GCE AS MARKING SCHEME

SUMMER 2017

AS (NEW)
CHEMISTRY - UNIT 1
2410U10-1

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.

UNIT 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.

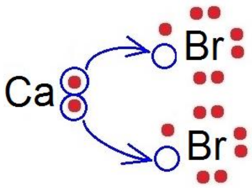
Marking abbreviations

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.		 (1) forming Ca^{2+} and Br^- ions (1)		2		2		
2.		sodium and oxygen (1) they have the largest electronegativity difference (1)	 1	1		 2		
3.	(a)	in a coordinate bond both bonding electrons come from one atom while in a covalent bond both atoms contribute one electron in the shared pair	1			1		
	(b)	e.g. Al_2Cl_6, NH_4^+	1			1		
4.	(a)	${}^{81}_{36}Kr + {}^{0}_{-1}e \rightarrow {}^{81}_{35}Br$ (+v)		1		1		
	(b)	2.29×10^5 years		1		1	1	
5.		$10.8 = (11 \times 0.8) + (x \times 0.2)$ (1) $0.2x = 2$ $x = 10$ (1)		2		2	1	
		Section A total	**3**	**7**	**0**	**10**	**2**	**0**

Section B

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)	(i)		$\Delta E = hf$ and $f = c/\lambda$ (h = Planck's constant, c = speed of light) (1) energy = $hc/\lambda = 6.63 \times 10^{-34} \times 3.00 \times 10^{8} / 656 \times 10^{-9}$ (1) energy = 3.03×10^{-19} J (1)		3		3	3	
		(ii)		measuring the convergent frequency / wavelength at the convergence limit (1) calculate the ionisation energy using $\Delta E = hf$ (1)	2			2		
	(b)	(i)		hydrogen lower value since it has a smaller nuclear charge (1) electron comes from the same shell / no extra shielding (1)	2			2		
		(ii)		award (1) for any two of following • hydrogen higher value since no shielding of outer electron / lithium has shielding of outer electron • outweighs smaller nuclear charge / greater effective nuclear charge • H outer electron closer to nucleus / lithium loses electron from higher energy sub-shell	2			2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		$V_2 = \frac{P_1V_1T_2}{P_2T_1}$ (1) $V_2 = \frac{1.01 \times 10^5 \times 125 \times 325}{1.01 \times 10^5 \times 297}$ $V_2 = 137\ \text{cm}^3$ (1)	1	1		2	2	
		(ii)		$n = \frac{PV}{RT}$ (1) $V = 1.6 \times 10^{-4}\ \text{m}^3$, T = 293 K (1) $n = \frac{1.01 \times 10^5 \times 1.6 \times 10^{-4}}{8.31 \times 293}$ $n = 6.64 \times 10^{-3}$ mol (1)	1	2		3	3	
	(d)			the student is incorrect because: H_2O contains 2 bonding pairs and 2 lone pairs of electrons (1) BeH_2 contains 2 bonding pairs only (1) therefore different shapes since electron pairs arrange themselves to be as far apart as possible/ different number of electron pairs (1)			3	3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)	(i)		volume is 50 cm^3 therefore mass is 50 g (1) density = 50/54.5 = 0.917 g cm^{-3} (1)		2		2	1	
		(ii)		any of following for (1) • hydrogen bonding exists in both water and ice but it extends throughout the whole structure in ice • in ice hydrogen bonds hold the molecules together in an open (tetrahedral) structure • the molecules are further apart in ice than they are in water (so ice is less dense than water)	1			1		
				Question 6 total	**9**	**8**	**3**	**20**	**9**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	(a)			moles = 0.05 × 0.25 = 0.0125 (1) mass = 0.0125 × 106 = 1.325 g (1) dissolve mass in small volume of (deionised) water (1) add solution to a 250 cm^3 volumetric / graduated flask (1) using a funnel / wash beaker (1) make up to the mark and invert / shake well to mix (1)	4	2		6	1	6
	(b)	(i)		26.20 cm^3 - do not accept 26.2			1	1		1
		(ii)		$\frac{0.10}{26.30} \times 100 = 0.38\ \%$		1		1	1	1
		(iii)		e.g. funnel kept in burette (1) therefore value of titre less, since more acid dropped into burette from funnel (1) or difficult to see when indicator changed colour (1) therefore value of titre more, since end point overshot (1) or jet not filled / air bubble in burette (1) therefore value of titre more, since acid used to fill jet / bubble (1) or burette not rinsed with acid beforehand (1) therefore value of titre is more, since acid solution is more dilute (1)			2	2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		moles HCl = 0.090 × 0.02265 = 2.04×10^{-3} (1) moles NaOH unused in 25 cm^3 sample = 2.04×10^{-3} moles NaOH in volumetric flask = 2.04×10^{-2} (1) initial moles NaOH = 1.00 × 0.050 = 5×10^{-2} moles NaOH reacted = $5.00 \times 10^{-2} – 2.04 \times 10^{-2} = 2.96 \times 10^{-2}$ (1) allow ecf		2	1	3	2	3
