GCE AS MARKING SCHEME

SUMMER 2018

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

INTRODUCTION

This marking scheme was used by WJEC for the 2018 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

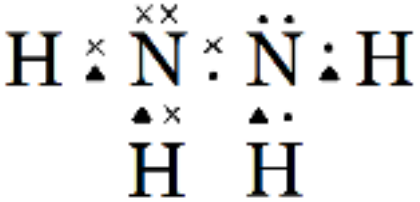
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1.				8	1			1		
2.				Group 2			1	1		
3.					1			1		
4.	(a)			PCl_5 + **4**H_2O → H_3PO_4 + **5**HCl		1		1		
	(b)			M_r H_3PO_4 = 98(.03) and either M_r HCl = 36.5(1) or M_r PCl_5 = 208.5 and M_r H_2O = 18(.02) (1) atom economy = 35 % (1) ecf possible from part (a)		2		2	1	
5.	(a)			ability to attract electrons in a covalent bond / a shared electron pair	1			1		
	(b)			increase in number of protons / charge on the nucleus	1			1		
6.	(a)			Cl_2 + $2Br^-$ → Br_2 + $2Cl^-$	1			1		
	(b)			silver nitrate solution / $AgNO_3(aq)$ gives cream/off-white precipitate	1			1		1
				Section A total	**6**	**3**	**1**	**10**	**1**	**1**

Section B

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	(a)	(i)		van der Waals forces are stronger in iodine than in chlorine / more van der Waals forces in iodine than in chlorine (1) iodine has more electrons than chlorine (1) therefore more energy needed to overcome forces / higher melting temperature (1)	3			3		
		(ii)		aluminium has more valence electrons than sodium therefore stronger metallic bonds	1			1		
		(iii)		silicon has a giant molecular structure, phosphorus only has weak forces between the molecules	1			1		
	(b)			nitrogen is higher since it only has unpaired 2p electrons, O has two unpaired and two paired 2p electrons / N $1s^2\ 2s^2\ 2p^3$, O $1s^2\ 2s^2\ 2p^4$ (1) repulsion between paired electrons makes it easier to remove one of the electrons / takes more energy to remove unpaired electron (1)	2			2		
	(c)			percentage abundance 121 = 57%, 123 = 43% (1) accept 121 = 28.5, 123 = 21.5 if divided by 50 in calculation relative atomic mass = 121.9 (1)		2		2	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			^{90}Sr and ^{228}Th not suitable because half-life is too long so they remain in the body for a long time (1) ^{210}At and ^{228}Th not suitable because α-radiation is most ionising /causes most damage in the body (1) ^{99}Tc suitable because short half-life and γ-radiation does not stay in body (1)			3	3		
				Question 7 total	**7**	**2**	**3**	**12**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8.	(a)	(i)		furthest line to the left	1			1		
		(ii)		electron falls from higher energy levels to lower energy levels / to n = 2 (1) the difference between any two energy levels is fixed / energy levels are quantised (1)	2			2		
	(b)	(i)		this is the energy required to remove an electron from an atom of hydrogen / for an electron to go from n = 1 to n = ∞ (1) in the gaseous state (1) [award (1) for correct equation with state symbols but no explanation]	2			2		
		(ii)		E = hf (1) f = 2.18×10^{-18} / 6.63×10^{-34} (1) f = 3.29×10^{15} (1)	1	2		3	3	
	(c)			$V_2 = \frac{163 \times 273}{398} = 112$ (1) n hydrazine = 112/22400 = 0.00500 (1) M_r hydrazine = 0.160/0.005 = 32 so molecular formula is N_2H_4 (1) ecf possible credit alternative method using pV = nRT		2	1	3	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		 shared pair of electrons between N atoms (1) rest of electrons correct (1) accept all electrons represented as dots/crosses		2		2		
		(ii)		a covalent bond where the electrons are not shared equally between the atoms / unequal electron density	1			1		
	(e)			$N_2H_4 + H_2O \rightleftharpoons N_2H_5^+ + OH^-$ accept $N_2H_4 + 2H_2O \rightleftharpoons N_2H_6^{2+} + 2OH^-$		1		1		
				Question 8 total	**7**	**7**	**1**	**15**	**5**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9.	(a)			$\frac{0.001}{0.500} \times 100 = 0.20$ % award (1) if one error made e.g. failure to convert mg to g		2		2	1	2
	(b)	(i)		it is the number of moles of ascorbic acid used that is important / concentration of acid is not important			1	1		1
		(ii)		heated to ensure that all the acid / the tablet dissolved		1		1		1
	(c)			total volume of titres = $26.73 \times 3 = 80.20$ cm^3 / third titre is 26.80 cm^3 (1) so final reading must be 27.00 cm^3 (1) do not accept 26.99 cm^3		1 1	 1	 2	 2	 2
	(d)			volume of sodium hydroxide added would be less (1) since fewer moles of acid present / calculated mass of acid in tablet would be less (1) award (2) for volume NaOH added **more** since OH groups in ascorbic acid oxidised to acid		 1	1 	 2		 2
	(e)			moles NaOH = $2.67(3) \times 10^{-3}$ which is equal to moles acid (1) mass acid = 0.4704 g (1) percentage acid = 94.1 (1)		 3		 3	 2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(f)	(i)		$[H^+] = 0.02$ (1) pH = 1.7 (1) award (1) for pH = 2		2		2	2	
		(ii)		oxidation state Mn changes from IV to II therefore it is reduced (1) oxidation state Cl changes from –1 to 0 therefore it is oxidised (1)		2		2		
				Question 9 total	**0**	**12**	**3**	**15**	**7**	**8**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10.	(a)	(i)		$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$ (1) K_c = 0.119 (1) $dm^6\ mol^{-2}$ (1) student is correct since $K_c < 1$ / very small (1)		3	1	4	1 1	
		(ii)		student incorrect since equilibrium shifts to left (1) system opposes change by taking in heat, favouring endothermic direction (1)	1		1	2		
	(b)			$n(NH_3)$ = 58720 (1) n(DAP) = 22020 (1) maximum mass DAP = 2909 (1)		3		3	1 1	
	(c)			pV = nRT (1) $V = \frac{2.54 \times 10^{-3} \times 8.31 \times 393}{101000}$ (1) $V = 8.21 \times 10^{-5}\ m^3$ (1) $V = 82.1\ cm^3$ (1) credit alternative method using molar volume	1	3		4	1 1 1	
				Question 10 total	**2**	**9**	**2**	**13**	**7**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11.	(a)	(i)		**Indicative content** • add acid (not sulfuric/hydrochloric) to prove if carbonate present • if fizzing/effervescence carbonate present • if carbonate present, add acid until no more fizzing • divide solution into two (accept divide solution before adding acid) • add barium chloride to one half • precipitate shows that sulfate is present • add siver nitrate to other half • precipitate shows that chloride is present	2	2	2	6		6

