GCE AS MARKING SCHEME

SUMMER 2016

CHEMISTRY - COMPONENT 2
B410U20-1

INTRODUCTION

This marking scheme was used by WJEC for the 2016 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.

AS CHEMISTRY

SUMMER 2016 MARK SCHEME

COMPONENT 2 ENERGY, RATE AND CHEMISTRY OF CARBON COMPOUNDS

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark, apart from extended response questions where a level of response mark scheme is applied.

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Extended response questions

A level of response mark scheme is applied. The complete response should be read in order to establish the most appropriate band. Award the higher mark if there is a good match with content and communication criteria. Award the lower mark if either content or communication barely meets the criteria.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

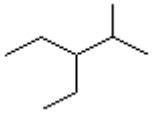
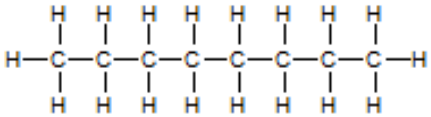
Marking abbreviations

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

Credit should be awarded for correct and relevant alternative responses which are not recorded in the mark scheme.

Section A

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1.	*(a)*					1		1		
	(b)			 Accept $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$		1		1		
2.				$C_4H_{10} + 6½O_2 \rightarrow 4CO_2 + 5H_2O$ or $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$		1		1		
3.				e.g. H^+, Br^+ (accept partial charges)	1			1		
4.	*(a)*			Peak of curve lower than **and** to right of original peak	1			1		
	(b)			**Minimum** energy needed for reaction to take place	1			1		

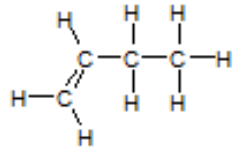
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	*(a)*			Nickel/platinum/palladium	1			1		
	(b)			Changes liquid vegetable oils into solid edible fats (e.g. margarines)	1			1		
	(c)			Add bromine/bromine water (1) Colour changes from brown to colourless (1) Accept potassium manganate(Vll) solution (1) Colour changes from purple to green/brown (1)	2			2		2
				Section A total	**7**	**3**	**0**	**10**	**0**	**2**

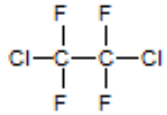
Section B

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	*(a)*	(i)		**B** = Butanal (1) **C** = Butyl ethanoate (1)		2		2		
		(ii)		C_3H_7COONa Accept NaC_3H_7COO		1		1		
		(iii)		Other possible structures are butan-2-ol, methylpropan-2-ol, methylpropan-1-ol (2) (Accept displayed formulae) (1) for 2 correct structures Cannot be methylpropan-2-ol / must be primary or secondary alcohol since it is oxidised (1) Cannot be butan-2-ol / must be primary alcohol since it is oxidised to acid (1) Could be methylpropan-1-ol since it is a primary alcohol (1)		2	1 1 1	5		
		(iv)		Thermometer with bulb opposite outlet to condenser (1) Condenser with correct water connections (1) Suitable overall diagram	3			3		3

