

Question	Answer	Marks
1(a)	zinc blende is burnt/roasted/heated in air; zinc sulfide + oxygen → zinc oxide + sulfur dioxide;	2
(b)	zinc oxide + carbon → zinc + carbon dioxide/monoxide;	1
(c)	zinc sulfate; pure zinc; $Zn^{2+} + 2e^{-} \rightarrow Zn$ ; $Zn \rightarrow Zn^{2+} + 2e^{-}$ ; zinc <u>ions</u> are removed (from solution) and replaced (into solution); at the same rate / speed;	6
(d)(i)	c	1
(d)(ii)	any two from: <ul style="list-style-type: none"> <li>• hard(er)/less malleable;</li> <li>• strong(er);</li> <li>• (better) appearance;</li> <li>• (more) resistant to corrosion;</li> </ul>	2
(e)(i)	steel (or iron) is exposed to oxygen <b>and</b> water;	1
(e)(ii)	Zn more reactive than Fe (allow steel); Zn loses/transfers electrons (more readily) <b>and</b> forms (+ve) ions (in preference to Fe); Fe (allow steel) is more reactive than Cu; Fe loses/transfers electrons (more readily) <b>and</b> forms (+ve) ions (in preference to Cu);	4

Question	Answer	Marks
2(a)(i)	vibrate (about fixed position)/vibration;	1
(a)(ii)	electrostatic force of) attraction; (between) positive ions and negative ions/oppositely charged ions/unlike charged ions/cations and anions;	1 1
(a)(iii)	regular/repeated/pattern/framework/ordered/alternating/organised (arrangement of); positive and negative ions/oppositely charged ions/cations and anions/unlike charged ions;	1 1
(b)(i)	correct direction (going towards negative electrode);	1
(b)(ii)	$\text{Li}^+ + e \rightarrow \text{Li}$ / $\text{Li}^+ \rightarrow \text{Li} - e$ ;	1
(b)(iii)	$2\text{Br} \rightarrow \text{Br}_2 + 2e$ / $2\text{Br} - 2e \rightarrow \text{Br}_2$ formulae; balancing;	2
(b)(iv)	Br /bromide (ion); electron lost/donated electrons/increased oxidation state/increased oxidation number/oxidation numbers changed from -1 to 0/increased valency;	1 1

Question	Answer	Marks
2(c)	<p><b>M1</b> (gas) hydrogen (given off at cathode)/H<sub>2</sub>;  <b>M2</b> hydroxide <u>ions</u>/lithium hydroxide/OH /LiOH are alkali(ne);  <b>M3</b> 2LiBr + 2H<sub>2</sub>O → 2LiOH + H<sub>2</sub> + Br<sub>2</sub>;  <b>or</b>  2H<sup>+</sup> + 2e → H<sub>2</sub>/2H<sup>+</sup> → H<sub>2</sub> - 2e ;  <b>or</b>  2Br → Br<sub>2</sub> + 2e /2Br - 2e → Br<sub>2</sub>;  <b>or</b>  2H<sup>+</sup> + 2Br → H<sub>2</sub> + Br<sub>2</sub>;</p>	<b>3</b>

- 3 (a) (i) insufficient/limited oxygen [1]  
**or**  $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$
- coke/carbon reacts with carbon dioxide [1]  
**or**  $\text{C} + \text{CO}_2 \rightarrow 2\text{CO}$
- (ii)  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$  [2]  
 species (1) balancing (1)
- (b) carbon dioxide [1]
- (ii)  $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$  [2]  
 [1] each side corr
- (iii) (molten) iron higher density (than slag) [2]
- (iv) No oxygen in contact with iron **or** layer of slag prevents hot iron reacting with oxygen/air **or** (all) oxygen reacts with carbon (so no oxygen left to react with iron) [1]
- (c) air/oxygen and water (need both) [1]
- (ii) aluminium oxide layer is impervious **or** non-porous **or** passive **or** unreactive **or** will not allow water/air to pass through it (rust allows passage of water **or** air **or** it flakes off) [1]
- (d) 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  $\text{Zn}^{2+}$  **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]
- (ii) R to L in wire [1]
- (iii)  $2\text{H}^+ + 2\text{e} \rightarrow \text{H}_2$  [1]  
 species (1) balancing (1)

[Total: 19]

- 4 (a) (i) rate decreases [1]  
concentration of sodium chlorate ((I))/reactant decreases [1]
- (ii) (initial) gradient greater/steeper (must start at origin) [1]  
same final volume of oxygen [1]
- (iii) (to prevent)photochemical reaction/(to prevent)reaction catalysed by  
light/light breaks down or decomposes sodium chlorate((I)) [
- (iv) particles have more energy/particles move faster/ [1]  
more collisions [1]  
collisions more frequent or more often/greater chance of collision/collision  
rate increases/more particles have energy to react/more collisions are  
successful or effective [1]
- (b)  $2Cl \rightarrow Cl_2 + 2e( ) / 2Cl - 2e( ) \rightarrow Cl_2$  [1]  
 $2H^+ + 2e( ) \rightarrow H_2 / 2H^+ \rightarrow H_2 - 2e( )$  [1]  
hydrogen formed at cathode/- and chlorine at anode/+ [1]  
Na<sup>+</sup> and OH<sup>-</sup> or sodium ions and hydroxide ions left in solution/form/become  
sodium hydroxide [1]
- (ii)  $Cl_2 + 2NaOH \rightarrow NaClO/NaOCl + NaCl + H_2O$  [2]  
Species (1) Balancing (1)

[Total: 14]