GCE A LEVEL MARKING SCHEME

SUMMER 2018

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

INTRODUCTION

This marking scheme was used by WJEC for the 2018 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

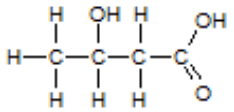
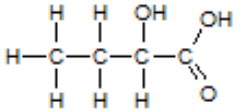
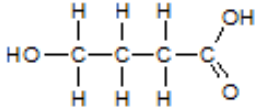
EXPERIMENTAL TASK

MARK SCHEME Test 1

Skill		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
Parts A & B	Teacher-awarded marks	efficient use of solutions (1) efficient use of time (1) working safely (1)	3			3		3
Part A award credit if skill is shown in one titration or the other	Titration recording – table	appropriate table drawn including titles and units (1)		1		1		1
	Titration recording – data	all readings recorded to 0.05 cm^3 (1) correct titres (1)		2		2		2
	Titration recording – 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 accuracy	comparison with teacher's results titration 1 ± 0.2 cm^3 3 marks ± 0.4 cm^3 2 marks ± 0.6 cm^3 1 mark titration 2 ± 0.2 cm^3 3 marks ± 0.4 cm^3 2 marks ± 0.6 cm^3 1 mark		6		6		6
Part B	Observations	dichromate(VI) test • solution turns from orange to green (1) iodoform test • pale yellow precipitate / antiseptic smell (1) silver nitrate test • no observable change (1) *See alternative version when marking Test 2*		1 1 1		3		3

Skill	Question	Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
Analysis of results **Part A**	(i)	number of moles of HCl (1) concentration of NaOH (1)		2		2	1	2
	(ii)	number of moles of NaOH (1) concentration of $C_nH_{2n+1}COOH$ in mol dm^{-3} (1) Mr of $C_nH_{2n+1}COOH$ (1) molecular formula C_3H_7COOH (1)		2	2	4	3	2

Analysis of results **Part B**	(iii)	dichromate(VI) test • the compound is a 1° alcohol or 2° alcohol or an aldehyde (1) iodoform test • the compound contains a CH_3CO group or a $CH_3CH(OH)$ group (1) silver nitrate test • Y cannot be Cl, Br or I (1) *See alternative version when marking Test 2*			1 1 1	3		3
	(iv)	 (1) must give a 2° alcohol on decarboxylation because that product gives a positive iodoform test (1) if correct structure not given award (1) for other four carbon acid with reasoning in terms of M_r of 88  			2	2		
	(v)	award (1) for discussion of chemical shifts of two peaks in relation to the structure given in part (iv) award (1) for discussion of splitting pattern of two peaks in relation to the structure given in part (iv)			2	2		
	Total		**3**	**17**	**10**	**30**	**4**	**24**

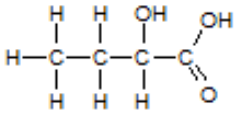
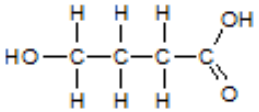
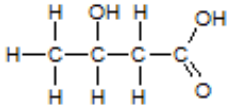
Mark Scheme Amendments for Test 2

Part B	Observations	dichromate(VI) test • solution turns from orange to green (1) iodoform test • no observable change (1) silver nitrate test • no observable change (1)		1 1 1		3		3

Part B Analysis of results	(iii)	dichromate(VI) test • the compound is a 1° or 2° alcohol or an aldehyde (1) iodoform test • the compound does not contain a CH_3CO group or a $CH_3CH(OH)$ group (1) silver nitrate test • Y cannot be Cl, Br or I (1)			1 1 1	3		3

Note

These marking amendments were applied where candidates taking Test 1 got no observable results for the iodoform test.

	(iv)	  award (1) for either of these structures must give a 1° alcohol on decarboxylation because that product gives a negative iodoform test (1) if correct structure not given award (1) for other four carbon acid with reasoning in terms of M_r of 88 			2	2		
	(v)	award (1) for discussion of chemical shifts of two peaks in relation to the structure given in part (iv) award (1) for discussion of splitting pattern of two peaks in relation to the structure given in part (iv)			2	2		

PRACTICAL METHODS AND ANALYSIS TASK

MARK SCHEME

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		to increase the rate of the reaction / to increase the surface area of the $CaCO_3$	1			1		1
		(ii)		to remove any water (from the burette) which would dilute the sodium hydroxide solution / no impurities remain in the burette	1			1		1
		(iii)		to make sure that reaction (between NaOH(aq) and HCl(aq)) is complete / all HCl has reacted / all NaOH has reacted	1			1		1
	(b)			titration 4 smallest volume (of NaOH)		1		1		1

