GCE AS MARKING SCHEME

SUMMER 2017

AS (NEW)
CHEMISTRY AS COMPONENT 1
B410U10-1

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 1: THE LANGUAGE OF CHEMISTRY, STRUCTURE OF MATTER AND SIMPLE REACTIONS

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				$2p^6 3s^2 3p^6 4s^2 3d^6$ / $2p^6 3s^2 3p^6 3d^8 (4s^0)$		1		1		
2				0.75		1		1		
3	(a)			tendency of an atom joined by a covalent bond to attract the bonded pair of electrons towards itself	1			1		
	(b)			Cl—Cl $\quad \overset{\delta-}{\text{F}}$—$\overset{\delta+}{\text{Cl}}$		1		1		
4	(a)			$K_c = \dfrac{[NO_2]^2}{[N_2O_4]}$		1		1		
	(b)			$K_c = \dfrac{(1.6)^2}{0.2} = 12.8 \text{ mol dm}^{-3}$ accept 13 mol dm^{-3} allow ecf from incorrect K_c expression		1		1	1	
5				any temperature above 900 °C but comment needed on **trend**		1		1		
6				+5		1		1		
7				any soluble hydroxide **and** any soluble copper(II) salt		1		1		1
8				$3Cu(s) + 8HNO_3(aq) \rightarrow 3Cu(NO_3)_2(aq) + 2NO(g) + 4H_2O(l)$		1		1		
				Section A total	**1**	**9**	**0**	**10**	**1**	**1**