5-6 marks
Devises a plan with relevant observations and conclusions that unambiguously shows that one, two or three anions are present.
The candidate constructs a relevant, coherent and logically structured method 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
Devises a plan with relevant observations and conclusions that shows that two or three anions could be present.
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
Devises a simple plan with some observations and conclusions that shows that one of the anions could be present.
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
		(ii)		incorrect since other cations form soluble salts with these anions (1) carry out flame test – if flame turns yellow cation is sodium (1)	1		1	2		1
	(b)	(i)		**A** is simple molecular (1) **D** is ionic (1) **B** is **probably** giant molecular but **could be** ionic since not all ionic substances are soluble (1) **C** is **probably** metallic but **could be** giant molecular (graphite) since graphite conducts electricity (1)	2		2	4		
		(ii)		**B** - use higher temperatures to melt the solid and test the molten substance for electrical conductance (1) if **B** conducts then ionic / if **B** does not conduct then giant molecular (1) **OR** **C** - add acid (and warm) and see if effervescence forms (1) if **C** effervesces then metal / if **C** does not effervesce then graphite (1) credit sensible alternative physical tests e.g. hardness of **B**, malleability of **C**		1	1	2		2
		(iii)		can be difficult to get powdered metal to conduct electricity / powdered metal not shiny / not sonorous / not malleable		1		1		1
				Question 11 total	**5**	**4**	**6**	**15**	**0**	**10**

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SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
Section A	6	3	1	10	1	1
7.	7	2	3	12	2	0
8.	7	7	1	15	5	0
9.	0	12	3	15	7	8
10.	2	9	2	13	7	0
11.	5	4	6	15	0	10
Totals	27	37	16	80	22	19