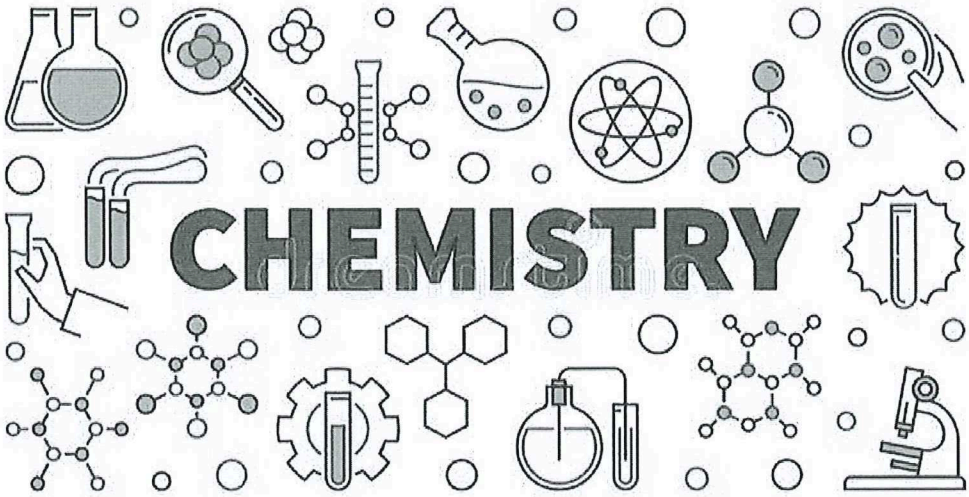
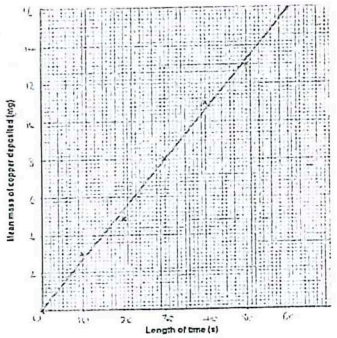


WJEC Chemistry 2

Dual Award – Higher Tier

2.3 Mark Scheme

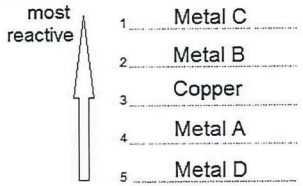
Common questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7/1	(a)			 award (2) for all points plotted correctly – tolerance ±½ square award (1) for any four correct points award (1) for straight line through origin do not accept point to point line		3		3	3	3
	(b)	(i)		2.5 (2) ignore +/– if incorrect award (1) for correct workings e.g. $\frac{8.2-8.0}{8.0} \times 100$ **or** $\frac{7.8-8.0}{8.0} \times 100$ **or** $\frac{0.2}{8.0} \times 100$	1	1		2	2	2
		(ii)		some of the copper fell to the bottom of the beaker / some copper was left in the beaker time too long or too short – neutral some copper was left on the electrode – neutral reference to concentration of solution – neutral			1	1		1

