

Question	Answer	Marks	AO Element	Notes	Guidance
1	substance that conducts electricity / (undergoes) electrolysis (1) decomposed / chemically changed OR molten / liquid / solution / aqueous AND containing ions / ionic (1)	2			
2	$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cu}(\text{s})$ 1 mark for any equation which has Cu as the product or Cu^{2+} ions on left 1 mark for correct species 1 mark for correct state symbols	3			
3(a)	copper formed / copper deposited	1			
3(b)	oxygen	1			
3(c)	copper removed or copper lost or copper forms ions	1			
4(a)	M1 breakdown of an ionic compound when molten or in aqueous solution M2 (by the passage of) electricity / electric current / electrical energy	2			

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4(b)	hydrogen chlorine sodium hydroxide	3			
4(c)	$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$ M1 H^+ on left hand side with e^- added M2 fully correct equation	2			
5(a)	the breakdown (into elements) (1) of an (ionic) compound by (the passage of) electricity (1)	2			
5(b)(i)	oxygen	1			
5(b)(ii)	glowing splint (1) relights (1)	2			
5(b)(iii)	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ M1 gain of electrons by H^+ M2 rest of equation	1			
5(c)	<i>the wires</i> : electrons (1) <i>the electrolyte</i> : ions (1)	2			

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5(d)	any two from: <ul style="list-style-type: none"> • green gas at positive electrode • bulb is brighter • rate of bubbles increases 	2			
6(a)	<i>the wires:</i> electrons (1) <i>the electrolyte:</i> ions (1)	2			
6(b)	any 2 from: <ul style="list-style-type: none"> • increases conductivity • as a solvent • lowers the operating temperature 	2			
6(c)	$Al^{3+} + 3e^{-} \rightarrow Al$	1			
6(d)	oxygen is made at the anode (1) the anodes are made of carbon (1) oxygen (made) reacts with carbon (1)	3			

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7(a)	<p><i>anode made of:</i> impure copper (1)</p> <p><i>cathode made of:</i> (pure) copper (1)</p> <p><i>electrolyte of:</i> (aqueous) copper sulfate (1)</p>	3			
7(b)	<p>silver (impurities) fall to the bottom of the cell (1)</p> <p>zinc (impurities) (dissolve) into solution (as ions) (1)</p> <p>because zinc is more reactive than copper AND silver is less reactive than copper (1)</p>	3			
8	A - 1 and 2	1			
9	C - The reaction $Zn \rightarrow Zn^{2+} + 2e^{-}$ occurs.	1			
10	A - $Cu^{2+} + 2e^{-} \rightarrow Cu$	1			
11	$Al^{3+} + 3e^{-} \rightarrow Al$ species (1) balancing (1)	2			

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12(a)	zinc more reactive (than iron/steel)	1			
	loses electrons	1			
	electrons move (from zinc) to iron	1			
	Zinc reacts (with air and water) or zinc corrodes or zinc is oxidised or zinc is anodic or zinc forms positive ions or zinc forms Zn ²⁺ or iron and steel don't react with air/water or iron and steel are not oxidised or iron and steel do not form ions or iron and steel do not lose electrons or iron and steel are cathodic	1			
12(b)	R to L in wire	1			
12(c)	2H ⁺ + 2e ⁻ → H ₂ species (1) balancing (1)	2			
13(a)	bauxite	1			

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13(b)	M1 aluminium oxide / amphoteric oxide dissolves OR iron(III) oxide / basic oxide does not M2 filter	2		COND on M1	
13(c)	Any two from: lowers (working) temperature or lowers mpt (of mixture) increases conductivity reduces cost OR energy need	2			
14(a)	sulfuric acid	1			
14(b)	$Zn^{2+} + 2e \rightarrow Zn$	1			
	oxygen or water	1		Allow: O ₂ and H ₂ O if no name seen	
	sulfuric acid	1		Allow: H ₂ SO ₄ if no name seen	
15(a)	from zinc to carbon (clockwise direction on or near the wire)	1			
15(b)	to allow <u>ions</u> to flow	1			

Question	Answer	Marks	AO Element	Notes	Guidance
15(c)	oxidation and loss of electron(s) or increase in oxidation number/state	1			
	reduction and decrease in oxidation number/state or gain of electron(s)	1			
16(a)	correct direction from zinc to lead	1			
16(b)	metals react by losing electrons	1			
	the more reactive metal / zinc will lose electrons more readily (making the electrode negatively charged)	1			
17(a)	manganese and zinc are more reactive than lead (and / or copper)	1			
	lead is more reactive than copper	1			

- Mark Scheme

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17(b)	the polarity of a Mn / Zn (cell) or the voltages of Zn / Pb and Mn / Pb (cells)	1			
					[Total: 70]