

Question	Answer	Marks
3(a)(i)	M1 positive ions/cations (labelled or named in text); M2 electrons (labelled or named in text); M3 attraction between positive and negative;	3 1 1 1
3(a)(ii)	(conduction due to) movement of electrons / mobile electrons;	1
3(b)	GaCl_3 ; $\text{Ga}_2(\text{SO}_4)_3$;	2 1 1
3(c)(i)	$2\text{O}_3 + 6\text{HNO}_3 \rightarrow 2\text{Ga}(\text{NO}_3)_3 + 3\text{H}_2\text{O}$ formula of $\text{Ga}(\text{NO}_3)_3$; all formulae and balancing correct;	2
3(c)(ii)	$2\text{O}_3 + 2\text{NaOH} \rightarrow \text{Na}_2\text{Ga}_2\text{O}_4 + \text{H}_2\text{O}$; formula of $\text{Na}_2\text{Ga}_2\text{O}_4$; all formulae and balancing correct;	2
Question	Answer	Marks
3(d)	any 2 from: <ul style="list-style-type: none"> • (do not) corrode; • strong; • hard; • (improved) appearance; 	2

Question	Answer	Marks
4(a)(i)	/heat and in air/oxygen;	1
(a)(ii)	$2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$; SO ₂ on right of equation; all formulae and balancing correct;	2
(b)(i)	<p>M1 heat produced by carbon/coke (burning in) oxygen/air; OR $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ produces heat/exothermic; OR $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$ produces heat/exothermic (scores M1 and M2);</p> <p>M2 $\text{C} + \text{CO}_2 \rightarrow 2\text{CO}$; OR $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$;</p> <p>M3 $\text{ZnO} + \text{CO} \rightarrow \text{Zn} + \text{CO}_2$; OR $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$; OR $2\text{ZnO} + \text{C} \rightarrow 2\text{Zn} + \text{CO}_2$;</p>	3 1 1 1
(b)(ii)	temperature (inside the furnace) is above 907 °C/temperature (inside the furnace) is above the boiling point (of zinc) / 1000 °C is above the boiling point (of zinc);	1
(b)(iii)	con /condensing/condense;	1
(c)	<p>M1 zinc is more reactive than iron/zinc is higher in the reactivity series than iron ora; M2 zinc loses electrons; M3 iron/steel/oxygen/air/water gains electrons OR electrons move to iron/steel/oxygen/air/water; M4 (therefore) iron does not lose electrons/get oxidised/form iron(II) /form iron(III);</p>	4 1 1 1 1

Question	Answer	Marks
(d)(i)	green precipitate; red-brown/brown/orange precipitate;	1 1 2
d(ii)	ox agent/oxidant;	1
(d)(iii)	agent/reductant;	1
(d)(iv)	iron(III)/Fe ³⁺ ;	1
(d)(v)	iron(II)/Fe ²⁺ ;	1

Question	Answer	Marks
5(a)(i)		1
(a)(ii)		1
(a)(iii)		1
(a)(iv)		1
a)(v)		1
(b)(i)	air;	1
(b)(ii)	(iron;	1
(b)(iii)	any 2 from: carbon dioxide; carbon monoxide; nitrogen;	2
(c)(i)	as the percentage of carbon increases, so the malleability decreases;	1
(c)(ii)	M1 oxygen (gas) blown in; M2 carbon dioxide formed/ $C + O_2 \rightarrow CO_2$;	2 1 1