GCE AS MARKING SCHEME

SUMMER 2017

AS (NEW)
CHEMISTRY AS COMPONENT 2
B410U20-1

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.

COMPONENT 2: ENERGY, RATE AND CHEMISTRY OF CARBON COMPOUNDS

MARK SCHEME

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.

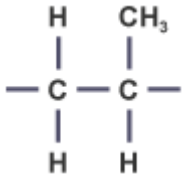
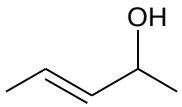
Marking abbreviations

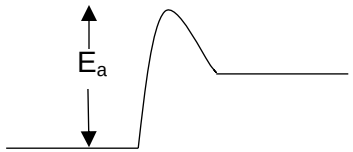
The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

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

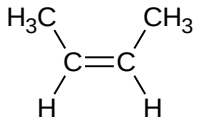
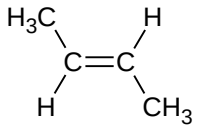
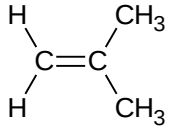
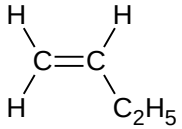
Credit should be awarded for correct and relevant alternative responses which are not recorded in the mark scheme.

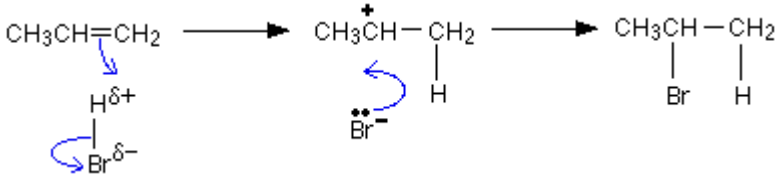
Section A

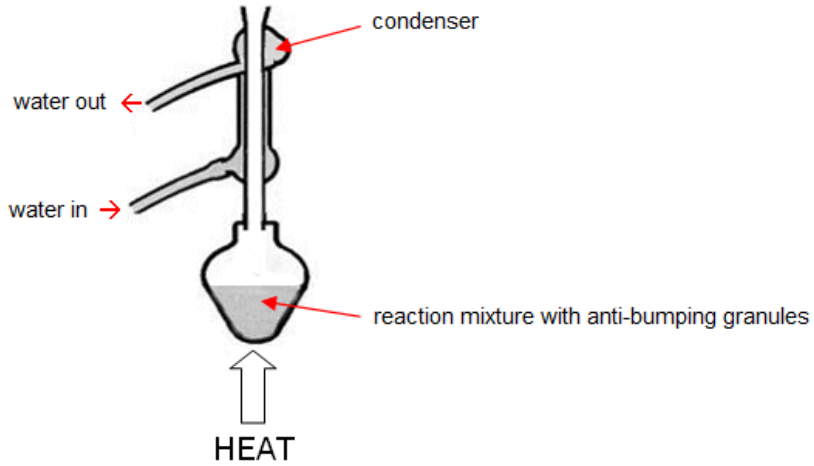
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			2,2,4-trimethylpentane		1		1		
	(b)			$C_{10}H_{22} \rightarrow C_7H_{16} + C_3H_6$		1		1		
2						1		1		
3				in primary alcohols the —OH group is joined to a carbon atom bonded to one carbon atom and two hydrogen atoms, in secondary alcohols the carbon atom is bonded to two carbon atoms and one hydrogen atom	1			1		
4	(a)					1		1		
	(b)			colour changes from purple to colourless		1		1		1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)				1			1		
	(b)			profile starts and finishes in same place but Ea is greater / curve is higher	1			1		
6				add Na_2CO_3 / $NaHCO_3$ (1) bubbles seen (1)	2			2		2
				Section A total	**5**	**5**	**0**	**10**	**0**	**3**

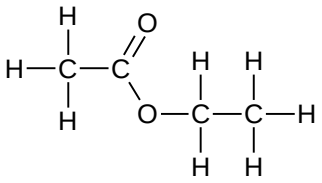
Section B

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			σ-bonds formed between C and H atoms and σ- and π-bonds formed between two C atoms (1) π-bonds formed by sideways overlap of *p*-orbitals (1) π-bonds gives region of high electron density (and weaker) (1) react by electrophilic addition (1)	4			4		
	(b)			structural **and** geometric / *E*-*Z* / cis-trans (1)     award (2) for all four correct structures award (1) for any two correct structures award (2) if only structural isomerism identified and three structural isomers (including only one of the *E*-*Z* isomers) drawn	1	2		3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		 dipole and curly arrow in HBr (1) curly arrow from double bond (1) curly arrow from Br^- to carbocation (1)	3			3		
		(ii)		secondary carbocation is more stable than primary carbocation	1			1		
	(d)	(i)		nucleophilic substitution	1			1		
		(ii)		alcoholic potassium/sodium hydroxide (+ heat)	1			1		1
	(e)			2-bromopropane since only two different proton environments (1) relative areas of the peaks must be 6:1 (1)			2	2		
	(f)	(i)		species with an unpaired electron	1			1		
		(ii)		C—F bond is stronger than the C—Cl bond	1			1		
				Question 7 total	**13**	**2**	**2**	**17**	**0**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		oxidation (1) potassium dichromate(VI) (1)	2			2		2
		(ii)		 flask with vertical condenser (1) unsealed apparatus (1) heat (1) reaction mixture being heated returns to the flask / vapour is (cooled and) condensed (1)	4			4		4