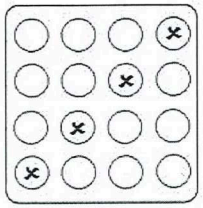
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	I	aluminium ions are positively charged and cathode is negative (1) opposites attract / move to opposite charge / gain three electrons from the cathode (1) aluminium 'atoms' – do not credit for first mark but second mark possible	2			2		
			II	$2\ Al_2O_3 \rightarrow$ 4 Al + $3\ O_2$ both products (1) correct balancing (1) balancing mark can only be awarded if both products are correct		2		2	1	
		(ii)		K_2CO_3		1		1		
				Question 7/1 total	**3**	**7**	**1**	**11**	**6**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		mass of copper produced = 1.39g (1) second mark awarded for working showing yield to be 109% yield = $\frac{1.39}{1.27} \times 100 = 109\%$ (1) no ecf possible		2		2	2	2
		(ii)		the copper(II) oxide / charcoal was impure / some charcoal reacts with the air / not all the copper(II) oxide reacted / charcoal in excess accept 'not enough charcoal to reduce all of the copper(II) oxide' reference to heat or time is neutral			1	1		1
	(b)	(i)		accept reduction by carbon monoxide or carbon $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$ reactants and products (1) balancing (1) balancing mark can only be awarded if both the reactants and products are correct	2			2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		7.7×10^4 (3) 77000 (2) if answer incorrect credit each of following $\frac{22}{100} \times (5 \times 10^5)$ or 1.1×10^5 (1) $\frac{112}{160} \times (1.1 \times 10^5)$ or $0.7 \times (1.1 \times 10^5)$ (1) ecf possible		3			3	
				Question 5 total	**2**	**5**	**1**	**8**	**5**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*			 award (2) for all four correct award (1) if **C** and **B** are above copper **and A** and **D** are below copper but the order is wrong			2	2		2
	(b)	(i)		(metal) **Z** → (metal) **W**		1		1		1
		(ii)		0.1			1	1		1
	(c)			the copper ions / Cu^{2+} ions gain (2) electrons ≡ reduction (1) the zinc atoms / Zn loses (2) electrons ≡ oxidation (1) award (1) for general explanation of both oxidation and reduction without reference to the equation reference to gaining oxygen – neutral		2		2		2
				Question 3 total	**0**	**3**	**3**	**6**	**0**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		award (1) for either of following aluminium is more reactive than iron aluminium displaces iron award (1) for correct reference to reduction e.g. aluminium reduces iron(III) oxide aluminium takes the oxygen away from the iron iron(III) oxide is reduced	2			2		
		(ii)		Fe_2O_3 + 2Al → **2Fe + Al_2O_3** products (1) balancing (1) balancing mark can only be awarded if the correct products given		2		2		
		(iii)		70% (2) if incorrect award (1) for any of following $M_r(Fe_2O_3)$ = 160 56 + 56 + 16 + 16 + 16 total relative mass of iron = 112 56 + 56		2		2	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		 all four crosses shown (1) award (1) for any of following metals do not displace themselves from solution metals do not react with their own nitrate metals do not react with themselves metals have the same reactivity – neutral answer correct explanation may be credited when the first mark is not awarded	2			2		2
		(ii)		0.381g / 0.38g / 0.4g (3) if answer incorrect credit working $112 \leftrightarrow 190.5$ / $(2 \times 56) \leftrightarrow (3 \times 63.5)$ / $\frac{0.224}{112}$ (1) $\frac{0.224}{112} \times 190.5$ (1) alternative method 0.004 mol Fe (1) 0.006 mol Cu (1) ecf possible		3		3	3	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		$\boxed{2}\ Cl^- \longrightarrow Cl_2 + \boxed{2}\ e^-$ (1) award (1) for either of following chloride / Cl^- ions lose electrons oxidation is loss of electrons do not accept - chlorine / zinc chloride loses electrons	2			2		
		(ii)	I	award (1) for any of following some of the zinc chloride/electrolyte is also on the electrode impurities also stick to the electrode product of side reactions stick to the electrode			1	1		1
			II	the chlorine formed is a gas / does not stick to the electrode	1			1		1
				Question 4 total	**7**	**7**	**1**	**15**	**5**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			burns and produces heat / acts as a fuel (1) forms carbon monoxide (1) carbon monoxide reduces the iron oxide / is a reducing agent (1) award last marking point for coke as a reducing agent if no reference to carbon monoxide	3			3		
	(b)	(i)		100g of $CaCO_3$ can produce 56g of CaO (1) 8g $CaCO_3$ can produce $\frac{56}{12.5}$ g of CaO or 4.48g of CaO (1) award (1) for any of following 4.48 to one decimal place is 4.5 therefore Charlie is correct 4.48 to one decimal place is 4.5 4.48 therefore Charlie is correct do not accept 4.5 and Charlie with **no working** alternative methods 0.08 mol $CaCO_3$ (1) 0.08 × 56 = 4.48g CaO (1) award (1) for any of following 4.48 to one decimal place is 4.5 therefore Charlie is correct 4.48 to one decimal place is 4.5 4.48 therefore Charlie is correct			3	3	3	3

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				'trial and error' methods working backwards from any of the values given e.g. $\frac{4.4 \times 100}{56} = 7.86$ $\frac{4.5 \times 100}{56} = 8.04$ closest to 8.0g therefore Charlie $\frac{5.0 \times 100}{56} = 8.93$ $\frac{100}{8} = 12.5$ $12.5 \times 4.4 = 55$ $12.5 \times 4.5 = 56.3$ closest to 56 therefore Charlie $12.5 \times 5.0 = 62.5$						
		(ii)		$CaSiO_3$		1		1		
	(c)			$\boxed{4}\ Fe + 3O_2 \longrightarrow \boxed{2}\ Fe_2O_3$ award (1) for formula award (1) for balancing only if formula is correct		2		2		
				Question 4 total	**3**	**3**	**3**	**9**	**3**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7				**Indicative content** • ions are free to move because aluminium oxide is molten • ions travel to the oppositely charged electrodes because opposite charges attract / Al^{3+} ions go to the cathode / O^{2-} ions go to the anode • reduction is gain of electrons, oxidation is loss of electrons at the cathode – reduction • $Al^{3+} + 3e^- \rightarrow Al$ • aluminium ions gain 3 electrons to form aluminium atoms at the anode – oxidation • $2O^{2-} \rightarrow O_2 + 4e^-$ • two oxide ions lose 2 electrons each to form two oxygen atoms • these pair up to form oxygen molecules **5-6 marks** Good explanation of the movement of ions towards both electrodes and of reduction and oxidation of both ions in terms of gain/loss of electrons; attempt at electrode equations *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.*	6			6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				3-4 marks Attempt at explanation of the movement of ions and of reduction and oxidation in terms of gain/loss of electrons *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1-2 marks** Simple description of the movement of ions during the process; knowledge of reduction or oxidation in terms of gain/loss of electrons *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or no response worthy of credit.*						
				Question 7 total	**6**	**0**	**0**	**6**	**0**	**0**