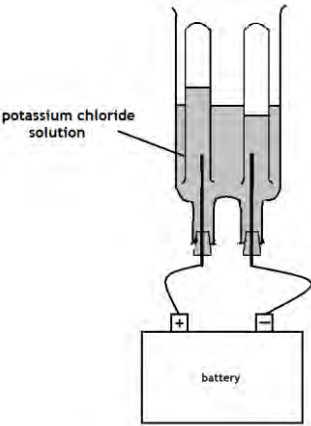


Question number	Answer	Notes	Marks
1 (a)	<p>(i) Na / sodium / Mg / magnesium</p> <p>(ii) Si / silicon / P / phosphorus / S / sulfur / Cl / chlorine</p>	<p>Ignore name and formula of compound</p> <p>Accept aluminium</p> <p>If both name and formula given both must be correct</p> <p>If both name and formula given both must be correct</p>	<p>1</p> <p>1</p>
(b) (i)	<p><math>[\text{Mg}]^{2+} [:\ddot{\text{Cl}}:]^{-} [:\ddot{\text{Cl}}:]^{-}</math></p> <p><b>M1</b> correct electronic configuration for magnesium ion and correct charge on ion</p> <p><b>M2</b> correct electronic configuration for both chloride ions</p> <p><b>M3</b> correct charges on both chloride ions</p>	<p>Allow electrons on brackets</p> <p>Allow any combination of dots and crosses</p> <p>Allow 0 or 8 electrons in outer shell</p>	<p>3</p>
(ii)	<p><b>M1</b> electrostatic attraction/forces between ions</p> <p><b>M2</b> of opposite charge</p>	<p>M3 indep</p> <p>accept positive</p>	<p>2</p>

(iii)	<p><b>M1</b> attraction (between ions) is strong</p> <p><b>M2</b> lots of ions (in structure) / giant structure / lattice / lots of/many bonds</p> <p><b>M3</b> (therefore) lot of (thermal/heat) <u>energy</u> required to overcome attraction / to break down the lattice</p>	<p>and negative ions accept cations and anions M2 dep on M1 Accept attraction/forces between oppositely charged ions for 1 mark only Reject references to atoms/molecules/IMF for M1 and M2</p> <p>Accept strong (ionic) bonding/strong ( ionic) bonds</p> <p>Accept lot of (thermal/heat) <u>energy</u> required to break (ionic) bonds</p> <p>If any reference to attraction between atoms/molecules/electrons scores 0/3 If any reference to covalent bonding/covalent structure/IMF scores 0/3</p>	3
(c)		Correct answer with or without working scores 2 marks	2

	<p><b>M1</b> mol Al = <math>20/3</math> (= 6.67)</p> <p><b>M2</b> mass Al = (answer to M1 x 27) = 180 (g)</p> <p><b>OR</b></p> <p><b>M1</b> 3 faradays give 1 mol <b>OR</b> 27 g / 30 faradays give 10 mol <b>OR</b> 270 g</p> <p><b>M2</b> 20 faradays gives 180 (g)</p>	<p>M2 CQ on M1 eg 540 scores 1 mark 6.67 gives 180(.09) scores 2 marks 6.7 gives 180.9 = 181 scores 2 marks 6.66 gives 179.82 scores M2 only Accept any number of sig fig except 1</p>	
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Question number	Answer	Notes	Marks						
2 a		<p><b>M1</b> both bungs inserted AND electrodes connected to battery</p> <p><b>M2</b> both tubes inverted over electrodes</p> <p><b>M3</b> solution placed in the voltameter and labelled as potassium chloride / KCl(aq)</p> <p>For <b>M3</b>, ignore all three liquid levels, except that the level in the voltameter must be above the bottoms of both tubes if present</p>	3						
b	<table border="1" data-bbox="296 730 955 942"> <thead> <tr> <th data-bbox="296 730 468 801">Polarity</th> <th data-bbox="468 730 955 801">Equation</th> </tr> </thead> <tbody> <tr> <td data-bbox="296 801 468 867">-(ve)</td> <td data-bbox="468 801 955 867"><math>2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-</math></td> </tr> <tr> <td data-bbox="296 867 468 942">+(ve)</td> <td data-bbox="468 867 955 942"><math>2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-</math></td> </tr> </tbody> </table>	Polarity	Equation	-(ve)	$2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-$	+(ve)	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	<p><b>M1</b> for <math>2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-</math></p> <p><b>ACCEPT</b> <math>2\text{Cl}^- - 2\text{e}^- \rightarrow \text{Cl}_2</math></p> <p><b>M2</b> for -(ve) in top row <b>AND</b> +(ve) in bottom row</p> <p><b>ACCEPT</b> negative and positive</p> <p><b>IGNORE</b> cathode and anode</p>	2
Polarity	Equation								
-(ve)	$2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-$								
+(ve)	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$								
c	<p>burns with a pop / squeak</p> <p>OR</p> <p>use burning/lit spill / use flame to see if pop/squeak</p>	<p>Must be reference to test and result</p> <p>Reference to spill/match with no indication of flame is not enough</p> <p><b>ACCEPT</b> splint for spill</p> <p><b>REJECT</b> reference to glowing spill/splint</p> <p>Ignore flame extinguished</p> <p>'Squeaky pop test' alone is not sufficient</p>	1						