		(ii)		moles $(NH_4)_2SO_4$ used = 1.48×10^{-2} mass $(NH_4)_2SO_4$ = $1.48 \times 10^{-2} \times 132.18$ = 1.96 g (1) percentage $(NH_4)_2SO_4 = \frac{1.96}{4.24} \times 100 = 46.2\ \%$ (1) allow ecf from part (i) and for any calculated mass		2		2	1	
				Question 7 total	**4**	**7**	**4**	**15**	**5**	**13**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
8.	(a)	(i)	$4CuFeS_2 + \mathbf{10½}O_2 \rightarrow \mathbf{4}Cu + \mathbf{2}FeO + Fe_2O_3 + \mathbf{8}SO_2$		1		1		
		(ii)	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$	1			1		
		(iii)	M_r $CuFeS_2$ = 183.5 (1) % Cu = $\frac{1.3}{100} \times \frac{63.5}{183.5} \times 100$ = 0.45 % (1)		2		2	1	
		(iv)	Cu reduced oxidation number changes from +1 to 0 (1) S oxidised oxidation number changes from –2 to +4 (1) O reduced oxidation number changes from 0 to –2 (1)		3		3		
	(b)		strong acid is one that fully dissociates in aqueous solution (1) concentrated acid consists of a large quantity of acid and a small quantity of water (1)	2			2		
	(c)	(i)	moles NaOH = 0.0125 × 0.0159 = 1.988×10^{-4} (1) concentration acid = $\frac{1.988 \times 10^{-4}}{0.025}$ = 7.95×10^{-3} mol dm^{-3} (1)		2		2	1	2
		(ii)	if pH = 2.10 then $[H^+]$ = 7.94×10^{-3} mol dm^{-3} (1) since this is the same as the concentration of the acid, it must have fully dissociated (and teacher is correct) (1)			2	2	1	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		colour change from yellow-green to blue (1) the system will try to minimise this effect by using up the water and so the position of equilibrium moves to the left (1)			2	2		2
		(ii)		colour changes from blue to yellow-green (1) the system opposes the change by taking in heat so the position of equilibrium moves in the endothermic direction (1)			2	2		2
				Question 8 total	**3**	**8**	**6**	**17**	**3**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9.	(a)			**Indicative content** to identify halides • addition of silver nitrate • chlorides give white precipitate, bromide gives cream precipitate to identify magnesium compounds • addition of sulfuric acid • magnesium compounds give solutions, barium and calcium compounds give precipitates to identify barium compounds • addition of sodium hydroxide • barium compounds give solutions, calcium and magnesium compounds give precipitates • once compound identified further reagents not added to it		4	2	6		6
				5-6 marks Describes full details of all the tests and observations and how they allow all five compounds to be identified. *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** Describes most of the tests in detail including observations that allow most of the compounds to be identified. *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** Describes some of the tests but lacks details and observations to allow identification of the compounds. *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
	(b)			flame test (1) brick-red colour (1)	2			2		2
	(c)	(i)		$Ba^{2+}(aq) + CO_3^{2-}(aq) \rightarrow BaCO_3(s)$		1		1		
		(ii)		to ensure that all the carbonate ions were precipitated	1			1		1
	(d)			some of the carbonates decompose / evolve CO_2 on heating (1) this will result in a lower mass being recorded (1)		1	1	2		2
	(e)	(i)		calcium chloride contains a lattice of oppositely charged ions (that are attracted to each other) / in the solid state the ions cannot move freely (1) in the molten state / in solution the ions are free to move and carry electricity (1)	2			2		
		(ii)		in iodine pairs of atoms are bonded covalently to form molecules which are held together by van der Waals forces (1) these forces are weak / easy to break (1)	2			2		
		(iii)		bonding in magnesium consists of a regular array of metal ions surrounded by a 'sea' of delocalised valence electrons (1) when a force is applied the layers of metal ions slide over each other forming a new shape (1)	2			2		
				Question 9 total	**9**	**6**	**3**	**18**	**0**	**11**

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SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
Section A	3	7	0	10	2	0
6.	9	8	3	20	9	0
7.	4	7	4	15	5	13
8.	3	8	6	17	3	6
9.	9	6	3	18	0	11
Totals	28	36	16	80	19	30