OCR GCSE GATEWAY CHEMISTRY A · J248

CHEMISTRY



MARK SCHEME

M3 ALGEBRA

SCORE	PERCENTAGE
/39	%

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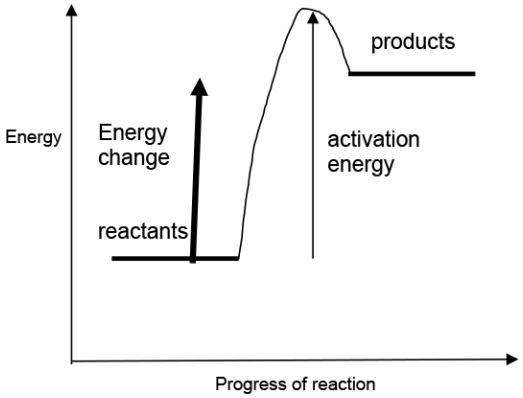
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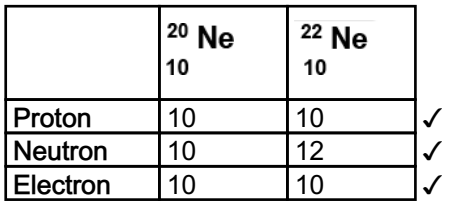
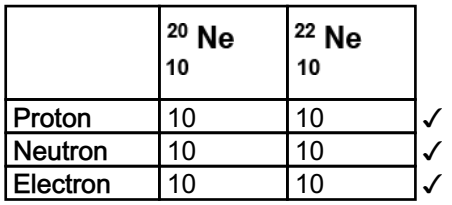
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Question			Answer/Indicative content	Marks	Guidance
1		i	<table><tr><th>Reaction mixture</th><th>Start temperature (°C)</th><th>End temperature (°C)</th><th>Temperature change (°C)</th></tr><tr><td>X</td><td>20.0</td><td>25.5</td><td>(+) 5.5</td></tr><tr><td>Y</td><td>19.0</td><td>8.0</td><td>–11</td></tr><tr><td>Z</td><td>20.0</td><td>20.0</td><td>0</td></tr></table>	1 (AO1.2)	
		ii	Y ✓ the temperature went down / decreased / energy is taken in ✓	2 (AO3.2b 1.1)	
		iii	 Activation energy ✓ Energy change ✓ Reactants ✓	3 (AO1.1)	**ALLOW** max 1 mark for correct shape if labels are missing / incorrect
			Total	**6**	
2		i	Unreactive ✓ Full outer shell (of electrons) ✓	2 (AO2.1 1.1)	**ALLOW** doesn't bond / doesn't lose or gain electrons / doesn't share electrons **ALLOW** (argon has a) stable electronic structure / 8 electrons in outer shell

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Question			Answer/Indicative content	Marks	Guidance
		ii		3 (AO2.1)	1 mark for each row
			Total	**0**	
3		i	Unreactive ✓ Full outer shell (of electrons) ✓	2 (AO2.1 1.1)	**ALLOW** doesn't bond / doesn't lose or gain electrons / doesn't share electrons **ALLOW** (argon has a) stable electronic structure / 8 electrons in outer shell
		ii		3 (AO2.1)	1 mark for each row
			Total	**5**	

