ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2022

Chemistry

Assessment Unit AS 1
assessing
Basic Concepts in Physical and Inorganic Chemistry

[SCH14]

TUESDAY 17 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.

COVID-19 Context
Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021-2022 only.

Section A

1 B

2 A

3 C

4 C

5 D

6 C

7 C

8 C

9 C

10 D

[1] for each correct answer   [10]   10

| | **Section A** | **10** |

11 **(a)** **(i)** oxidation and reduction of the same element in the same reaction [2]

   (ii) Cu_2O + H_2SO_4 → Cu + $CuSO_4$ + H_2O [1]

(b) flame test [1]
green-blue/blue-green (flame) [1] [2]

5

12 **(a)** iodine in water: yellow/brown [1]
iodine in hexane: purple/violet [1]
solublility: more soluble in hexane [1] [3]

(b) van der Waals' forces increase down the group [1]
due to increasing numbers of electrons [1]
hydrogen fluoride can form hydrogen bonds between molecules [1]
hydrogen bonds are stronger than van der Waals' forces [1] [4]

(c) **(i)** sodium bromate(I) [1] and sodium bromate(V) [1] [2]

   (ii) cold dilute sodium hydroxide solution [1]
Br_2 + 2NaOH → NaBr + NaBrO + H_2O [2]

   hot concentrated sodium hydroxide solution [1]
$3Br_2$ + 6NaOH → 5NaBr + $NaBrO_3$ + $3H_2O$ [2] [6]

   (iii) add silver nitrate solution [1]
cream precipitate [1] [2]

(d) **(i)** **chlorine:**
advantage: cheaper/provides residual protection/more soluble in water than ozone [1]
disadvantage: cannot kill some microorganisms/leaves chemicals in the water/unpleasant taste/toxic so low quantities used [1]
ozone:
advantage: kills more different types of microorganisms/breakdown product is oxygen/no residual chemicals in water/removes metal and organic particles/no unpleasant taste [1]
disadvantage: more expensive/does not provide residual protection/less soluble in water than chlorine [1] [4]

   (ii) damp universal indicator paper/damp litmus paper [1] bleaches [1] [2]

23

13 (a) (i) Li(g) → Li⁺(g) + e⁻ [2]

(ii) Indicative points:

- General increase across the period
- Shielding generally remains the same
- Nuclear charge increases
- Atomic radius decreases
- Be higher than B due to stability of filled (2)s subshell
- N higher than O due to stability of half-filled (2)p subshell

Band	Response	Mark
A	Candidates must use appropriate specialist terms to fully explain the trend using a minimum of 5 points of indicative content. They must use good spelling, punctuation and grammar and the form and style are of an excellent standard.	[5]–[6]
B	Candidates must use appropriate specialist terms to explain the trend using a minimum of 3 points of indicative content. They must use satisfactory spelling, punctuation and grammar and the form and style are of a good standard.	[3]–[4]
C	Candidates explain partially the trend using a minimum of 2 points of indicative content. They use limited correct spelling, punctuation and grammar and the form and style are of a basic standard.	[1]–[2]
D	Response not worthy of credit	[0]

[6]

(b) (i) the extent to which an atom attracts the bonding electrons in a covalent bond [2]

(ii) greater nuclear charge/atomic radius decreases [1]
greater pull on (covalently) bonded electrons [1] [2]

(c) (i) large difference in electronegativity [1]

(ii)

[2]

(iii) $\overset{\delta+\quad\delta-}{\text{O—F}}$ [1]

(iv) bent [1]

17

14 (a) (i) the average (weighted mean) mass of a formula unit relative to one-twelfth of the mass of an atom of carbon-12 [2]

(ii) $9/58.5 = 0.1538\,M$
$= 0.15\,M$ [2]

(b)

[2]

(c) (i) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$
(if balanced equation forming Na_2SO_4 is given then [–1]) [2]

(ii) stopper from a bottle of concentrated ammonia solution/glass rod dipped in concentrated ammonia solution [1]
white fumes/solid/smoke [1] [2] **10**

15 (a) (i) metallic bonding [1]
substantial energy required to break bonds/bonds are strong [1] [2]

(ii) delocalised electrons [1]
move and carry charge [1] [2]

(b) (i) outer electron is in the p-subshell [1]

(ii) period: 6 [1]
group: 3 [1] [2]

(iii) $[Xe]\,4f^{14}5d^{10}6s^2$ [1]
$[Xe]\,4f^{14}5d^{10}$ [1] [2]

(c) $2Tl + H_2SO_4 \rightarrow Tl_2SO_4 + H_2$ [2]

(d) moles $Tl_2O_3 = \dfrac{1.72}{456} = 3.772 \times 10^{-3}$
moles of $O_2 = 3.772 \times 10^{-3}$
mass of $O_2 = 3.772 \times 10^{-3} \times 32 = 0.121\,g$ [3] **14**

16 (a) a salt which contains water of crystallisation [1]

(b) an acid which partially dissociates in water [1]

(c) (i) phenolphthalein [1]
colourless [1] to pink [1] [3]

(ii) moles of NaOH = (25.4 × 0.1)/1000 = 2.54×10^{-3}
moles of $(COOH)_2$ in 25 cm^3 = (2.54×10^{-3})/2 = 1.27×10^{-3}
moles of $(COOH)_2$ in 250 cm^3 = 1.27×10^{-2}
mass of $(COOH)_2$ in 250 cm^3 = (1.27×10^{-2}) × 90 = 1.14 g [3]

(iii) mass of water in 1.60 g = 1.60 − 1.14 = 0.46 g
moles $(COOH)_2$: H_2O = 1.14/90 : 0.46/18
= 0.0127 : 0.0256
= 1 : 2
x = 2 [3]

	AVAILABLE MARKS
	11
Section B	**80**
Total	**90**