GCE A LEVEL MARKING SCHEME

SUMMER 2017

A LEVEL (NEW)
CHEMISTRY - UNIT 5
1410U50-1

INTRODUCTION

This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

A2 UNIT 5: PRACTICAL EXAMINATION

EXPERIMENTAL TASK

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

The mark total should be entered onto the grid on the front cover.

Marking rules

All work should be seen to have been marked.

Crossed out responses not replaced should be marked.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

A2 UNIT 5: PRACTICAL EXAMINATION

EXPERIMENTAL TASK

MARK SCHEME Test 1

Skill		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
Parts A & B	Teacher-awarded marks	working safely (1) efficient use of time (1) dilution (1)	3			3		3
Part A	Titration data – table	appropriate tables drawn including units (1) all three titles (1)		2		2		2
	Titration data – recording	correct mass and titres (1) all readings recorded to 0.05 cm^3 (1)		2		2		2
	Titration data – mean titre	concordant titres selected (1) mean value for titre calculated (1)		1	1	2		2

Skill		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
Part A	Titration data – accuracy	comparison with teacher's results ± 0.2 cm^3 5 marks ± 0.4 cm^3 4 marks ± 0.6 cm^3 3 marks ± 0.8 cm^3 2 marks ± 1.0 cm^3 1 mark		5		5		5
Part B	Observations	sodium hydroxide • solution **X** – green precipitate (turning brown at surface) • solution **Y** – blue precipitate • solution **Z** – white precipitate; dissolves in excess potassium iodide • solution **X** – no visible change • solution **Y** – brown solution & white precipitate • solution **Z** – no visible change barium chloride • solution **X** – white precipitate • solution **Y** – white precipitate • solution **Z** – white precipitate *See alternative version when marking Test 2*		1 1 1 1 1 1		6		6

Skill	Question	Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
Part A Analysis of results	(i)	number of moles of MnO_4^- ions $= \frac{c \times \text{mean titre}}{1000}$		1		1	1	1
	(ii)	$MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{2+}\ 4H_2O$		1		1	1	1
	(iii)	number of moles of iron(II) ions in $25cm^3$ 5 × value from part (i) (1) allow ecf based on candidate's equation number of moles of iron(II) ions in $250cm^3$ 50 × value from part (i) (1)			2	2	2	2
	(iv)	mass of iron(II) sulfate present in original sample 151.9 × final answer from part (iii)			1	1	1	1
	(v)	percentage of iron(II) sulfate in “Moss Killer” $= \frac{\text{value from part (iii)}}{\text{mass}} \times 1000$ must make reference to comment on the container			1	1	1	1

Part B Analysis of results	(vi)	solution **X** • Fe^{2+} – green precipitate with OH^-(aq) (turning brown at surface) (1) solution **Y** • Cu^{2+} – blue precipitate with OH^-(aq) / brown solution & white precipitate with I^-(aq) (1) solution **Z** • Zn^{2+} – white precipitate with OH^-(aq) (dissolves in excess OH^-(aq)) accept colourless solution linked to full *d*-shell (1) *See alternative version when marking Test 2*			1 1 1	3		3
	(vii)	Ba^{2+}(aq) + SO_4^{2-}(aq) → $BaSO_4$(s)		1		1		1
	Total		**3**	**19**	**8**	**30**	**6**	**30**

Part B	Observations	sodium hydroxide • solution **X** – blue precipitate • solution **Y** – white precipitate; dissolves in excess • solution **Z** – green precipitate (turning brown at surface) potassium iodide • solution **X** – brown solution & white precipitate • solution **Y** – no visible change • solution **Z** – no visible change barium chloride • solution **X** – white precipitate • solution **Y** – white precipitate • solution **Z** – white precipitate		1 1 1 1 1 1		6		6

Part B Analysis of results	(vi)	solution **X** • Cu^{2+} – blue precipitate with $OH^-(aq)$ / brown solution & white precipitate with $I^-(aq)$ (1) solution **Y** • Zn^{2+} – white precipitate with $OH^-(aq)$ (dissolves in excess $OH^-(aq)$) accept colourless solution linked to full *d*-shell (1) solution **Z** • Fe^{2+} – green precipitate with $OH^-(aq)$ (turning brown at surface) (1)			1 1 1	3		3