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		any two of following for (1) • yield would be reduced / reactants (products) would be lost • complete oxidation could not occur • vapour is flammable / acidic			2	2		2
		(iv)		0.206 (2) if answer is incorrect award (1) for mass of ethanol = 9.48 g ecf possible from incorrectly calculated mass		2		2	2	
		(v)		ethanal / aldehyde is formed (1) only partial oxidation occurs (1)		2		2		
	(b)			0.170 mol of ethanoic acid (1) from 0.262 mol of ethanol (1) 12.0 (1) ecf possible throughout		3		3	1 1	
				Question 8 total	**6**	**7**	**2**	**15**	**4**	**8**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		C : H : O $\frac{54.5}{12} : \frac{9.1}{1.01} : \frac{36.6}{16}$ 4.54 : 9.01 : 2.29 (1) 1.98 : 3.93 : 1 empirical formula C_2H_4O (1) molecular formula $C_4H_8O_2$ (1)		3		3	1 1	
		(ii)		 (1) ethyl ethanoate (1) accept correct formula for methyl propanoate / propyl methanoate		2		2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			**Indicative content** • renewability – ethene from crude oil is non-renewable, glucose is renewable • energy used – fermentation does not require high temperature/ pressure,so lower energy demand • effect on environment – the CO_2 given off is taken in by plants as they grow so fermentation process carbon neutral • availability of raw materials – oil-producing countries use ethene, warm countries can grow sugar • atom economy – hydration is 100% • on balance fermentation / hydration is more sustainable		3	3	6		
				5-6 marks Candidate gives opinion and fully considers most of the advantages and disadvantages of both methods. *The candidate constructs a relevant, coherent and logically structured account including all 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** Candidate gives opinion and considers some of the advantages and disadvantages of both methods or most of the advantages or disadvantages of both methods. *The candidate constructs a coherent account including most 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 are generally sound.* **1-2 marks** Candidate considers one or two of the advantages or disadvantages of both methods. *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
	(c)			conc sulfuric acid / aluminium oxide (1) ethanol would contain an absorption at 3200 to 3550 cm^{-1} due to O—H bond / 1000 to 1300 cm^{-1} due to C—O bond but would not contain an absorption at 1620 to 1670 cm^{-1} or ethene would contain an absorption at 1620 to 1670 cm^{-1} due to C=C bond but would not contain an absorption at 3200 to 3550cm^{-1} / 1000 to 1300 cm^{-1} (1)	1		1	2		1
				Question 9 total	**1**	**8**	**4**	**13**	**2**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)	(i)		any of following for (1) • no heat lost • reaction is complete • specific heat capacity of the solution is the same as water • density of solution is 1.00 g cm^{-3}		1		1		1
		(ii)	I	$\Delta H = \frac{-mc\Delta T}{n}$ (1) ΔT = 8.8 °C, m = 50.0 g, n = 0.0415 mol (1) ΔH = –44318 J mol^{-1} (1) ΔH = –44.3 kJ mol^{-1} **must** be given to three sig figs (1) ecf possible throughout		4		4	1 1 1	4
			II	enthalpy change less negative / less exothermic (1) less $MgCO_3$ to react so temperature rise will be lower (1)			2	2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		volumetric pipette more accurate / more precise / lower percentage error (1) measuring cylinder faster /easier / more convenient (1)			2	2		2
		(iv)		2.3		1		1	1	
		(v)		$\Delta_r H = \Delta H_1 - \Delta H_2$ (1) $\Delta_r H = -70.7$ (1) ecf from part (ii)I		2		2	2	
	(b)			$-1313 = -1144 - [100.8 + 2\Delta_f H(NO_2)]$ (1) $\Delta_f H(NO_2) = 34.1$ (1)		2		2	2	
				Question 10 total	**0**	**10**	**4**	**14**	**8**	**9**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11	(a)			gas syringe accept collection over water using graduated collection vessel	1			1		1
	(b)			use a weighing balance to measure mass of CO_2 / gas lost (1) over time (1)	1		1	2		2
	(c)			moles of $MgCO_3 = 5.9 \times 10^{-3}$ moles of HCl = 8.0×10^{-3} (1) since ratio $MgCO_3$: HCl is 1:2 only 4.0×10^{-3} moles of $MgCO_3$ react therefore carbonate is in excess / he is correct (1)			2	2	1	
	(d)			initial rate = 32 (1) (exact value depends on tangent drawn) unit $cm^3\ min^{-1}$ (1)		2		2	2	2
	(e)			curve drawn is less steep than the original and falls short of / levels off at 48 cm^3 (1) because there is a decrease in concentration so there are fewer successful collisions per unit time (1) volume amount of carbon dioxide has halved since the number of moles of hydrochloric acid has halved (1)		2	1	3		
	(f)			surface area of magnesium carbonate	1			1		1
				Question 11 total	**3**	**4**	**4**	**11**	**3**	**6**

COMPONENT 2: ENERGY, RATE AND CHEMISTRY OF CARBON COMPOUNDS

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
Section A	5	5	0	10	0	3
7	13	2	2	17	0	1
8	6	7	2	15	4	8
9	1	8	4	13	2	1
10	0	10	4	14	8	9
11	3	4	4	11	3	6
Totals	28	36	16	80	17	28