GCE A LEVEL MARKING SCHEME

SUMMER 2019

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

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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

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) working safely (1)	2			2		2
Part A Results	Hydrogen peroxide concentrations	appropriate range and intervals chosen total volume **must** be 14 cm^3		1		4		1
	Table	appropriate titles and units	1					
	Reaction times	appropriate time range approximately 10-200 s (1) time decreases as volume of hydrogen peroxide increases (1)			2			2
Part B Results	Table	transfer of **Part A** result (1) sensible precision in times recorded (1) do **not** accept 2 decimal places	1		1	4		1
	Results	reaction time decreases as temperature increases (1) decrease gets smaller as temperature increases (1)			2			2

Skill	Question	Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
Analysis Part A	(i)	three/four hydrogen peroxide concentrations calculated correctly (2) award (1) if one/two hydrogen peroxide concentrations calculated correctly rates calculated correctly (1) **must** be given to minimum 2 significant figures		2 1		7	3	3
	(ii)	appropriate scales on both axes (1) **all** points plotted correctly – tolerance ±½ square (1) line of best fit (1)		2	1		3	3
	(iii)	award (1) for either of following • first order because rate is **directly** proportional to hydrogen peroxide concentration • first order because rate doubles when concentration doubles			1		1	

Skill	Question	Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
Analysis Part B	(iv)	award (1) for each correct column (award (1) for each correct **row** if this benefits candidate)		4		13	3	
	(v)	appropriate scale on y-axis (1) **three/four** points plotted correctly – tolerance ±½ square (2) award (1) for any **two** points plotted correctly line of best fit (1)		3	1		4	
	(vi)	line gradient calculated (1) activation energy calculated in kJ mol^{-1} (1) – **must** be positive value		2			2	
	(vii)	sensible equation – must have one peroxide and two iodide ions ONLY ECF possible from incorrect order for hydrogen peroxide in part (iii) rate equation - neutral answer		1				
	(viii)	times would be too short <u>at higher temperatures</u> with a solution of <u>higher concentration</u> (2) award (1) for any of following • gives an appropriate range of reaction times • times would be too short with a solution of higher concentration • other concentrations would give too short a time at higher temperatures			2			2
		Total	**4**	**16**	**10**	**30**	**16**	**16**

MARK SCHEME ALTERNATIVES FOR Test 2

Skill	Question	Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
Analysis Part B	(vii)	sensible equation – must have one peroxide and two hydrogen ions ONLY ECF possible from incorrect order for hydrogen peroxide in part (iii) rate equation - neutral answer		1				
	(viii)	shorter times recorded (1) lower activation energy value calculated (1)			2			2