Section B

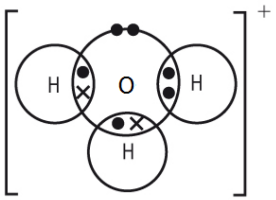
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)			conductivity due to presence of free / delocalised / sea of electrons (1) more free electrons in Al than Na so Al has greater conductivity / Al has 3 such electrons whilst Na has 1 so more conductivity in Al (1)	2			2		
	(b)			iodine is simple molecular **and** diamond is giant molecular (1) (to change state) iodine molecules have to overcome temporary dipole / Van der Waals forces (1) (to change state) carbon atoms have to break covalent bonds (1) temporary dipole attractions (in iodine) overcome by gentle heating / covalent bonds (in diamond) not broken even at high temperatures / temporary dipole attractions weak & covalent bonds strong (1)	4			4		
	(c)			bonding in both is ionic and melting involves overcoming attraction between positive and negative ions (1) this attraction is greater for magnesium oxide (than it is for sodium chloride (1) (because) ions in magnesium oxide are 2+ and 2– whilst in sodium chloride are 1+ and 1– / (because) ions in magnesium oxide are more highly charged than those in sodium chloride (1)	3			3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			the brown solution (at the end) is bromine in both cases (1) any **two** of following for (1) each chlorine is a better oxidising agent (than bromine) chlorine takes electron from bromi<u>**d**</u>e (because) chorine is smaller bromine cannot react with chloride (1)	 3	1		 4		 4
				Question 9 total	**12**	**1**	**0**	**13**	**0**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)	(i)		energy needed to remove one electron from (every atom) in 1 mol of element in the gaseous state (1) under standard conditions (1)	2			2		
		(ii)	I	(for ionisation to take place) an electron must overcome the attraction between it and the nucleus (1) this increases for successive ionisations as each electron is being removed from an increasingly positive species / ratio of protons : electrons goes up (1)	2			2		
			II	**X** is in Group II – some attempt at explanation required (1) big jump after removal of two electrons / new shell broken into after removal of two electrons (1)			2	2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		**Indicative content** • for ionisation energy determination transitions to n = 1 must be used / Lyman series must be used (**statement 1**) • lines in visible spectrum comes from transitions involving n = 2 / Balmer series • electrical energy excites electrons • electrons fall back and give off energy • lines formed since only some energies are allowed • lines are closer together at higher energies • since energy levels get closer • convergence limit is when electron removed / ionisation takes place • use $E = hf$	5		1	6		
				5-6 marks Recognition that Lyman series required, clear understanding of electron transition and convergence of lines/energy levels *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** Basic understanding of electron transition and convergence of lines/energy levels *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** Some knowledge of electron transition between energy levels *The candidate attempts to link at least two relevant points from the indicative material. Coherence is limited by omission and/or inclusion of irrelevant materials. 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**
		(ii)		$\Delta E = 6.63 \times 10^{-34} \times 3.28 \times 10^{15}$ (= 2.175×10^{-18} J) (1) $6.63 \times 10^{-34} \times 3.28 \times 10^{15} \times 6.02 \times 10^{23}$ (1) 1310 (1) answer **must** be given to 3 sig figs		3		3	3	
				Question 10 total	**9**	**3**	**3**	**15**	**3**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11	(a)	(i)		pH = –log [H^+]	1			1		
		(ii)		0.30		1		1	1	
		(iii)		any three of following for (1) each • ethanoic acid is a weak acid and hydrochloric acid is strong • ethanoic acid has a low**er** concentration of H^+ ions • ethanoic acid is partially dissociated • $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$	3			3		
	(b)	(i)		 all full outer shells (1) one electron pair clearly from O (1) ignore charge		2		2		
		(ii)		co-ordinate bond / dative covalent bond	1			1		
		(iii)		106° to 108° (1) 3 bond pairs and 1 lone pair (1) lone pair-bond pair repulsion greater than bond pair-bond pair repulsion (1) allow ecf if 4 bond pairs in (i)		3		3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		if a change in conditions is applied to a system in equilibrium (1) the equilibrium moves in the direction that tends to minimise the effect of the change (1)	2			2		
		(ii)		solution turns yellow (1) added OH^- ions remove H^+ and equilibrium moves to LHS (to form chromate(VI)) (1)			2	2		2
				Question 11 total	**7**	**6**	**2**	**15**	**1**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
12	(a)	(i)		mass water = 0.274 (g) mass anhydrous barium chloride = 1.645 (g) (1) **both** required correct M_r values for water and barium chloride $\Rightarrow$ 18 and 208 (1) **both** required $\frac{1.645}{208} : \frac{0.274}{18} \Rightarrow 0.0079 : 0.0152$ (1) 1 : 1.92 therefore $x = 2$ (1)		3	1	4	3	4
		(ii)		to avoid loss by spitting / fumes / loss of solid do **not** accept 'to avoid loss of water'	1			1		1
		(iii)		use a greater mass of hydrated solid (1) increases **percentage** accuracy (1) ensure that all water has been lost (1) heat to constant mass (1) neutral answer: 'heat for longer or hotter'			4	4		4
		(iv)		x is a whole number so small variation in answer is irrelevant - some comment required			1	1		1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		carbonate / CO_3^{2-} do **not** accept sulfate / SO_4^{2-}			1	1		1
		(ii)		any metal ion apart from Group I		1		1		1
		(iii)		$Ba^{2+}(aq) + CO_3^{2-}(aq) \rightarrow BaCO_3(s)$ ecf possible e.g. if sulfate given in (i)		1		1		
				Question 12 total	**1**	**5**	**7**	**13**	**3**	**12**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
13	(a)			no **single** colour change is visible		1		1		1
	(b)			23.05 ignore any missing values in table			1	1	1	1
	(c)			moles HCl added = 100/1000 × 2.06 = 0.206 (1) moles NaOH used in titration = 0.0231 moles HCl left after reaction in 25 cm^3 = 0.0231 (1) moles HCl left after reaction in 100cm^3 = 0.0924 (1) moles HCl reacted with mineral sample = 0.206 – 0.0924 = 0.1136 (1)		1 1 1	1	4	3	4
	(d)			CO_3^{2-} + **2**H^+ → CO_2 + $\mathbf{H_2O}$ moles carbonate = 0.1136/2 = 0.0568 allow ecf		1		1		
	(e)			4.77/0.0568 = 84 therefore mineral is magnesite ecf possible			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(f)			maximum error in **two** readings = 0.1 (1) 0.1/23.00 × 100 = 0.435 (1) award (1) if calculation based on **one** reading i.e. 0.05 error		2		2	1	2
	(g)	(i)		$n = \frac{pV}{RT}$ (1) conversion of volume to m^3 and temperature to K (1) $= \frac{1.01 \times 10^5 \times 1.31 \times 10^{-3}}{8.31 \times 298} = 0.0534$ (1)		3		3	3	
		(ii)		conclusion is confirmed **because** 4.59 g of magnesite is 0.055 mol 1 mol magnesite produces 1 mol CO_2 amount of CO_2 formed corresponds to 0.053 mol ecf possible			1	1		
				Question 13 total	**0**	**10**	**4**	**14**	**8**	**8**

COMPONENT 1: THE LANGUAGE OF CHEMISTRY, STRUCTURE OF MATTER AND SIMPLE REACTIONS

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
Section A	1	9	0	10	1	1
9	12	1	0	13	0	4
10	9	3	3	15	3	0
11	7	6	2	15	1	2
12	1	5	7	13	3	12
13	0	10	4	14	8	8
Totals	30	34	16	80	16	27