Question			Answer/Indicative content	Marks	Guidance
4		i	Bond breaking is endothermic / takes in energy ✓ Bond making is exothermic / gives out energy ✓ More energy is given out (during bond making) than is taken in (during bond breaking) ✓	3 (AO2 × 1.1) (AO2.1)	**DO NOT ALLOW** ideas about more bonds **IGNORE** idea that more energy is **used** during bond making than is taken in during bond breaking **IGNORE** idea that it takes more energy to make bonds than to break bonds
		ii	C–H: 4 × 413 = 1652 **AND** O=O: 2 × 498 = 996 Total energy = 1652 + 996 = 2648 (kJ / mol) ✓	1 (AO1.2)	
		iii	C=O: 2 × 805 = 1610 **AND** O–H: 4 × 464 = 1856 Total energy = 1610 + 1856 = 3466 (kJ / mol) ✓	1 (AO1.2)	
		iv	Energy change = 2648 – 3466 = –818 (kJ / mol) ✓	1 (AO1.2)	Answer MUST show – sign for mark **ALLOW** ECF from parts (ii) & (iii)
			Total	6	
5			**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 297 award 3 marks** Relative formula mass of $MgCO_3$ = 24.3 + 12 + 16 × 3 = 84.3 ✓ Number of moles = $25 \times \frac{1000}{84.3}$ = 296.5599051 = 297 ✓ (to 3 sig fig)	3 (AO2.2 × 2) (AO1.2)	**DO NOT ALLOW** 84 **ALLOW ECF** from incorrect RFM of $MgCO_3$ eg RFM of 84, number of moles = 298 **ALLOW** ECF for sig fig mark
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
6		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 120 (tonnes) award 3 marks M_r of NH_3 = 17 **AND** M_r of NH_4NO_3 = 80 ✓ Mass of ammonium nitrate = $\frac{80}{17}$ x 25.5 / 1.5 x 80 ✓ = 120 (tonnes) ✓	3 (AO2.1)	**ALLOW** ECF from incorrect RMMs
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 10(g) award 2 marks Actual mass = $\frac{80 \times 12.5}{100}$ ✓ = 10 (g) ✓	2 (AO1.2) (AO2.2)	**ALLOW** % yield = (am ÷ pm) x 100 **OR** 80 = (am ÷ 12.5) x 100 for 1 mark if no other mark awarded
			Total	5	
7		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 120 (tonnes) award 3 marks M_r of NH_3 = 17 **AND** M_r of NH_4NO_3 = 80 ✓ Mass of ammonium nitrate = $\frac{80}{17}$ × 25.5 / 1.5 × 80 ✓ = 120 (tonnes) ✓	3 (AO2.1)	**ALLOW** ECF from incorrect RMMs
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 10(g) award 2 marks Actual mass = $\frac{80 \times 12.5}{100}$ ✓ = 10 (g) ✓	2 (AO1.2) (AO2.2)	**ALLOW** % yield = (am ÷ pm) × 100 **OR** 80 = (am ÷ 12.5) × 100 for 1 mark if no other mark awarded
			Total	5	

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Question			Answer/Indicative content	Marks	Guidance
8	a		**Any one from:** Use a single indicator / named single indicator eg methyl orange / phenolphthalein (instead of universal indicator)✓ Idea that universal indicator does not give a sudden colour change / universal indicator gives a continuous colour change / ORA ✓ **OR** Fill the burette exactly to the 0.00 cm^3 line ✓ Idea that this will give accurate volume of acid ✓ **OR** Idea of adding acid to the alkali <u>slowly</u> **or** <u>dropwise</u> (near the end point) ✓ Idea that indicator should change colour on addition of one drop (of acid) ✓ **OR** Idea of swirling the alkali while adding the acid ✓ To ensure mixing of acid and alkali / AW ✓ **OR** Use a white tile under the conical flask ✓ To see the colour change easily / clearly ✓ **OR** Repeat the experiment <u>until concordant or consistent results are obtained</u> ✓ To obtain a more accurate titre / AW ✓ **OR** Idea of doing a rough titration ✓ As this will give you an idea of the endpoint ✓	2 (AO3.3b)	**Explanation must be linked to improvement** **ALLOW** idea of using a pH probe or pH meter to give a more accurate indication of when neutralisation occurs **ALLOW** idea of missing the end point **ALLOW** two improvements, with no explanation, for 1 mark if no explanations given

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Question			Answer/Indicative content	Marks	Guidance
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE **If answer = 23.65 (cm^3) award 2 marks** Use of volume of acid from titrations 2, 3 & 4 / Use of 23.60, 23.70 & 23.65 ✓ Accurate volume of acid = 23.65 (cm^3) ✓	2 (AO2.2)	**DO NOT ALLOW** 23.7 (cm^3) **ALLOW** 1 mark for average calculated using all results, ie 24.18 / 24.175 (cm^3) but **DO NOT ALLOW** 24.2 (cm^3)
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE **If answer = 0.106 (mol / dm^3) award 4 marks** moles of alkali $= \frac{0.200 \times 25.0}{1000}$ / 0.200 x 0.0250 / moles of acid = $\frac{0.005}{2}$ = 0.0025 / 2.5×10^{-3} ✓ $= \frac{0.0025}{0.02365}$ / $\frac{0.0025 \times 1000}{23.65}$ / $\frac{2.5 \times 10^{-3}}{0.02365}$ / $\frac{2.5 \times 10^{-3} \times 1000}{23.65}$ / 0.1057 (mol/dm^3) ✓ concentration = 0.106 (mol / dm^3) (3 sig. figs) ✓	4 (AO3 × 2.2) (AO1.2)	**ALLOW** ECF from moles of alkali **ALLOW** ECF from average titre in **(i)** **ALLOW** ECF from moles of acid i.e. conc = $\frac{\text{moles}}{0.02365}$ or $\frac{\text{moles} \times 1000}{23.65}$
			Total	8	
9			B	1 (AO2.1)	
			Total	1	

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