Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2025

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination
Practical Booklet B (Theory)

[SCH32]

THURSDAY 29 MAY, AFTERNOON

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.

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

AVAILABLE MARKS

1 **(a)** solid/hydrated manganese(II) chloride/hydrated salt in evaporating basin [1]
gauze and tripod [1]
heat source [1] [3]

(b) **(i)** mass of evaporating basin [1]
mass of evaporating basin and hydrated salt [1] [2]

(ii) heat and weigh [1]
repeat until no further change in mass [1] [2]

(c) mass of water = 4.00 – 2.55 = 1.45 (g)

moles of water = $\frac{1.45}{18}$ = 0.0806

moles of anhydrous $MnCl_2$ = $\frac{2.55}{126}$ = 0.0202

x = $\frac{0.0806}{0.0202}$ = 4

Formula = $MnCl_2.4H_2O$ [3]

(d) dissolve solid in deionised water [1]
add silver nitrate solution [1]
white precipitate [1]
add ammonia solution and precipitate disappears [1] [4] 14

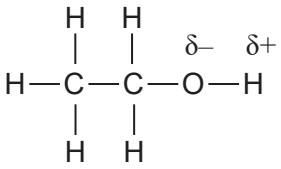
2 **(a)** **(i)**

Liquid	Deflection	Polar/Non-polar
cyclohexane		Non-polar
water	Yes	Polar
tetrachloromethane	No	Non-polar

[3]

(ii) polythene [1]

(b)



structure [1]
correct partial charges [1] [2]

AVAILABLE MARKS

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3 **(a)** **(i)** $CH_3CH(OH)CH_2CH_3 + PCl_5 \rightarrow CH_3CHClCH_2CH_3 + POCl_3 + HCl$ [1]

(ii) steamy fumes/misty fumes [1]

(iii) stopper from bottle of concentrated ammonia solution/
glass rod dipped in concentrated ammonia solution [1]
white smoke/fumes [1] [2]

(b) any **two** from:
heat
ethanol
sealed tube [2]

(c) **(i)** 

[1]

(ii)

Name of product	Method of preparation
butanal [1]	distil [1]
butanoic acid [1]	heat under reflux [1]

[4]

AVAILABLE MARKS

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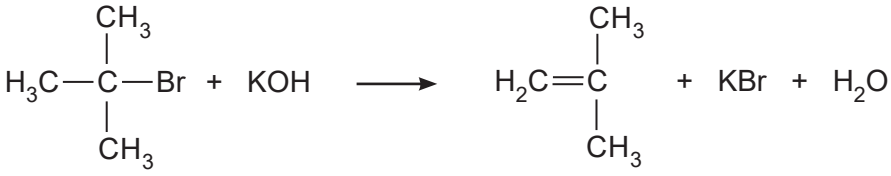
4 **(a)** **(i)** keep reactants in contact/hold liquid [1]

(ii) insoluble [1]

(iii) $(CH_3)_3CBr + KOH \rightarrow CH_2C(CH_3)_2 + KBr + H_2O$

or



[1]

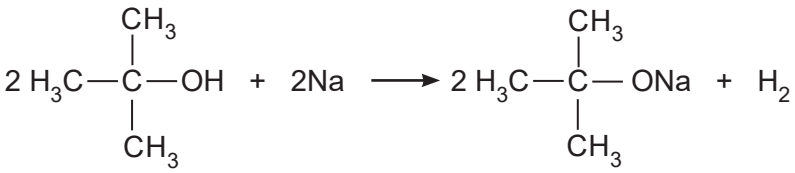
(b) mass of 2-bromo-2-methylpropane = 1.08 × 1.22 = 1.3176 g

moles of 2-bromo-2-methylpropane = $\frac{1.3176}{137}$ = 0.00962

volume of methylpropene = 0.00962 × 24000 = 231 (cm^3) [3]

(c) **(i)** add acidified potassium dichromate(VI) solution and warm
remains orange [1]

(ii) $2(CH_3)_3COH + 2Na \rightarrow 2(CH_3)_3CONa + H_2$ [2]



(iii) any **two** from:
fizzing
solid disappears
heat released [2]

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AVAILABLE MARKS

			AVAILABLE MARKS
5	**(a)**		

Substance	Colour
solid iodine	grey-black [1]
solid potassium iodide	white [1]

[2]

(b) yellow/brown solution [1]

(c) blue-black [1]

(d) nichrome wire [1]
dipped in concentrated hydrochloric acid [1]
into the sample and into a blue Bunsen burner flame [1]
lilac flame/pink through cobalt glass [1] [4]

(e) **(i)** $2I^- + Pb^{2+} \rightarrow PbI_2$ [1]

(ii) moles of KI = $\frac{10 \times 0.15}{1000} = 1.5 \times 10^{-3}$

moles of $Pb(NO_3)_2$ = $\frac{10 \times 0.10}{1000} = 1.0 \times 10^{-3}$

limiting reactant = KI

moles of PbI_2 formed = $\frac{1.5 \times 10^{-3}}{2} = 7.5 \times 10^{-4}$

mass of $PbI_2 = 7.5 \times 10^{-4} \times 461 = 0.34575$ g = 350 mg [4] 13

Total **55**