OCR GCSE GATEWAY CHEMISTRY A · J248

CHEMISTRY



MARK SCHEME

WS1.2 EXPERIMENTAL SKILLS AND STRATEGIES

SCORE	PERCENTAGE
/77	%

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Question			Answer/Indicative content	Marks	Guidance
1			D	1 (AO1.2)	
			Total	**1**	
2	a	i	A **AND** D ✓	1 (AO3.1a)	
		ii	**Any two from:** Conducts electricity in molten state ✓ Does not conduct electricity in solid state ✓ High melting point ✓	2 (AO3.2b)	ALLOW dissolve in water
	b	i	Add water (and stir) ✓ Filtration ✓ **B** collects on filter paper ✓	3 (AO3.3a 1.2 3.3a)	
		ii	Distillation **OR** evaporation **OR** heating ✓ Removes water **OR** dries C **OR** removes some water and leave to crystalise ✓	2 (AO1.2 3.3a)	**ALLOW** boiling
			Total	**8**	
3	a	i	pH meter ✓	1 (AO1 1.2)	**ALLOW** pH probe
		ii	Wash the probe with water ✓ Put the probe into the solution ✓	2 (AO1.2)	**ALLLOW** calibrate the meter / probe

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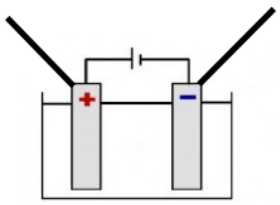
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Question			Answer/Indicative content	Marks	Guidance
	b		*Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks)** Correctly names the acid and the base used in the neutralisation reaction. **AND** Method can be followed to make a pure, dry sample of potassium chloride. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Correctly names the acid and the base used in the neutralisation reaction. **OR** Method can be followed to make a salt sample. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Method includes adding acid to base. **OR** Correctly names either the acid or the base used in the neutralisation reaction. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	6 (AO1.1 ×2 2.2 ×2 3.3a ×2)	**AO1.1 Demonstrates knowledge and understanding of neutralisation reactions** • base neutralises the acid • acid + base → salt + water • potassium chloride is a salt • potassium chloride is neutral **AO2.1 Application of knowledge and understanding related to making a salt by neutralisation** • acid used is hydrochloric acid • base used is potassium hydroxide / potassium oxide / potassium carbonate • pH paper / pH probe is used to show solution made is neutral **AO3.3 Analyse of information and ideas to develop experimental procedures** • pH probe will not contaminate the solution • evaporate some of the water to form crystals • leave the crystals to dry / dry crystals in an oven

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Question			Answer/Indicative content	Marks	Guidance
			Total	9	
4		i	anode  cathode	2 (AO2 × 1.2)	All correct = 2 marks 1 or 2 correct = 1 mark
		ii	Positive electrode: bromine ✓ Negative electrode: lead ✓	2 (AO2 × 2.2)	**DO NOT ALLOW** bromide **ALLOW** reversed 1 mark
		iii	$PbBr_2$ ✓	1 (AO2.1)	
			Total	5	
5			**Any two from:** Change the glass beaker for a metal container ✓ Move the spirit burner closer to the container / glass beaker / metal container ✓ Use a draught shield ✓ Add a lid (to the beaker) ✓	2 (AO3.3b ×2)	**IGNORE** put all thermometer (bulb) in water
			Total	2	

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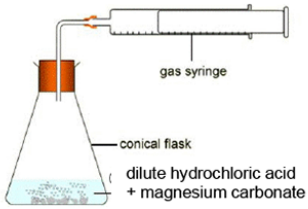
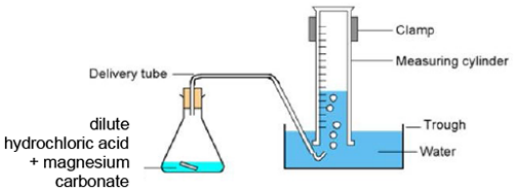
Question			Answer/Indicative content	Marks	Guidance
6	a		Ink dissolves in solvent ✓	1 (AO1.1)	**ALLOW** Pencil will not dissolve in solvent **ALLOW** so it doesn't move (with the solvent) / doesn't mix with the spots / solvent / colours in ink don't separate / ink has colours in it / ink would run
	b		Circle / dot drawn on start line in diagram ✓	1 (AO2.2)	
	c		A ✓	1 (AO3.2a)	
			Total	**3**	
7		i	Condenser ✓	1 (AO1.2)	
		ii	Distillation ✓	1 (AO1.1)	**DO NOT ALLOW** fractional
		iii	Add thermometer ✓ Water goes in at the bottom (of condenser) **OR** water comes out at the top (of condenser) ✓	2 (AO2 × 3.3b)	**ALLOW** take out the funnel
			Total	**4**	
8			B ✓	1 (AO2.2)	
			Total	**1**	
9			**C** ✓	1 (AO1.2)	
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
10	a		**Any one from:** Use a single indicator / named single indicator eg methyl orange / phenolphthalein (instead of universal indicator)✓ Idea that universal does not give a sudden colour change / universal indicator gives a continuous colour change / ORA ✓ OR Fill the burette exactly to the 0.0 cm^3 line ✓ Idea that this will give accurate volume of acid ✓ OR Idea of adding acid to the alkali **slowly or dropwise** near the end point ✓ As 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 ✓ OR Use a white tile under the conical flask ✓ To see the colour change easily / clearly ✓	2 (AO3.3b)	**Explanation must be linked to reason** **ALLOW** idea of using a pH probe or pH meter
	b		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 23.65 (cm^3) award 2 marks** Use of volume of acid from only titrations 2 & 3 / Use of only 23.60 & 23.70 ✓ Accurate volume of acid = 23.65 (cm^3) ✓	2 (AO2.2)	**ALLOW** 1 mark for average calculated using all results, ie 24.35 (cm^3)
			Total	**4**	

