Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2015

Chemistry

Assessment Unit AS 1

assessing

Basic Concepts in Physical and Inorganic Chemistry

[AC112]

WEDNESDAY 10 JUNE, AFTERNOON

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	B	
2	B	
3	C	
4	A	
5	D	
6	C	
7	C	
8	D	
9	A	
10	C	
[2] for each correct answer	[20]	20
	Section A	**20**

Section B

AVAILABLE MARKS

11 **(a)** $2K + BeCl_2 \rightarrow 2KCl + Be$ [1]

(b) $Be + Cl_2 \rightarrow BeCl_2$ [1]
$Be + 2HCl \rightarrow BeCl_2 + H_2$ [1]

(c) **(i)** the electrons in the bonds [1] repel equally [1]
linear [1] [3]

(ii) $BeCl_2$: red, pH 0–2/strongly acidic.
NaCl: green, pH 7/neutral solution. [4]

Quality of written communication [2]

(d) **(i)** no, there are 6 electrons [1]

(ii) yes, there are 8 electrons [1]

(iii) electron pair donated by one atom to form a bond [2]

(iv) covalent or dipole-dipole bonds need to be broken [1]
Needs energy to break bonds [1] 18

12 **(a)** **(i)**

isotope	protons	neutrons	electrons
^{54}Fe	26	28	26
^{56}Fe	26	30	26
^{57}Fe	26	31	26

error [–1] [3]

(ii) $\frac{(54 \times 5.8) + (56 \times 91.6) + (57 \times 2.6)}{100} = 55.9$
[1] deducted for an error [2]

(iii) same number/structure of electrons } both needed
identical chemical properties [1]

(b) **(i)** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$ [1]

(ii) $Cl_2 + 2Fe^{2+} \rightarrow 2Cl^- + 2Fe^{3+}$
[1] for correct formula
[1] for correct ratio [2]

(iii) electronic configuration of Fe^{3+} contains $3d^5$ [1]
half-filled subshell has increased stability [1] [2] 11

AVAILABLE MARKS

13 (a) (i) $2Na + O_2 \rightarrow Na_2O_2$ [1]

(ii)

$Na^+ : O^{2-}$

$1.2 \times 10^{24} : 6.0 \times 10^{23}$

$2 : 1$

Na_2O [1]

(b) $\frac{500\,000}{6.02 \times 10^{23}} = 8.306 \times 10^{-19}$ J

$\frac{8.306 \times 10^{-19}}{6.63 \times 10^{-34}} = 1.253 \times 10^{15}$

$\frac{3.0 \times 10^{8}}{1.253 \times 10^{15}}$

2.394×10^{-7}

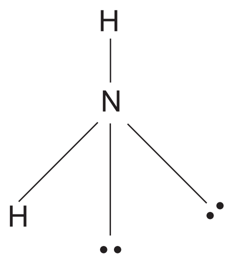
239.4 nm [4]

(c) (i) $2NH_3 + 2Na \rightarrow 2NaNH_2 + H_2$ [1]

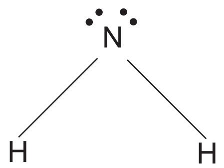
(ii)

	1s	2s	2p	
N	↑↓	↑↓	↑ ↑ ↑	[1]
N^-	↑↓	↑↓	↑↓ ↑ ↑	[1]

(iii)



or



or correct dot and cross diagram

[1]

(iv) bent/V-shaped/non-linear [1]

(v) ammonia – 1 lone pair } both needed for [1]
amide ion – 2 lone pairs }
lone pair–lone pair repulsion on amide [1] > lone pair–bond pair repulsion on ammonia/pushes bond pairs closer/reduces bond angles [1] [3]

14

	AVAILABLE MARKS

14 (a) (i) $\frac{234 \times 10^3}{58.5} = 4 \times 10^3$

$NaCl : NaHCO_3$
1 : 1
Moles of $NaHCO_3 = 4 \times 10^3$
[–1] for each error [2]

(ii) $NaHCO_3 : Na_2CO_3$
2 : 1
Moles of $Na_2CO_3 = 2 \times 10^3$
Mass of $Na_2CO_3 = 2 \times 10^3 \times 106$
$= 212$ kg
[–1] for each error [2]

(b) (i) $\frac{24.3}{1000} \times 0.2 = 4.86 \times 10^{-3}$ [1]

(ii) moles of $Na_2CO_3 = 4.86 \times 10^{-3}$ [1]

(iii) moles of Na_2CO_3 in 250 $cm^3 = 4.86 \times 10^{-2}$ [1]

(iv) $\frac{6.00}{4.86 \times 10^{-2}} = 123.50$ [1]

(v) 106 [1]

(vi) $106 + 18x = 123.50$
$x = 1$ [1]

(c) (i) $\overset{\delta^+}{C}=\overset{\delta^-}{O}$ $\overset{\delta^-}{O}-\overset{\delta^+}{H}$
[1] for each [2]

(ii) dipoles cancel out/molecule is symmetrical [1]

(iii) Sufficient energy at 100°C [1]
to break the hydrogen bonds [1]. [2] 15

					AVAILABLE MARKS
15	**(a)**	**(i)**	The extent to which an atom attracts the bonding electrons in a covalent bond.	[2]	
		(ii)	As Group is descended the atomic radius increases Therefore (force of) attraction from nucleus to bonding electrons decreases	[2]	
		(iii)	Moving from HCl to HI the molecules increase in RFM/mass/no. of electrons Increased strength of van der Waals forces	[2]	
		(iv)	Between molecules of HF there are (van der Waals forces and) H-bonds H-bonds (are much stronger and) require (a lot) more energy to break 2nd mark dependent on first	[2]	
		(v)	HF < HCl < HBr < HI, H–I lowest bond energy – both needed	[1]	
	(b)	**(i)**	yellow/orange/brown to colourless		
		(ii)	Disproportionation is the simultaneous oxidation and reduction of the same species	[2]	
			Oxidation of Br_2 to BrO^-, $0 \rightarrow +1$ Reduction of Br_2 to Br^-, $0 \rightarrow -1$ (Both required for second mark)	[2]	
		(iii)	$3Br_2 + 6OH^- \rightarrow 5Br^- + BrO_3^- + 3H_2O$	[2]	
	(c)	**(i)**	N is potassium iodide	[1]	
		(ii)	O is potassium bromide	[1]	
			P is bromine gas	[1]	
			Q and R are sulfur dioxide and hydrogen bromide	[2]	22
				Section B	**80**
				Total	**100**