Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2013

Chemistry

Assessment Unit AS 1

assessing

Basic Concepts in Physical and Inorganic Chemistry

[AC112]

WEDNESDAY 12 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 examiners are looking for in responding to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help candidates 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 this 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

1 C

2 A

3 B

4 C

5 D

6 D

7 A

8 D

9 C

10 D

[2] for each correct answer [20] 20

Section A **20**

Section B

11 (a) (i)

	Relative mass	Relative charge
Proton	1	1+
Neutron	1	0
Electron	$\frac{1}{1800} - \frac{1}{2000}$ negligible	1–

error [–1] [3]

(ii)

Atomic number	116
Mass number	**293**
Number of protons	**116**
Number of neutrons	177
Number of electrons	**116**

([1] each) [3]

(b) (i) Atoms with the same atomic number/number of protons [1]
but with a different mass number/number of neutrons [1] [2]

(ii) ((54 × 5.84) + (56 × 91.76) + (57 × 2.12) + (58 × 0.28))/100
= 55.91
([–1] for each mistake, [–1] if not correct to 2 decimal places) [2] 10

12 (a) Arrow from n = 3 to n = 2 [1]
Arrow from n = 4 to n = 2 [1] [2]

(b) $E = hf = (6.63 \times 10^{-34}) \times (3.28 \times 10^{15}) = 2.175 \times 10^{-18}$
$(2.175 \times 10^{-18}) \times (6.02 \times 10^{23}) = 1\,309\,350\ J\ mol^{-1}$
1309 ($kJ\ mol^{-1}$)
([–1] for each mistake, [–1] if not $kJ\ mol^{-1}$) [3]

(c)

Flame colour	Metal ion
Blue-green	**Cu^{2+}**
Crimson	**Li^{+}**
Green	**Ba^{2+}**

(Must be formula not name, [1] each) [3] 8

13 **(a)** **(i)** A solution of (accurately) known concentration [1]

(ii) $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$ [1]

(b) **(i)** $(0.1 \times 30.3)/1000 = 3.03 \times 10^{-3}$ [1]

(ii) 3.03×10^{-3} [1]

(iii) 3.03×10^{-2} [1]

(iv) $(3.03 \times 10^{-2}) \times 60 = 1.82\,g$ units needed [1]

(v) $\frac{1.82}{25 \times 1.02} \times 100 = 7.14(\%)$ [1]

(c) Phenolphthalein [1]
From colourless [1] to pink/red [1] [3] 10

14 **(a)** p(-block) [1]
Outer electrons in the p-orbital [1] [2]

(b) **(i)** Increasing number of valence/outer/free electrons [1]
Greater attraction between these and the (fixed) cations [1] [2]

(ii) Strong covalent bonds [1]
throughout a giant structure [1] (reference to ionic bonding [0]) [2]

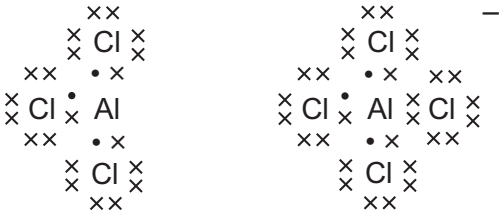
(iii) $S_8 \rightarrow P_4$ – More atoms/greater mass/more electrons [1]
Greater van der Waals forces (between the molecules) [1] [2]

(c) Atomic radius decreases across the Period/from sodium to argon [1]
(Outer) electrons are in the same energy level/shielding remains the same [1]
Nuclear charge increases causing greater attraction between the nucleus and the (outer) electrons [1] [3] 11

15 **(a)** **(i)** A shared pair of electrons (between two atoms) [1]
Each atom provides one electron [1] [2]

(ii) When forming a compound an atom tends to gain, lose or share electrons to achieve eight [1]
in its outer shell [1] [2]

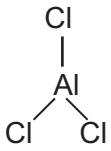
(b) **(i)**



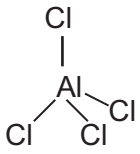
([2] each, [–1] for each mistake, [–1] if dot and cross not used) [4]

(ii) Dative/co-ordinate bond [1]

(iii) trigonal planar
(diagram [1], name [1])



tetrahedral
(diagram [1], name [1])



[4] 13

16 (a) (i) As the Group is descended there are more energy levels [1]

(ii) Going down the Group the molecules get heavier/there are more electrons [1]
causing van der Waals forces between the molecules [1] [2]

(iii) The extent to which an atom attracts the (bonding) electrons in a covalent bond [1]

(iv) Fluorine has the smallest radius [1]
greatest attraction between its nucleus and the bonding electrons [1] [2]

(v) $F(g) \rightarrow F^+(g) + e^-$
([1] for equation, [1] for state symbols) [2]

(vi) Going down the Group the outer electrons are further from the nucleus [1]
Increased shielding (from the inner electrons) [1] [2]

(b) (i) $Cl_2 + H_2O \rightarrow HOCl + HCl$ [1]

(ii) $Cl_2 = 0$
$HOCl = +1$
$HCl = -1$
} oxidation numbers [2]
Cl is both oxidised, $0 \rightarrow +1$ and reduced, $0 \rightarrow -1$ [1] [3]

(iii) Disadvantages:
Storing large quantities of chlorine causes problems/
Chlorine poisonous/toxic/
Freedom of choice

Advantages:
Chlorine remains in the water after it leaves the treatment plant/
Chlorine gas can be compressed/chlorine is relatively cheap
To a maximum of [3] [3]

Quality of written communication [2]

(c) (i) Colourless solution [1] turns yellow/brown [1]
$Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ [1] [3]

(ii) Yellow/orange solution [1] turns brown/yellow [1]
or colourless → yellow/brown
not yellow → yellow
$2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$ [1] [3]

(iii) Yellow [1] precipitate [1]
$Ag^+ + I^- \rightarrow AgI$ [1] [3] 28

Section B 80

Total 100