Question			Answer/Indicative content	Marks	Guidance
11	a		Use of gas syringe / upturned measuring cylinder / burette to collect gas over water ✓ Apparatus will work ✓ eg  **OR**  **And any three from:** Measure known volume of acid ✓ Add known mass of magnesium carbonate ✓ Measure volume of gas every 30 seconds ✓ Repeat with different concentrations of acid ✓ Repeat using same temperature ✓	5 (AO3.3a)	**ALLOW** idea of same volume of acid in each experiment **ALLOW** idea of same mass of magnesium carbonate in each experiment **ALLOW** Measure volume of gas at any sensible time interval **ALLOW** just the idea of measuring the time taken for a fixed volume of gas to be produced or the volume of gas produced in a fixed time **IGNORE** measure the time taken for the reaction to finish
	b	i	Linear scale on both x and y axes ✓ All points plotted correctly scores 2 marks **BUT** 3 or 4 points plotted correctly scores 1 mark Line of best fit through points ✓	4 (AO3 × 2.2)	**ALLOW** ± ½ square **NB** Check that 7.0×10^{-3} is plotted as 0.7×10^{-2}
		ii	(Rate of reaction) increases ✓	1 (AO3.1a)	

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Question			Answer/Indicative content	Marks	Guidance
		iii	Idea that acid particles move faster / particles have more energy ✓ Idea of increased collision frequency (between acid and thiosulfate) ✓ Idea of more successful collisions / collisions (between acid and thiosulfate) are more energetic / more particles have the activation energy ✓	3 (AO2.2)	IGNORE references to 'faster' collisions IGNORE just 'more collisions'
			Total	13	

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Question			Answer/Indicative content	Marks	Guidance
12			Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Describes tests, the results, and identifies each of the three samples **AND** Includes correct balanced symbol equations for the reactions which occur. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Describes tests, the results, and identifies each of the three samples **OR** Describes a test and the result, to identify one of the three samples and attempts to identify the other two **AND** Includes a balanced symbol equation for the reaction which occurs. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Describes a test and the result, to identify one of the three samples. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	6 (AO3 × 1.2) (AO3 × 2.2)	**AO1 Knowledge and understanding of alkanes, alkenes and acids** • Alkanes do not react with bromine water • Alkenes react with bromine water / bromine water is decolourised • Acids react with carbonates to give off carbon dioxide / fizzing observed **AO2 Application and knowledge of tests and results** • Add sodium carbonate (or any suitable carbonate) • Ethanoic acid effervesces • Pentane and pentene do not effervesce • ALLOW other suitable reactions, eg addition of a metal; ethanoic acid effervesces • ALLOW use of universal indicator to identify ethanoic acid • Add bromine water to separate samples of pentane and pentene and shake • With pentene bromine water changes from orange to colourless / bromine water is decolourised • With pentane and ethanoic acid bromine water stays orange **AO2.1 Application of knowledge and understanding to produce balanced symbol equations** $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + CO_2 + H_2O$ $C_5H_{10} + Br_2 \rightarrow C_5H_{10}Br_2$
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
13	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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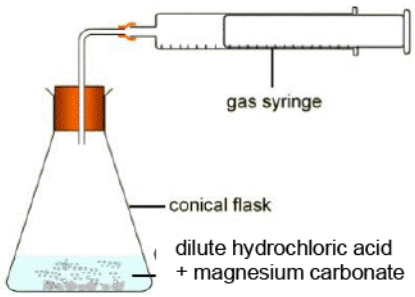
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Question			Answer/Indicative content	Marks	Guidance
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE **If answer = 23.65 (cm^3) award 2 marks** Use of volume of acid from titrations 2, 3 & 4 / Use of 23.60, 23.70 & 23.65 ✓ Accurate volume of acid = 23.65 (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	

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Question			Answer/Indicative content	Marks	Guidance
14			Labelled diagram showing gas syringe connected to conical flask ✓  ✓ ✓ **And any three from:** Measure known volume of acid ✓ Add known mass of magnesium carbonate ✓ Measure volume of gas every 30 seconds ✓ Repeat with different concentrations of acid ✓	4 (AO3.3a)	**NB** Apparatus must work
			Total	**4**	

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Question			Answer/Indicative content	Marks	Guidance
15	a		Idea that inert electrodes do not react with the electrolyte / inert electrodes are unreactive ✓	1 (AO1.2)	**ALLOW** so that electrodes do not take part in the reaction
	b	i	Copper sulfate ✓	1 (AO3.2a)	
		ii	Copper chloride produces chlorine which is a toxic gas / copper sulfate does not produce chlorine which is a toxic gas ✓ Zinc bromide / sulfuric acid do not have copper ions **OR** copper sulfate / copper chloride contain copper ions ✓	2 (AO2 × 3.2b)	**IGNORE** idea that chlorine gas is dangerous / hazardous **ALLOW** idea that the solution contains copper ions
	c	i	Oxygen / O2 ✓	1 (AO3.2a)	**IGNORE** O
		ii	Hydrogen is less reactive than sodium / ORA ✓	1 (AO3.2b)	**Assume unqualified answer refers to hydrogen (gas)**
		iii	$2H^+ + 2e^- \rightarrow H_2$ Formula ✓ Balancing ✓	2 (AO2.1 1.2)	**ALLOW** any correct multiple, including fractions **ALLOW** = **OR** ⇌ instead of → **DO NOT ALLOW** and / & instead of '+' **ALLOW** e for e^- Balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae e.g. 2H+ + 2e → H2
			Total	**8**	

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