PRACTICAL METHODS AND ANALYSIS TASK

MARK SCHEME

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	*(a)*			to prevent more than one nitro group being substituted	1			1		1
	(b)			dissolve solid in <u>minimum</u> volume of <u>hot</u> ethanol (1) award (1) each for up to **two** of the following • filter off any insoluble impurities whilst hot • allow to cool (to crystallise solid) • filter and dry	3			3		3
	(c)			mass of methyl benzenecarboxylate = 1.08 × 5.0 = 5.4 (1) moles of methyl benzenecarboxylate = $\frac{5.4}{136.08}$ = 0.040 (1) theoretical mass of methyl 3-nitrobenzenecarboxylate = 0.040 × 181.07 = 7.24 (1) percentage yield = $\frac{4.56}{7.24} \times 100 = 63$ % (1)		1 1 1 1		4	3	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		5-aminobenzene-1,3-dicarboxylic acid award (1) each for up to **two** of the following reagent: Na_2CO_3 / $NaHCO_3$ observation: fizzing (1) reagent: HNO_2 / 5-10°C followed by (alkaline) naphthalene-2-ol / phenol observation: orange/red coloured precipitate (1) reagent: HNO_2 / > 10°C observation: fizzing / bubbles / colourless gas (1)		2		2		2
		(ii)		1-(4-hydroxy-3-nitrophenyl)ethanone award (1) each for up to **three** of the following reagent: $FeCl_3$(aq) observation: purple coloured solution reagent: Br_2(aq) observation: white precipitate reagent: 2,4-dinitrophenylhydrazine observation: orange-yellow precipitate reagent: I_2(aq) / NaOH(aq) or KI(aq) / NaClO(aq) observation: yellow precipitate		3		3		3
				Question 1 total	**4**	**9**	**0**	**13**	**3**	**9**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2				outlines a suitable plan that would allow the identification of **all** four species (2) outlines a suitable plan that would allow the identification of **two/three** species (1)			2			2
				award (1) each for up to **three** observations linked to the reagent(s) used and species identified			3			3
				award (1) each for up to **three** ionic equations linked to the reagent(s) used and species identified	3			8		
				carbonate ion addition of dilute H_2SO_4 - fizzing and $CO_3^{2-}(aq)$ identified $CO_3^{2-} + 2H^+ \rightarrow H_2O + CO_2$						
				iodide ion addition of $AgNO_3(aq)$ - yellow precipitate and $I^-(aq)$ identified $Ag^+ + I^- \rightarrow AgI$						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				chlorine addition of aqueous iodide - yellow / brown coloured solution formed and $Cl_2(aq)$ identified $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ **or** addition of $AgNO_3(aq)$ - white precipitate and $Cl^-(aq)$ identified explanation of formation of $Cl^-(aq)$ required for both marks to be awarded e.g. $Cl_2 + H_2O \rightarrow HCl + HClO$ or $Cl_2(aq)$ contains $Cl^-(aq)$ $Ag^+ + Cl^- \rightarrow AgCl$ **thiosulfate ion** dropwise addition of I_2 solution formed - yellow / brown solution of I_2 becomes colourless and $S_2O_3^{2-}(aq)$ identified $I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$ **or** addition of dilute sulfuric acid - off-white precipitate / cloudy white solution and $S_2O_3^{2-}(aq)$ identified $S_2O_3^{2-} + 2H^+ \rightarrow SO_2 + S + H_2O$						
				Question 2 total	**3**	**0**	**5**	**8**	**0**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*			to obtain concordant results	1			1		1
	(b)	(i)		13.10 cm^3 ($\mathbf{V_1}$) used in first stage to react with Na_2CO_3 and further 13.10 cm^3 required in second stage (to react with $NaHCO_3$ produced) because it is 1:1 mol equivalent			1	1		1
		(ii)		moles HCl = $\frac{7.70}{1000}$ × 0.196 = 0.00151 mol (1) moles $NaHCO_3$ in 25 cm^3 = 0.00151 mol moles $NaHCO_3$ in 500 cm^3 = 0.0302 mol (1) mass $NaHCO_3$ in the mixture = 0.0302 × 84.01 = 2.54 g percentage by mass $NaHCO_3$ in the mixture = $\frac{2.54}{8.72}$ × 100 = 29.1 % (1)			1 1 1	3	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		moles Na_2CO_3 in 500 cm^3 of solution = $\frac{5.43}{106}$ = 0.0513 mol (1) moles Na_2CO_3 in 25 cm^3 of solution = 0.00256 mol moles CO_2 = 0.00256 mol volume CO_2 = 0.00256 × 24.5 = 0.0628 dm^3 = 62.8 cm^3 (1)		2		2	2	
		(ii)		volume CO_2 from $NaHCO_3$ = (99.7 – 62.8) = 36.9 cm^3 ECF possible from part (i) moles CO_2 = $\frac{36.9 \times 10^{-3}}{24.5}$ = 0.00151 mol (1) **must** show working award (1) for either of following • repeat of calculation from *(b)*(ii) moles $NaHCO_3$ in 500 cm^3 = 0.0302 mol mass $NaHCO_3$ in the mixture = 0.0302 × 84.01 = 2.54 g percentage by mass $NaHCO_3$ in the mixture = $\frac{2.54}{8.72}$ × 100 = 29.1 % • 0.00151 mol $NaHCO_3$ in 25 cm^3 is consistent with value calculated in *(b)*(ii) so gives the same percentage / 29.1 %		2		2	1	
				Question 3 total	**1**	**4**	**4**	**9**	**5**	**2**

A2 UNIT 5: PRACTICAL EXAMINATION

SUMMARY OF ASSESSMENT OBJECTIVES

	Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
Experimental Task	**Total**	**4**	**16**	**10**	**30**	**16**	**16**
Practical Methods and Analysis Task	**1**	**4**	**9**	**0**	**13**	**3**	**9**
	2	**3**	**0**	**5**	**8**	**0**	**5**
	3	**1**	**4**	**4**	**9**	**5**	**2**
		12	**29**	**19**	**60**	**24**	**32**