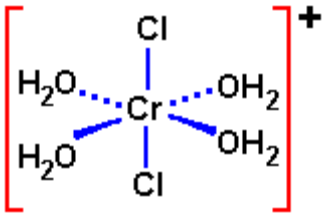
PRACTICAL METHODS AND ANALYSIS TASK

MARK SCHEME

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1.	(a)			$n = \frac{PV}{RT} = \frac{(1.01 \times 10^5) \times (93 \times 10^{-6})}{8.31 \times 295} = 0.00383$ mol (O_2 gas) (1)	1				1	
				$n(H_2O_2) = 2 \times 0.00383 = 0.00766$ mol (1)		1				
				$v = \frac{n}{c} = \frac{0.00766}{0.306} = 0.0250$ dm^3 / 25.0 cm^3 (1)		1		3	1	
				unit must correspond to volume for final mark						
				ecf possible throughout						
	(b)	(i)		suitable scale on x-axis and y-axis (1)						
				points plotted (±1 square) (1)		1			1	
				curve of best fit drawn through origin (1)		1			1	
				initial rate of reaction from tangent drawn at t = 0						
				47 (cm^3 min^{-1}) accept range 44-50 (1)			1		1	
							1		1	
				conversion to units of dm^3 s^{-1}						
				$\frac{47}{1000 \times 60} = 7.83 \times 10^{-4}$ **must** be in standard form						
				accept range 7.33×10^{-4} to 8.33×10^{-4} (1)						
				ecf possible throughout	1			5	1	5

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		rate = 2 × initial rate of oxygen formation e.g. 1.57×10^{-3} dm^3 s^{-1} / 94 cm^3 min^{-1} (1) allow ecf on rate calculated from b(i); unit not needed rate is double because the ratio of moles of $H_2O_2(aq)$: $O_2(g)$ is 2 : 1 (1)			1 1	 2		
	(c)			award (1) for each of following points • fair test using same volume of $H_2O_2(aq)$ each time / same temperature (of 22°C if using data given in the stem of the question) / (same mass of catalyst / same surface area of catalyst) • comparison of rate at two or more different concentrations of $H_2O_2(aq)$ e.g. 0.306 mol dm^{-3} and 0.153 mol dm^{-3} • rate at 0.153 mol dm^{-3} would be half the rate at 0.306 mol dm^{-3} / rate is directly proportional to $[H_2O_2]$			3	3		3
	(d)			any **one** of the following methods <u>and</u> sensible reasoning • follow loss in mass over time **because** $O_2(g)$ is evolved • follow pressure over time **because** $O_2(g)$ is evolved • sample at regular time intervals, quench and titrate (against MnO_4^-/H^+) **to find** H_2O_2 concentration at those times	1			1		1
				Question 1 total	**3**	**4**	**7**	**14**	**7**	**9**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2.				Method 1						
				green solution suggests $Cr^{3+}(aq)$ (1)	1					1
				confirmed by $Cr^{3+}(aq) + 3OH^{-}(aq) \rightarrow Cr(OH)_3(s)$						
				ignore state symbols (1)		1				
				dissolves in excess NaOH(aq)						
				$Cr(OH)_3(s) + 3OH^{-}(aq) \rightarrow [Cr(OH)_6]^{3-}(aq)$						
				ignore state symbols (1)		1				1
				accept $[Cr(H_2O)_6]^{3+}$ ion and corresponding equations						
				Method 2						
				$Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$						
				ignore state symbols (1)		1				1
				13.33 g of **W** = $\frac{13.33}{266.6}$ = 0.05 mol						
				7.18 g of AgCl = $\frac{7.18}{143.5}$ = 0.05 mol (1)		1			1	
				1 mol of **W** contains 1 mol of Cl^{-} ions not co-ordinately bonded to Cr^{3+} (1)			1			
				therefore compound **W** is isomer III / $\left[CrCl_2(H_2O)_4\right]Cl.2H_2O$ (1)			1			

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2.				octahedral complex drawn e.g.  (1) must show the 3D arrangement			1	8		
				Question 2 total	**1**	**4**	**3**	**8**	**1**	**3**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>3.</td><td></td><td></td><td></td><td>
<table>
<tr><th>Pair</th><th>Reagent(s)</th><th>Observation</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">2,4-DNPH</td><td>no reaction</td></tr>
<tr><td>yellow/orange/red solid</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">$Na_2CO_3(s)$</td><td>fizzing / effervescence</td></tr>
<tr><td>no reaction</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">$Br_2(aq)$</td><td>white / off-white precipitate</td></tr>
<tr><td>no reaction</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">$I_2(aq)$ / NaOH(aq)
or
KI(aq) / NaClO(aq)</td><td>no reaction</td></tr>
<tr><td>pale yellow solid formed</td></tr>
</table>
for each pair of isomers
award (1) for suitable reagent(s) + positive result
award (1) for suitable reagent(s) + negative result

award (0) if reagent(s) cannot distinguish between the isomers

accept other answers – up to (2) marks per pair but credit each reagent once only
</td><td>4</td><td>4</td><td></td><td>8</td><td></td><td>8</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 3 total</td><td>4</td><td>4</td><td>0</td><td>8</td><td>0</td><td>8</td></tr>
</table>

A2 UNIT 5: PRACTICAL EXAMINATION

SUMMARY OF ASSESSMENT OBJECTIVES

	Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
Experimental Task	**Total**	**3**	**19**	**8**	**30**	**6**	**30**
Practical Methods and Analysis Task	**1.**	**3**	**4**	**7**	**14**	**7**	**9**
	2.	**1**	**4**	**3**	**8**	**1**	**3**
	3.	**4**	**4**	**0**	**8**	**0**	**8**
		11	**31**	**18**	**60**	**14**	**50**