Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2025

Chemistry

Assessment Unit AS 1

assessing

Basic Concepts in Physical and Inorganic Chemistry

[SCH14]

TUESDAY 13 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.

Where one response is required to gain a mark, candidates will not gain credit if a correct response is given alongside one or more incorrect responses. This is referred to as listing.

AVAILABLE MARKS

Section A

1 C

2 C

3 C

4 B

5 C

6 B

7 B

8 B

9 C

10 D

[1] for each correct answer [10] 10

Section A **10**

Section B

AVAILABLE MARKS

11 (a)

Name	Formula
sodium thiosulfate	**$Na_2S_2O_3$ [1]**
calcium phosphate [1]	$Ca_3(PO_4)_2$
potassium nitrite	**KNO_2 [1]**
ammonium chromate [1]	$(NH_4)_2CrO_4$

[4]

(b) (i) $2Cr_2(SO_4)_3 \rightarrow 2Cr_2O_3 + 6SO_2 + 3O_2$ [2]

(ii) make a solution of chromium(III) sulfate [1]
add barium chloride solution [1]
white precipitate [1] [3]

(iii) sulfur(IV) oxide [1]

(iv) relights a glowing splint [1] 11

12 **(a)** $Cl(g) \rightarrow Cl^+(g) + e^-$ [1]

(b) distance of outermost electron from the nucleus increases [1]
shielding increases [1] [2]

(c) increase in RFM/RMM/number of electrons [1]
stronger van der Waals' forces between the molecules [1] [2]

(d) **(i)**

halogen \ potassium halide	potassium chloride	potassium bromide	potassium iodide
chlorine			
bromine	×		✓
iodine	×	×	

[1]

(ii) colourless to yellow/brown/orange [1]

(iii) $Cl_2 + 2Br^- \rightarrow Br_2 + 2Cl^-$ [1]

(iv) add silver nitrate solution [1]
then add dilute ammonia solution [1]
no precipitate remains/precipitate (fully) disappears [1] [3]

(e) **(i)** steamy/misty fumes [1]

(ii) red-brown vapour [1]

(iii) sodium hydrogensulfate
hydrogen bromide
bromine
sulfur dioxide
water [3]

(iv) bromide ions can reduce concentrated sulfuric acid/concentrated sulfuric acid can oxidise bromide ions [1]

(f) 6.5 mg = 0.0065 g

moles of NaBr = $\frac{0.0065}{103}$ = 6.311×10^{-5} in 100 cm^3

= 6.311×10^{-4} in 1000 cm^3 = 6.3×10^{-4} (M) [3]

AVAILABLE MARKS

20

AVAILABLE MARKS

13 (a) (i) (a compound composed of) two or more different halogens bonded together [1]

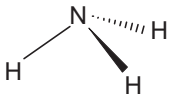
(ii) +3 [1]

(iii)

[1]

(b) (i) $2ClF_3 + 2NH_3 \rightarrow N_2 + Cl_2 + 6HF$ [2]

(ii)



[1]

(iii) Indicative content

ammonium ion:
- tetrahedral
- bond angle is 109.5°
- four bonding pairs (and no lone pairs)
- bonding pairs repel equally

azanide ion:
- bent
- bond angle is 104.5°
- two bonding pairs and two lone pairs
- lone pairs repel more than bonding pairs

Band	Response	Mark
A	Candidates must use appropriate specialist terms including a minimum of 7 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 5 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 3 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]

12

14 (a) (i) rotten egg smell [1]

(ii) hydrogen sulfide has lower boiling point than water [1]
water has hydrogen bonding between the molecules [1]
hydrogen bonding stronger than VDW/permanent dipole-dipole attractions between hydrogen sulfide molecules [1] [3]

(iii) $H_2S \rightarrow S + 2e^- + 2H^+$ [1]

(iv) $HNO_3 + 3H^+ + 3e^- \rightarrow NO + 2H_2O$ [1]

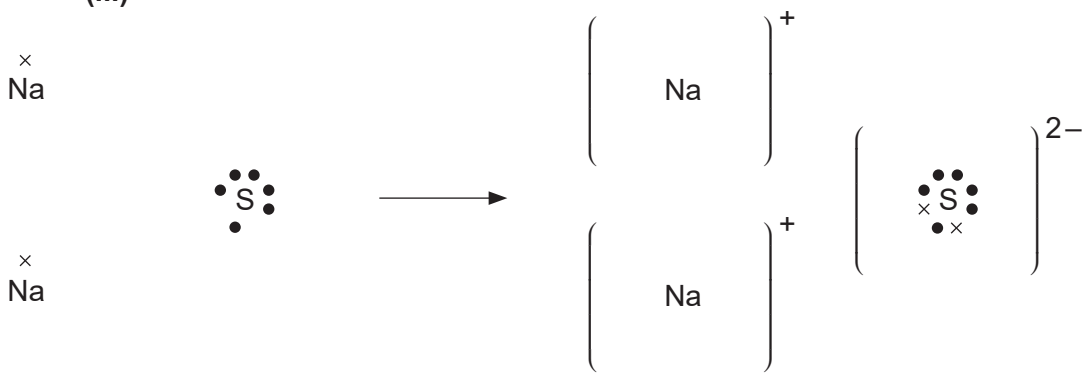
(v) $3H_2S + 2HNO_3 \rightarrow 3S + 2NO + 4H_2O$ [1]

(b) (i) attraction between sodium ions and delocalised electrons [1]
lattice/layers of positive ions [1] [2]

(ii) sodium: $1s^2\ 2s^2\ 2p^6\ 3s^1$ [1]

sulfur: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$ [1] [2]

(iii)



[2]

(iv) moles $Na_2S = \frac{59}{78} = 0.756$

moles $H_2O = \frac{41}{18} = 2.28$

$x = \frac{2.28}{0.756} = 3$ [3]

(c) (i) electrons cannot move and carry charge [1]

(ii) a covalent bond in which there is unequal sharing of the bonding electrons [1]

(iii) not deflected as molecule is not polar due to symmetrical shape [1]

AVAILABLE MARKS

19

15 (a) dissolve in a small volume of deionised water stirring with a glass rod [1]
transfer the solution with rinsings to the volumetric flask [1]
make up to the mark by adding deionised water to the volumetric flask [1]
until the bottom of the meniscus is on the mark [1]
stopper the flask and invert to mix thoroughly [1] [5]

(b) (i) a solution for which the concentration is known [1]

(ii) moles of HCl = $\frac{50 \times 0.175}{1000}$ = 0.00875

$0.00875 = \frac{\text{total volume} \times 0.1}{1000}$

total volume = $\frac{0.00875 \times 1000}{0.1}$ = 87.5 cm^3

volume of water required = 87.5 – 50 = 37.5 cm^3 [3]

(c) (i) methyl orange [1]
strong acid and weak base titration [1]
yellow to red [1] [3]

(ii) moles HCl = $\frac{24.5 \times 0.1}{1000}$ = 0.00245

moles M_2CO_3 in 25 cm^3 = $\frac{0.00245}{2}$ = 0.001225

moles M_2CO_3 in 500 cm^3 = 0.001225 × 20 = 0.0245

RFM M_2CO_3 = $\frac{2.60}{0.0245}$ = 106

RAM of M = $\frac{(106 - 12 - 48)}{2} = \frac{46}{2}$ = 23 so M = Na/sodium [4]

(d) mean titre would be lower [1]
less M_2CO_3 in 2.60 g [1] [2]

	AVAILABLE MARKS
	18
Section B	**80**
Total	**90**