Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2024

Chemistry

Assessment Unit AS 1

assessing

Basic Concepts in Physical and Inorganic Chemistry

[SCH14]

TUESDAY 14 MAY, MORNING

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what the examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The purpose of mark schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents the final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example where there is no absolute correct response – all teachers will be familiar with making such judgements.

Section A

	AVAILABLE MARKS
1 C	
2 C	
3 C	
4 B	
5 C	
6 B	
7 B	
8 D	
9 C	
10 B	
[1] for each correct answer **Total**	**10**

Section B

AVAILABLE MARKS

11 (a)

Test	Practical procedure	Observations	Ion present
A	Add 1 cm^3 of silver nitrate solution to a solution	white precipitate	**chloride [1]**
B	Add 1 cm^3 of dilute hydrochloric acid to a solid sample	**bubbles/fizzing [1]**	carbonate
C	**Add barium chloride solution to a solution [1]**	**white precipitate [1]**	sulfate
D	Add a few drops of concentrated sulfuric acid to a solid sample	misty fumes red-brown vapour	**bromide [1]**
E	Carry out a flame test on a solid sample	**green-blue/blue-green [1]**	copper(II)

[6]

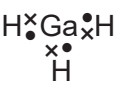
(b) ppt soluble/disappears in dilute ammonia solution/colourless solution formed [1]

(c) $CO_3^{2-} + 2H^+ \rightarrow CO_2 + H_2O$ [1]

(d) bromine [1]

(e) no red-brown vapour/only misty fumes [1]
(concentrated) phosphoric acid cannot oxidise HBr [1] [2]

11

				AVAILABLE MARKS
12	**(a)**	**(i)**	 [1]	
		(ii)	120° [1]	
	(b)	**(i)**	$\overset{\delta+}{Ga}—\overset{\delta-}{H}$ [1]	
		(ii)	equally polar bonds, arranged symmetrically/dipoles cancel [1]	
	(c)	**(i)**	$3LiGaH_4 + GaCl_3 \rightarrow 3LiCl + 4GaH_3$ [2]	
		(ii)	tetrahedral [1]	
		(iii)	hydride ion shares a lone pair of electrons [1] co-ordinate [1] (bond) [2]	
	(d)	**(i)**	$2GaH_3 + 3H_2SO_4 \rightarrow Ga_2(SO_4)_3 + 6H_2$ [2]	
		(ii)	pops with a burning splint [1]	
	(e)	**(i)**	water chemically bonded within a crystal structure [1]	
		(ii)	moles of $Ga(NO_3)_3.8H_2O = \frac{3.15}{400} = 7.875 \times 10^{-3}$ moles of $Ga_2O_3 = \frac{7.875 \times 10^{-3}}{2} = 3.9375 \times 10^{-3}$ mass of $Ga_2O_3 = 3.9375 \times 10^{-3} \times 188 = 0.74025\,g$ loss in mass = 3.15 – 0.74025 = 2.41 g [4]	
		(iii)	decomposition not complete/loss of solid from container/side reactions [1]	18

13 (a) (i) the energy required to convert one mole of gaseous ions with a double positive charge into gaseous ions with a triple positive charge [2]

(ii) they have no third electron to remove/H has 1 and He has 2 [1]

(iii) $F^{2+}(g) \rightarrow F^{3+}(g) + e^-$ [1]

(iv) Mg/atomic number 12: electron removed from second energy level closer to nucleus [1]
electron removed from filled p subshell [1]
less shielding [1] [3]

(v) increasing nuclear charge/decreasing ionic radius [1]

(b) (i)

Element	Electronic confirmation of atom	Electronic configuration of 2+ ion
V	**$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2$**	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$
Cr	**$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$**	**$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4$**
Mn	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^2$	**$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5$**

each error [–1] [3]

(ii) manganese(II) ion/Mn^{2+} [1]
half-filled (3d) subshell [1] [2]

(iii) +6
+5
+6
all correct [2] one error [1] [2]

(c) (i) $SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2H^+ + 2e^-$ [2]

(ii) $2MnO_4^- + 5SO_3^{2-} + 6H^+ \rightarrow 2Mn^{2+} + 5SO_4^{2-} + 3H_2O$ [2] 19

AVAILABLE MARKS

				AVAILABLE MARKS
14	**(a)**	molecular covalent element:	any one from I_2/S_8/correct alternative [1]	
		non-polar covalent compound:	CO_2 or correct alternative [1]	
		polar covalent compound:	NH_3/any soluble amine/correct alternative [1] [3]	
	(b)	**(i)** graphite: contains delocalised electrons [1] which can move and carry charge [1] diamond: does not contain delocalised electrons/all outer electrons involved in bonding [1] [3]		
		(ii) diamond hard and graphite soft [1] diamond: 3D or giant tetrahedral structure [1] graphite: weak VDW forces between layers [1] [3]		
		(iii) high melting points [1] substantial energy required to break the strong covalent bonds [1] [2]		11
15	**(a)**	fluorine most electronegative element [1]		
	(b)	**(i)** oxidation and reduction of the same element in the same reaction [1]		
		(ii) $3Cl_2 + 6NaOH \rightarrow 5NaCl + NaClO_3 + 3H_2O$ [2]		
		(iii) hot and concentrated [1]		
	(c)	$KClO_4$ [1]		
	(d)	**(i)** electron acceptor [1]		
		(ii) $Cl_2 + 2KI \rightarrow 2KCl + I_2$ [1]		
		(iii) colourless to yellow/brown [1]		9

16 (a) Indicative content

- phenolphthalein
- colourless to pink
- rinse burette with sodium hydroxide solution/rinse pipette with tartaric acid solution
- add solution from burette dropwise before the end point
- swirl the flask
- read burette at bottom of meniscus
- rinse down inside of conical flask with deionised water during the titration.

Band	Response	Mark
A	Candidates must use appropriate specialist terms including a minimum of **5** points of indicative content. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates must use appropriate specialist terms including a minimum of **3** points of indicative content. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates' brief and partial response includes a minimum of **2** points of indicative content. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit	[0]

[6]

(b) (i) moles of tartaric acid = $\frac{3.18}{150}$ = 0.0212

moles of tartaric acid in 25.0 cm^3 = $\frac{0.0212}{5}$ = 0.00424

moles of NaOH required = 0.00424 × 2 = 0.00848

volume of NaOH required = $\frac{0.00848 \times 1000}{0.480}$ = 17.7 cm^3 (to 3 sf) [5]

(ii) any **one** from:
not all solid dissolved
impurities in sample
average taken of concordant titres
colour change/end point subjective [1]

12

Section B **80**

Total **90**

AVAILABLE MARKS