style="list-style-type: none"> • research question correctly links most effective filter with lowest conductivity • plans to measure the conductivity using two purification methods • equipment to measure volume or temperature is listed • method is described and could easily be followed by another student 	6-9			
	<ul style="list-style-type: none"> • research question correctly links most effective filter with lowest conductivity and justifies this • plans to measure the conductivity using all three purification methods • equipment to measure volume and temperature is listed • complete method is described, fully explained and could easily be followed by another student • plans to repeat process and calculate mean values 	10-14			

4	a	<table border="1"> <thead> <tr> <th>Type of fuel</th> <th>Percentage of different types of fuel use in an urban area / %</th> <th>Percentage of different types of fuel use in a rural area / %</th> </tr> </thead> <tbody> <tr> <td>Wood</td> <td>36.2</td> <td>81.4</td> </tr> <tr> <td>Dung (animal waste)</td> <td>2.5</td> <td>9.4</td> </tr> <tr> <td>LPG</td> <td>41.5</td> <td>3.9</td> </tr> <tr> <td>Biogas</td> <td>3.2</td> <td>2.4</td> </tr> <tr> <td>Crop waste</td> <td>0.2</td> <td>1.8</td> </tr> <tr> <td>Kerosene</td> <td>15.8</td> <td>1.0</td> </tr> <tr> <td>Charcoal</td> <td>0.2</td> <td>0.1</td> </tr> <tr> <td>Electricity</td> <td>0.4</td> <td>0</td> </tr> </tbody> </table>	Type of fuel	Percentage of different types of fuel use in an urban area / %	Percentage of different types of fuel use in a rural area / %	Wood	36.2	81.4	Dung (animal waste)	2.5	9.4	LPG	41.5	3.9	Biogas	3.2	2.4	Crop waste	0.2	1.8	Kerosene	15.8	1.0	Charcoal	0.2	0.1	Electricity	0.4	0			
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	b	<p>Calcium hydroxide solution / $\text{Ca}(\text{OH})_2$ (aq) / Limewater</p> <p>Bubbling through (limewater) or passing through (limewater)</p> <p>(Limewater) will turn white or cloudy or a precipitate or CaCO_3 is formed if CO_2 is present</p>	<p><i>Ignore incorrect formula (eg CaOH) if calcium hydroxide or limewater are mentioned</i></p> <p>WTTE</p>	3	B																											
	c	<p>Fuels: either wood or dung identified both fuels identified</p> <p>variables: volume of CO_2 or gas is measured/dependent variable mass of fuel should be controlled (could be seen as part of method)</p> <p>Sufficient data: repeat for both fuels minimum three trials</p> <p>method: burn or set on fire or combust fuel collect gas in syringe leave until all fuel is burnt measure volume or amount or quantity of gas produced</p> <p>Safety: a safety concern is mentioned</p>	<p>Accept "amount"</p> <p>"Syringe" can be implied</p>	11	B																											
	d	<p>All the CO_2 is collected Or No CO_2 is lost</p>		1	C																											

e	(smoke indicates) incomplete combustion Less CO ₂ or unwanted products or smoke (produced) Results are not valid because all of the fuel did not burn		3	C
f	Increase air flow or more oxygen or more air	<i>Accept "accurate"</i> <i>WTTE</i>	1	C

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	b	<p>1.65 (g) Carbon dioxide</p> <p>g</p>	<p><i>Unit needed for second mark, award this mark independently</i></p>	2	C								
	c	<p>$1.65 \times 10 = 16.5$ g carbon dioxide</p> <p>$16.5/44 = 0.375$ moles</p> <p>$0.375 \times 22.7 = 8.51$</p> <p>dm^3 <i>or</i> l</p>	<p><i>ECF</i></p> <p><i>seen or implied</i></p> <p><i>award 3 for correct mass</i></p> <p><i>unit mark awarded independently</i></p>	4	C								

6	a	data values given in numerical order all volumes converted into cm ³																																	
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c	data value at 110s identified 21 (cm ³)	<i>Units required</i>		2	C																														
d	repeat measurement and calculate average value			1	C																														
7	a	Group 4 period 6	<i>accept group 14</i> <i>check group and number are correctly paired</i>		2	A																													
	b	good conductivity			1	A																													
	c	low reactivity (with air/water) or high chemical stability			1	A																													
	d	82 (protons) 126 (neutrons)	<i>Accept 126n, 82p</i> <i>Do not accept 126, 82</i>		2	A																													

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				10	D