Question number			Answer	Notes	Marks
3	a		too reactive / very reactive  <b>OR</b>  high in the reactivity series	Accept words with equivalent meaning  eg highly	1
	b	i	B (stage 2)		1
		ii	calcium chloride / CaCl <sub>2</sub>	If both name and formula given, mark name only	1
		iii	(they / the ions) are mobile	Accept free to move Accept move to electrodes (allow even if incorrect electrodes)  Accept ions break free from lattice/crystal Not just free Allow they/ions are delocalised Ignore references to conduction	1
		iv	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^{(-)}$	Accept $2\text{Cl}^- - 2\text{e}^{(-)} \rightarrow \text{Cl}_2$	1

Question number			Answer	Notes	Marks
3	c	i	<p><b>M1</b> Correct calculation of <math>M_r</math> (<math>\text{MgCl}_2</math>)</p> <p><b>M2</b> <math>M1 \times 2</math></p>	<p>Sample calculation:</p> <p><math>M1 = 95</math></p> <p><math>M2 = 190</math> (kg)</p> <p>Accept 190 000 g</p> <p><b>M2</b> CQ on <b>M1</b> when <b>M1</b> is a genuine attempt to calculate <math>M_r</math> (<math>\text{MgCl}_2</math>)</p> <p>Correct answer with no working scores 2</p>	2
	c		<p>Award 2 marks for 4 000</p> <p>Award 1 mark if one error</p>	<p>2 000 (wrong ratio for Mg and electrons)</p> <p>4 (working in grams instead of kilograms)</p>	2

Question number		Answer	Notes	Marks
3	d	<p><b>M1</b> Mix magnesium oxide and sulfuric acid (and heat)</p> <p><b>M2</b> Use excess MgO</p> <p><b>M3</b> Filter (before heating to remove some water)</p> <p><b>M4</b> <u>Heat</u> (the solution) to remove <u>some</u> water / for a short period of time</p> <p><b>M5</b> Leave to crystallise</p>	<p>If heated to dryness, no M4 or M5</p> <p>Allow place in a <u>warm</u> oven (to evaporate the excess water) to form crystals</p>	5

Question number	Answer	Notes	Marks
4 a i	correct statement about connection between number of electrons and moles/molecules/amounts (of both gases) OR reference to number of moles/molecules being equal (in both equations)	eg same number of electrons give same numbers of moles  eg equal moles of gases have equal volumes / volumes are proportional to numbers of moles	1
ii	(some/chlorine/it) is soluble / dissolves (in water / in the solution) OR (some/chlorine/it) reacts with water	Accept (some) oxygen also collected Reject chlorine reacts with graphite Ignore chlorine gas escapes Reject reacts with sodium chloride / reacts with sodium hydroxide	1
iii	M1 (solution) alkaline / pH greater than 7  M2 (because) hydroxide ions / OH <sup>-</sup> (formed)	Mark M1 and M2 independently Ignore basic Accept any value above 7 up to 14  Accept sodium hydroxide formed	2
b	M1 (result of litmus test) bleaches / goes white  M2 (result of KI test) brown (solution) / black precipitate or equivalent	Ignore red as intermediate colour Accept decolourises / colourless  Accept yellow and orange in place of brown Accept grey in place of black  Ignore shades such as pale / dark Reject red / red-brown / purple / blue-black	2



