Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2016

Chemistry

Assessment Unit AS 1

assessing

Basic Concepts in Physical and Inorganic Chemistry

[AC112]

TUESDAY 14 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 C	
2 C	
3 C	
4 B	
5 A	
6 A	
7 C	
8 D	
9 C	
10 B	
[2] for each correct answer [20]	20
Section A	**20**

Section B

AVAILABLE MARKS

11

Ion	Atomic number	Electronic structure
A^{3+}	5	**$1s^2$**
B^-	**35**	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$
C^{2-}	16	**$1s^2 2s^2 2p^6 3s^2 3p^6$**

[3] 3

12 **(a)** Each carbon covalently bonded to three others
Hexagonal layers with weak forces between them
Each carbon has a delocalised electron
Electron moves and carries charge [4]

Quality of written communication [2]

(b) Many strong covalent bonds which take a lot of energy to break [2] 8

13 **(a)** **(i)** violet/purple [1]

(ii) no change with HCl [1] red-brown gas forms with HBr [1] [2]

(iii) HCl has higher bond enthalpy than HBr [1]

(b) **(i)** Hydriodic is stronger
Hydrogen iodide has a weaker covalent bond [2]

(ii) $Na_2CO_3 + 2HI \rightarrow 2NaI + CO_2 + H_2O$ [2]

(c) HI higher M_r/more electrons [1]
Stronger/more van der Waals [1] 10

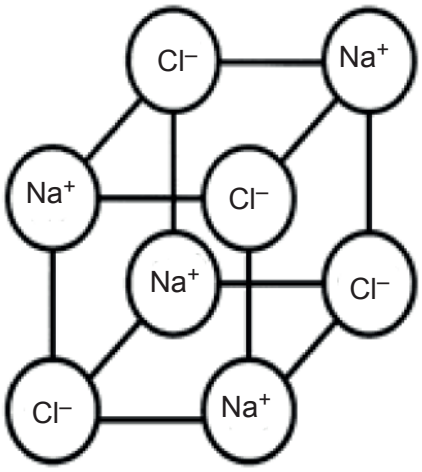
14 (a) (i) contains 1 electron in outer subshell [1]

(ii) needs one more electron to fill shell/subshell [1]

(b) (i) bond energy increases from fluorine to chlorine [1]
it then decreases down the group [1]

(ii) bond is shorter, (shorter) bonds are stronger [1]

(c) (i)



Sodium chloride [1]

(ii) $Na^{\bullet}$ H^{x}

$[Na]^{+}$ $[H^{x}_{\bullet}]^{-}$ (error [-1] mark) [3]

(iii) $NaH + H_2O \rightarrow NaOH + H_2$ [1]

(iv) 0.0183 [1]
0.0183 [1]
0.244 (mol dm^{-3}) [1] 13

15 (a) 35.48 [2]

(b) (i) oxidation and reduction of the same species in the same reaction [1]

(ii) 1. $2NaOH + Cl_2 \rightarrow NaCl + NaOCl + H_2O$ [2]

2. conditions – cold, dilute [1]

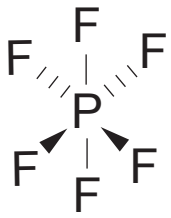
(iii) sodium chlorate(I) is ionic – strong ionic bonds
chlorine is molecular – weak van der Waals [2]

(c)

formula of chlorine oxide	oxidation number of chlorine
Cl_2O	+1
ClO_2	+4
Cl_2O_7	+7

[3] 11

AVAILABLE MARKS

					AVAILABLE MARKS
16	**(a)**	**(i)**	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 / Sr^{2+}$	[2]	
		(ii)	Same number of electrons/same electronic structure	[1]	
	(b)	**(i)**	2.84×10^{-19} (J)	[2]	
		(ii)	4.28×10^{14} (Hz)	[1]	
		(iii)	Electrons excited to higher energy levels. Electrons fall to lower levels. Energy emitted as red light	[3]	
	(c)	**(i)**	0.12		
		(ii)	0.0049		
		(iii)	0.098		
		(iv)	0.022		
		(v)	1.63 g		
		(vi)	63.7%	[6]	15
17	**(a)**	**(i)**	**(**When forming a compound,) an atom (tends to) gain, lose or share electrons to achieve eight in its outer shell. [1] Phosphorus does not as it has 12 electrons in the outer shell [1] fluorine does [1]	[3]	
		(ii)	 Octahedral	[2]	
		(iii)	six bonding pairs [1] repel equally to maximise separation [1]	[2]	
	(b)	**(i)**	oxidation and reduction occur in the same reaction	[1]	
		(ii)	+3	[1]	
		(iii)	$PbO_2 + SO_4^{2-} + \mathbf{4}H^+ + \mathbf{2}e^- \rightarrow PbSO_4 + \mathbf{2}H_2O$ $Pb + HSO_4^- \rightarrow PbSO_4 + H^+ + \mathbf{2e^-}$	[1] [1]	
		(iv)	$PbO_2 + Pb + SO_4^{2-} + HSO_4^- + 3H^+ \rightarrow 2PbSO_4 + 2H_2O$	[1]	12

				AVAILABLE MARKS
18	**(a)**	Bubble vapour through A solution of sodium chloride or hydrochloric acid White precipitate formed	[3]	
	(b)	**(i)** 9.26×10^{-6} moles , forming 9.26×10^{-9} (mol dm^{-3})	[2]	
		(ii) 0.02315 moles, 2.5 g	[1]	
	(c)	**(i)** Ag^{2+}	[1]	
		(ii) $C_4H_8SCl_2 + 2NaOH \rightarrow C_4H_8S(OH)_2 + 2NaCl$	[1]	8
			Section B	**80**
			Total	**100**