<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></td><td>(c)</td><td>(i)</td><td></td><td>
<table>
<tr><th></th><th>Correct order</th></tr>
<tr><td>Calculate the number of moles of NaOH used which is equal to the number of moles of unreacted HCl</td><td>2</td></tr>
<tr><td>Use the balanced equation to calculate the number of moles of $CaCO_3$</td><td>4</td></tr>
<tr><td>Calculate the number of moles of HCl added to the powdered eggshell</td><td>1</td></tr>
<tr><td>Calculate the percentage by mass of $CaCO_3$ in the powdered eggshell</td><td>6</td></tr>
<tr><td>Convert the number of moles of $CaCO_3$ to mass of $CaCO_3$ in grams</td><td>5</td></tr>
<tr><td>Calculate the number of moles of HCl that reacted with the powdered eggshell</td><td>3</td></tr>
</table>
</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>total moles HCl added = $10.00/1000 \times 1.10 = 1.1 \times 10^{-2}$ (1)

moles of NaOH used = moles of excess HCl
$= 24.80/1000 \times 0.0805 = 1.996 \times 10^{-3}$ (1)

moles of HCl reacted with $CaCO_3$ = $(1.1 \times 10^{-2}) - (1.996 \times 10^{-3})$
$= 9.004 \times 10^{-3}$ (1)

mass of $CaCO_3$ = $(9.004 \times 10^{-3} \div 2) \times 100.1 = 0.451$g (1)

percentage by mass of $CaCO_3$ = $(0.451 \div 0.482) \times 100$
$= 93.5$ (1)</td><td></td><td>1

1

1

1

1</td><td></td><td>5</td><td>1

1

1

1</td><td></td></tr>
</table>

<table>
<tr><th colspan="4">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></td><td>(d)</td><td></td><td></td><td>no – mark awarded for explanation

wet sample means that the actual mass of calcium carbonate is smaller than that recorded therefore the percentage by mass is lower</td><td></td><td></td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(e)</td><td></td><td></td><td>
<table>
<tr><td>Final burette reading / cm^3</td><td>15.85</td><td>32.45</td><td>31.35</td><td>20.05</td></tr>
<tr><td>Initial burette reading / cm^3</td><td>0.45</td><td>17.55</td><td>15.85</td><td>4.50</td></tr>
<tr><td>Titre / cm^3</td><td>15.40</td><td>14.90</td><td>15.50</td><td>15.55</td></tr>
<tr><td>Accept / reject</td><td>✓</td><td>×</td><td>✓</td><td>✓</td></tr>
</table>
correct titres volumes all given to 2dp (1)

mean titre = 15.48 cm^3 (1)</td><td></td><td>1

1</td><td></td><td>2</td><td></td><td>2</td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(f)			Lowri's method more than one sample weighed and therefore any mistake in weighing any one of the samples could be identified (1) Rhodri's method any of following for (1) • less time in preparation of 'sample mixture' • multiple titrations of the same 'sample mixture' – easier to compare consistency across titrations • mean value can be calculated – closer to true value • larger mass of powdered eggshell weighed therefore smaller percentage error in weighing			1 1	2		2
				Question 1 total	**4**	**8**	**3**	**15**	**4**	**9**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Test 1 must be a Group 2 salt (1)			1			
				Test 2 must be Ba^{2+} (or Sr^{2+}) (1)			1			
				Test 3 must be an iodide (1)		1				
				Test 4 white precipitate CuI/Cu_2I_2 (1)			1			
				brown solution iodine (1)			1			
				Test 5 solution becomes colourless / straw coloured (leaving white precipitate) (1)			1	6		6
		(ii)		(redox reaction) iodine reduced to iodide (1)		1				1
				award (1) for either of following equations						
				$I_2 + 2Na_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6$		1		2		
				$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$						
				ignore state symbols						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			Cation award (1) for either of following • flame test – apple green flame colour (crimson if Sr^{2+}) [ecf possible from incorrect Group 2 metal identified in Test 2] • add SO_4^{2-}(aq) – white precipitate	1					1
				Anion award (1) for either of following • add Ag^{+}(aq) – yellow precipitate • add Pb^{2+}(aq) – bright yellow precipitate	1			2		1
				Question 2 total	**2**	**3**	**5**	**10**	**0**	**9**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			award (1) for correct number of moles of **both** reactants $n(C_6H_8O_7) = 0.050$ mol $n(NaHCO_3) = 0.190$ mol award (1) for statement that compares the ratio of moles of both reactants with reference to the 3:1 stoichiometry			2	2	2	
	(b)			energy change = $78800 \times 0.050 = 3940$ J (1) energy change = $m \times c \times \Delta T$ $3940 = 50 \times 4.18 \times \Delta T$ $\Delta T = \frac{3940}{(50 \times 4.18)} = 18.9$ °C (1) final temperature = $24.4 - 18.9 = 5.5$ °C (1) ecf possible throughout	1	1 1		3	1 1	3
				Question 3 total	**1**	**2**	**2**	**5**	**4**	**3**

A2 UNIT 5: PRACTICAL EXAMINATION

SUMMARY OF ASSESSMENT OBJECTIVES

	Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
Experimental Task	**Total**	**3**	**17**	**10**	**30**	**4**	**24**
Practical Methods and Analysis Task	**1.**	**4**	**8**	**3**	**15**	**4**	**9**
	2.	**2**	**3**	**5**	**10**	**0**	**9**
	3.	**1**	**2**	**2**	**5**	**4**	**3**
		10	**30**	**20**	**60**	**12**	**45**