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	*(b)*	(i)		Nucleophilic substitution (1) Polarisation of C—Cl (1) Curly arrow from OH^- (1) Curly arrow to show C—Cl breaking / intermediate (1)	1 1 1	 1 	 	 4	 	
		(ii)		No peak at 650–800 cm^{-1} due to C—Cl bond (1) Peak at 2500–3500 cm^{-1} due to O—H bond Accept peak at 1000–1300 cm^{-1} due to C—O bond (1)		 2	 	 2	 	
		(iii)		Faster since C— I bond weaker than C—Cl bond	1			1		
				Question 6 total	**7**	**8**	**3**	**18**	**0**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	*(a)*			**Indicative content** • Alkenes react more readily than alkanes • Alkanes react by radical substitution / photohalogenation • Alkanes are unreactive since they contain strong σ-bonds only • Alkenes react by electrophilic addition • Alkenes contain σ-bonds and π-bonds • π-bond is weaker than σ-bond so is easily broken • π-bond gives region of high electron density	5	1		6		
				***5*-6 marks** Names both types of reaction and fully explains difference in reactivity *The candidate constructs a relevant, coherent and logically structured account including key elements of the indicative content. A sustained and substantiated line of reasoning is evident and scientific conventions and vocabulary are used accurately throughout.* **3-4 marks** Names at least one type of reaction and partially explains difference in reactivity *The candidate constructs a coherent account including many of the key elements of the indicative content. Some reasoning is evident in the linking of key points and use of scientific conventions and vocabulary is generally sound.* **1-2 marks** Names type of reactions but gives no explanation or simply explains why alkenes are more reactive but does not name reaction types *The candidate attempts to link at least two relevant points from the indicative content. Coherence is limited by omission and/or inclusion of irrelevant material. There is some evidence of appropriate use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give an answer worthy of credit.*						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	*(b)*			Heat with aqueous sodium hydroxide (1) Add nitric acid and aqueous silver nitrate (1) White precipitate observed (1)	3			3		3
	(c)	(i)				1		1		
		(ii)		Dissolved in ethanol + heated	1			1		1
	(d)			It has stronger/more Van der Waals forces (1) Because it has a larger surface area / hydrocarbon chain (1)		2		2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	*(e)*			Any two of following for (1) each • non-flammable • non-toxic • suitable volatility	2			2		
	(f)			C F Cl 14.0 / 12 = 1.17 / 1 : 44.5 / 19 = 2.34 / 2 : 41.5 / 35.5 = 1.17 / 1 (1)		1			1	
				Empirical formula is CF_2Cl (1)		1				
				Mass spectrum shows two chlorines in molecule / shows that M_r is 171 (1)		1				
				Molecular formula is $C_2F_4Cl_2$ (1)		1				
				Only one carbon environment so formula is  (1)			1	5		
				Question 7 total	**11**	**8**	**1**	**20**	**1**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8.	*(a)*			Axes labelled with values and units (1) Points drawn correctly (2) Straight line drawn through points (1)	1	 2 1		 4	 2	
	(b)			1/time = 6.20×10^{-3} (1) Time = 161 (1)		 2		 2	 2	 2
	(c)			Any of following • Measure the volume of SO_2 produced • Measure mass of SO_2 lost at constant time intervals • Sampling • Change in pH		 1		 1		 1
	(d)			Moles of $Na_2S_2O_3.5H_2O$ = 0.05 (1) Mass of $Na_2S_2O_3.5H_2O$ = 12.4 (1)		 2		 2	 2	 2
	(e)			She used a burette (1) To measure 18.0 cm^3 of thiosulfate and 12 cm^3 of water (1)		 2		 2	 2	 2
	(f)			Either of following • Total volume affects the concentrations of the reactants • Same depth/height of liquid above cross			 1	 1		 1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8.	*(g)*			Incorrect because flask could contain acid (1) This would react with thiosulfate solution before timer started (1) Accept correct because flask would contain some left over water (1) This would affect concentration of thiosulfate solution (1)			2	2		2
	(h)			Time taken would increase (1) There would be a smaller depth of liquid therefore less sulfur precipitate through which to look at cross (1)			2	2		2
				Question 8 total	**1**	**10**	**5**	**16**	**8**	**12**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9.	*(a)*	(i)		$\Delta H = -\frac{mc\Delta T}{n}$ (1) $\Delta T = -9.2$ °C, m = 50.0 g, n = 0.0925 (1) $\Delta H = 20787$ J mol^{-1} (1) $\Delta H = 20.8$ kJ mol^{-1} (1)	1	1 1	1	4	1 1 1	1 1 1
		(ii)		Any two of following • Record the steady temperature of the water before adding ammonium nitrate (1) • ΔT can be calculated accurately (1) **or** • Record the temperature at timed intervals after adding ammonium nitrate (1) • Graph can be extrapolated (1) **or** • Place lid on cup / insulate cup (1) • Prevent heat loss (1) **or** • Crush the ammonium nitrate (1) • Solid dissolves more quickly (1)			4	4		4
		(iii)		Measured 50.0 cm^3 of water using a burette / pipette (1) Since water has a density of 1 g cm^{-3} (1)			2	2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9.	*(b)*	(i)		Total enthalpy change for products = –842.9 Total enthalpy change for reactants = –970.4 (1)		1			1	
				Enthalpy change for reaction = 127.5 (kJ mol^{-1}) (1)		1		2		
		(ii)		Total bond enthalpies for reactants = 3436 (1)		1			1	
				Total bond enthalpies for products = 3410 (1)		1			1	
				Enthalpy change for reaction = 26 (kJ mol^{-1}) (1)		1		3		
		(iii)		Calculation using enthalpy change of formation is more accurate because average bond enthalpy values not actual ones used	1			1		
				Question 9 total	**2**	**7**	**7**	**16**	**6**	**9**

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
Section A	7	3	0	10	0	2
6.	7	8	3	18	0	3
7.	11	8	1	20	1	4
8.	1	10	5	16	8	12
9.	2	7	7	16	6	9
Totals	28	36	16	80	15	30