

Question	Answer	Marks
1(a)(i)	red and (the Cu^{2+} ion/copper ions) is gaining electrons/is decreasing in oxidation number;	1
(a)(ii)	formation of Cu^{2+} /copper ions at the anode happens at the same rate as; removal of Cu^{2+} /copper ions at the cathode ora;	2 1 1
(b)	replace (anode of) copper with nickel; replace electrolyte with nickel(II) sulfata/ NiSO_4 ;	2 1 1
(c)	(good) catalysts; variable oxidation numbers; form coloured compounds / coloured ions;	3 1 1 1

- 2 (a) (i) (attractive force between) positive ions and (negative) electrons [1]
 opposite charges attract ONLY [1]
 electrostatic attraction ONLY [1]
- (ii) lattice / rows / layers of lead ions / cations / positive ions [1]
NOT: atoms / protons / nuclei [1]
 can slide past each other / the bonds are non-directional [1]
- (b) anhydrous cobalt chloride becomes hydrated [1]
ACCEPT: hydrous
- (ii) carbon dioxide is acidic [1]
 sodium hydroxide and calcium oxide are bases / alkalis [1]
- (iii) Any two of: [2]
 water, calcium carbonate and sodium carbonate
ACCEPT: sodium bicarbonate
- (c) number of moles of CO₂ formed = 2.112 / 44 = 0.048 [1]
 number of moles of H₂O formed = 0.432 / 18 = 0.024 [1]
- x = 2 and y = 1 **NOT:** ecf from this line
- formula is 2PbCO₃.Pb(OH)₂ / Pb(OH)₂. 2PbCO₃ [1]

[Total:12]

- 3 (a) (i) no reaction [1]
- $\text{Fe} + \text{Sn}^{2+} \rightarrow \text{Fe}^{2+} + \text{Sn}$ / $2\text{Fe} + 3\text{Sn}^{2+} \rightarrow 2\text{Fe}^{3+} + 3\text{Sn}$ [2]
 for realising that there would be a reaction shown by an attempt to write an equation e.g. writing Fe_2Sn etc. allow [1]
- no reaction [1]
- (ii) tin oxide, nitrogen dioxide (accept nitrogen(IV) oxide/dinitrogen tetroxide), oxygen [2]
 All three for two
 accept correct formulae
- any two correct products [1]
- (b) (i) tin [1]
- (ii) $4\text{OH} \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}$ [2]
 not balanced allow [1]
- (iii) sulfuric acid [1]
- (c) zinc is more reactive than iron/steel [1]
 tin is less reactive than iron/steel [1]
- zinc corrodes/reacts/loses electrons/is oxidised/is anodic/provides sacrificial protection/
 forms positive ions (in preference to iron or steel) ORA [1]
 allow iron is cathodic for this mark.
- Iron/steel corrodes/reacts/rusts/loses electrons/is oxidised/is anodic/forms positive ions (in
 preference to tin). ORA [1]
 allow tin is cathodic for this mark

- 4 (a) (i) red brown or orange to colourless [1]
not just bromine decolourised
yellow (**not** dark) / white solid / precipitate / goes cloudy [1]
brown to yellow with no mention of solid/precipitate scores = [1]
- (ii) $\text{Br}_2 + \text{Na}_2\text{S} \rightarrow 2\text{NaBr} + \text{S}$ [1]
- (iii) look for two comments [1]
sulfide (ion) / sulfur (ion) loses electrons [1]
not sodium sulfide
bromine accepts them [1]
- (b) (i) oxidation [1]
not redox
- (ii) hydrogen / H_2 [1]
not H
- (iii) iron(II) hydroxide / ferrous hydroxide [1]
- (iv) $4\text{Fe}(\text{OH})_2 + \text{O}_2 + 2\text{H}_2\text{O} \rightarrow 4\text{Fe}(\text{OH})_3$ [1]
- (v) oxidation number or state or valency increases / electron loss / Fe^{2+} to Fe^{3+} [1]
not gains oxygen
- (vi) sacrificial protection **or** zinc is sacrificed /
zinc corrodes not iron **or** zinc corrodes therefore iron doesn't /
not just zinc rusts
zinc is oxidised in preference to iron /
zinc reacts with oxygen and water in preference to iron /
zinc more reactive or electropositive than iron /
zinc forms ions more readily than iron **or** zinc loses electrons more readily than iron /
electrons move on to iron /
iron is cathode **or** zinc is anode /
any **three** [3]

- 5 (a) (i) bauxite [1]
- (ii) to reduce melting point **or** improve conductivity
or as a solvent **or** reduce the working temperature [1]
- (iii) carbon dioxide **or** monoxide **or** fluorine [1]
- (b) aluminium [1]
- (ii) solution goes colourless **or** copper formed
or a brown solid forms **or** blue colour disappears
or bubbles
NOT goes clear **or** copper formed
- (iii) covered with an oxide layer [1]
- (c) reaction no reaction [1]
reaction reaction [1]
- (d) $2Al(OH)_3 = Al_2O_3 + 3H_2O$ [2]
Not balanced [1]
- (ii) Aluminium nitrate = aluminium oxide + nitrogen dioxide + oxygen
only TWO correct products [1] [2]

TOTAL = 12

6 (a)(i)	38p	38e	50n	[1]
	38p	38e	52n	[1]
	30p	28e	35n	[1]
(ii)	Same number of protons and different number of neutrons			[1]
(iii)	8+ 2			[1]
(b)(i)	<u>heat</u> zinc blende in <u>air</u> to form oxide reduce <u>oxide</u> with <u>carbon</u>			[1] [1]
(ii)	galvanising sacrificial protection alloys batteries roofing Any ONE			[1]
(c)(i)	hydrochloric acid			[1]
(ii)	$Sr^{2+} + 2e = Sr$ $2Cl - 2e = Cl_2$ or $2Cl = Cl_2 + 2e$			[1] [1]
(iii)	hydrogen [1] and strontium hydroxide [1]			
(d)(i)	zinc + water = zinc oxide + hydrogen heat [1] steam [1]			[1]
(ii)	$Sr + 2H_2O = Sr(OH)_2 + H_2$ Not balanced [1] cold water			[2] [1]
TOTAL = 19				