



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2023**

Chemistry

Assessment Unit AS 3

assessing

**Module 3: Practical Examination
Practical Booklet B (Theory)**

[SCH32]

THURSDAY 1 JUNE, MORNING

**MARK
SCHEME**

General Marking Instructions

Introduction

The main purpose of the mark scheme is to ensure that examinations are marked accurately, consistently and fairly. The mark scheme provides examiners with an indication of the nature and range of candidates' responses likely to be worthy of credit. It also sets out the criteria which they should apply in allocating marks to candidates' responses.

Assessment objectives

Below are the assessment objectives for **GCE Chemistry**:

Candidates should be able to:

AO1	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: in a theoretical context in a practical context when handling quantitative and qualitative data
AO3	Analyse, interpret and evaluate scientific information, ideas and evidence (in relation to particular issues) make judgements and reach conclusions develop and refine practical design and procedures

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 17 or 18-year-old which is the age at which the majority of candidates sit their GCE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. The exception to this for GCE Chemistry is when examiners are marking complex calculations and mechanisms when the examiners are briefed to mark by error or omission. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 17 or 18-year-old GCE candidate.

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Marking Calculations

In marking answers involving calculations, examiners should apply the 'carry error through' rule so that candidates are not penalised more than once for a computational error. To avoid a candidate being penalised, marks can be awarded where correct conclusions or inferences are made from their incorrect calculations.

Types of mark schemes

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response

In deciding which level of response to award, examiners should look for the number of indicative content points in candidate responses to ensure that the answer has been written to coincide with the question. In deciding which mark within a particular level to award to any response, quality of communication will be assessed and examiners are expected to use their professional judgement.

The following guidance is provided to assist examiners.

- **Threshold performance:** Response which just merits inclusion in the level but the quality of communication is basic should be awarded a mark at the bottom of the range.
- **High performance:** Response which fully satisfies the level description for both content and quality of communication should be awarded a mark at the top of the range.

Quality of written communication

Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions on theory examination papers that require them to respond in extended written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response as follows:

- Level C: Quality of written communication is basic.
Level B: Quality of written communication is good.
Level A: Quality of written communication is excellent.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

Level C (Basic): Basic reference to scientific terminology. The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

Level B (Good): Good reference to scientific terminology. The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

Level A (Excellent): Excellent reference to scientific terminology. The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

- 1 (a) $43.5 - 18 = 25.5^{\circ}\text{C}$ [2]
- (b) (i) $\text{heat} = 25 \times 4.2 \times 25.5 = 2677.5 \text{ J} = 2.68 \text{ (kJ)}$ [2]
- (ii) density (of solution) is 1 g cm^{-3} [1]
 specific heat capacity (of solution) is $4.2 \text{ (J g}^{-1} \text{ K}^{-1})$ [1] [2]
- (c) (i) $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$ [1]
- (ii) $\frac{25 \times 0.50}{1000} = 0.0125$ [1]
- (iii) $0.0125 \times 65 = 0.8125 \text{ g}$ [1]
- (iv) $\Delta H = \frac{2.68}{0.0125} = 214.4 = -210 \text{ (kJ mol}^{-1})$ [3]
- (v) add barium chloride solution [1]
 white precipitate [1] [2]
- (d) blue-green/green-blue [1]
- 2 (a) (i) $157.55 - 152.45 = 5.10 \text{ g}$ [1]
- (ii) hydrochloric acid is in excess [1]
- (iii) addition is exothermic/dissipate the heat [1]
- (iv) add a few cm^3 water [1]
 the layer that increases in volume is the aqueous layer [1] [2]
- (v) removes (excess) acid [1]
 $\text{NaHCO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$ [1] [2]
- (vi) acts as a drying agent [1]
 enough is added when the liquid goes clear [1] [2]
- (vii) filter/decant [1]
- (viii) anti-bumping granules [1]
- (ix) 2-methylpropan-2-ol is flammable [1]
- (x) boils over a wider range of temperatures/increases the boiling point [1]
- (b) $\frac{5.10}{74} = 0.0689 \text{ moles 2-methylpropan-2-ol}$
 = moles 2-chloro-2-methylpropane
- $0.0689 \times 0.40 = 0.0276$
- mass of 2-chloro-2-methylpropane = $0.0276 \times 92.5 = 2.55 \text{ g}$ [3]

AVAILABLE
MARKS

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(ii) gives a 'pop' with a burning splint [1]

3 (a)

Aqueous solution	Colour
Chlorine	green/colourless
Bromine	yellow/orange/brown
Iodine	yellow/brown
Potassium halide	colourless

[2]

(b) (i)

	Potassium chloride	Potassium bromide	Potassium iodide
Chlorine		✓	(✓)
Bromine	x		✓
Iodine	x	x	

[1]



(iii) two layers [1]
 one layer is colourless [1]
 one layer is purple [1] [3]



(ii) cold dilute alkali/sodium hydroxide solution [1] [1]

(iii) more effective at killing bacteria/it reacts and removes organic matter better than chlorine does/the breakdown product is oxygen/no residual chemicals left/no smell or taste to the water [1] 10

4 (a) iodine vapour would escape from the tube/iodine would sublime and there is less iodine to react with copper [1]

(b) Iodine is toxic [1]

(c) $3.28 - 2.94 = 0.34$ g [1]

(d) $2.94 - 2.77 = 0.17$ g [1]

(e)

	Cu	I
mass	0.17	0.34
moles	0.00266	0.00268
	CuI	

[3]

(f) (i) iodine oxidation state changes from -1 in I^- to 0 in I_2 which is oxidation [1]
 sulfur oxidation state changes from +6 in SO_4^{2-} to +4 in SO_2 which is reduction [1]
 redox is oxidation and reduction occur in the same reaction [1] [3]

(ii) starch solution [1]
 blue-black [1] [2]

Total

12

55