Question number	Answer	Notes	Marks
4 c i	to sterilise / disinfect (the water) OR to make it safe to drink	Accept kill bacteria / microbes / pathogens / microorganisms / (harmful) organisms / germs / viruses Ignore references to cleaning / purifying / bleaching / changing pH	1
	ii $H_2 + Cl_2 \rightarrow 2HCl$	Ignore state symbols	1
	iii dissolve in / add to water	Accept mixing with water / bubbling through water / react with water / make aqueous Ignore adding to liquid	1
			<b>Total 9 marks</b>

Question number		Answer	Notes	Marks
5	a	decomposition / breakdown / breakup / splitting / chemical change  by electricity / (electric) current / (flow of) electrons	Ignore specific examples that do not include key words (eg obtaining aluminium from its ore) Ignore separation / movement of ions  Mark independently	2
	b	A = chlorine / Cl <sub>2</sub> B = hydrogen / H <sub>2</sub> C = sodium hydroxide / NaOH	Ignore Cl Ignore H Ignore references to sodium chloride If both name and formula given, both must be correct, but ignore Cl and H Award 1 mark for chlorine and hydrogen the wrong way round	3

Question number			Answer	Notes	Marks
5	c	i	so that ions are mobile/can flow/free to move (in liquid) OR ions not mobile / cannot flow/ not free to move in solid	Accept $\text{Na}^+$ / $\text{Cl}^-$ in place of ions Ignore references to charged species and particles Reject references to moving electrons Reject no ions in solid Reference to solid can be implied (eg if not molten...)	1
		ii	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^{(-)}$	M1 for $\text{Cl}^-$ on left and $\text{Cl}_2$ on right M2 for balancing, DEP on M1 correct Accept $- 2\text{e}^{(-)}$ on LHS If neither M1 nor M2 awarded, then award 1 mark for $\text{Cl}^- \rightarrow \text{Cl} + \text{e}^{(-)}$ or $2\text{Cl}^- \rightarrow 2\text{Cl} + 2\text{e}^{(-)}$	2

(Total for Question 5 = 8 marks)

Question number	Answer				Accept	Reject	Marks
6 (a)	<b>Solution</b>	<b>Negative electrode</b>	<b>Positive electrode</b>	<b>Substance left</b>	correct formulae throughout	O for oxygen	1 2
	silver sulfate	silver					
	potassium nitrate		oxygen	potassium nitrate			
(b) (i)	platinum				carbon / graphite copper/ silver / gold / titanium		1
(ii)	to increase its (electrical) conductivity / to make it a (better) (electrical) conductor / to lower its (electrical) resistance IGNORE references to carrying current / charge / adds hydrogen ions				to increase the concentration/number of ions		1
(c) (i)	<u>Moles/amount</u> of hydrogen (produced) = 2 x <u>moles/amount</u> of oxygen (produced)				number of <u>molecules</u> of hydrogen (produced) is twice that of oxygen	explanations based on atoms	1
	IGNORE explanations based on forming water						
(ii)	(some of the) oxygen dissolves in water/acid				(some of the) oxygen reacts with the (carbon) electrode/to form CO <sub>2</sub> (which then dissolves)	oxygen reacts with water/(sulfuric) acid	1
(d)	<b>M1</b> - number of faradays = $\frac{482\ 500}{96\ 500}$ or 5					Incorrect units	1
	<b>M2</b> - $n(\text{H}_2) = \frac{1}{2} \times \text{M1}$ or 2.5						1
	Final answer on its own without working scores 2						
						<b>Total</b>	<b>9</b>