

OCR

Oxford Cambridge and RSA

day June 20XX – Morning/Afternoon**A Level Chemistry B (Salters)****H433/03 Practical skills in chemistry****SAMPLE MARK SCHEME****Duration:** 1 hour 30 minutes**MAXIMUM MARK 60****This document consists of 16 pages**

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Mark Scheme

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MARKING INSTRUCTIONS**PREPARATION FOR MARKING****SCORIS**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to scoris and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
- where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
 - if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.
6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
- if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
 - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
- If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, **best** describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme.

Once the level is located, award the higher or lower mark.

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

- **The science content determines the level.**
- **The communication statement determines the mark within a level.**

Level of response questions on this paper are **2(a)(i)** and **4(b)(iii)**.

11. Annotations

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument
✓	Marking point

12. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

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Question			Answer	Marks	Guidance
1	(a)	(i)	Boiling a mixture ✓ AND condensing/cooling the vapour to return it to the flask ✓	2	
		(ii)	Diagram showing a funnel with a filter paper above a perforated plate ✓ fitting into a flask or tube with a side arm ✓ indication of removal of air from the flask through the side arm ✓	3	ALLOW water flow through a tube connected to the side arm
		(iii)	Dissolve crystals in minimum of hot water ✓ Cool solution (to produce crystals) ✓ Filter off crystals AND wash with cold solvent ✓ Hexane-1,6-dioic acid is more soluble in hot water than in cold water ✓	4	'Minimum' amount of water MUST be stated
		(iv)	FIRST CHECK THE ANSWER ON THE ANSWER LINE yield = 31% award 2 marks M_r (repeat unit) = 226 $n(\text{nylon-6,6}) = 2.0/226 = 0.00885 \text{ (mol)} \checkmark$ $n(\text{hexane-1,6-dioic acid}) = 0.40/146 = 0.00274 \text{ (mol)}$ $0.00274/0.00885 \times 100 = 31 \text{ (\%)} \checkmark$ OR theoretical yield of acid = $0.00885 \times 146 = 1.29 \text{ g}$ $\text{yield} = \frac{0.40}{1.29} \times 100 = 31 \text{ (\%)} \checkmark$	2	ALLOW ECF from first marking point ALLOW 31.0
	(b)		('Fishy smell' caused by) $\text{H}_2\text{N}(\text{CH}_2)_6\text{NH}_2 \checkmark$	1	
Total				12	

Question		Answer	Marks	Guidance
2	(a) (i)*	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Develops a safe, fully detailed and accurate method that correctly includes apparatus. The full accurately labelled diagram reflects the method. The accurate observations/measurements recorded allow for a fair and accurate comparison between MgCO_3 and CaCO_3.</p> <p><i>The method is detailed, clear and logically structured. Accuracy is discussed in terms of the apparatus chosen. Observations/measurements are detailed and allows for a full comparison.</i></p> <p>Level 2 (3–4 marks) Develops a safe, detailed method that includes relevant apparatus. The diagram reflects this method and is labelled correctly. Details refer to accurate measurements. The observations/measurements recorded allow for a fair comparison between MgCO_3 and CaCO_3.</p> <p><i>The method is detailed and logical. Relevant apparatus is identified and there is reference to the accuracy of the measurements to be taken. The observations/measurements are relevant and supply evidence to allow a fair comparison.</i></p>	6	<p>Indicative scientific points may include</p> <p>Method with details</p> <ul style="list-style-type: none"> Crush lumps of calcium carbonate <i>to a powder using a pestle and mortar</i> Add calcium hydroxide to distilled water <i>and filter</i> Glass test tube/boiling tube to contain the solid fitted with a bung carrying a delivery tube which dips into a solution of calcium hydroxide in a test tube/boiling tube. Tube is heated <i>and is approximately horizontal</i>, solid (metal carbonate) and solution (calcium hydroxide) are clearly labelled in diagram. <p>Measurements</p> <ul style="list-style-type: none"> Measure time for cloudiness to first appear. Measure time taken to obscure a cross on paper OR alternative way of measuring relative thickness of ppt (of calcium carbonate) <p>Fair comparison</p> <ul style="list-style-type: none"> Equal mass of MgCO_3 and CaCO_3 Same volume and concentration of calcium hydroxide solution

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Question	Answer	Marks	Guidance
	<p>Level 1 (1–2 marks) Develops a basic safe method that includes relevant apparatus either in a correctly labelled diagram or named in the method. Suggests which observation(s)/measurement(s) need to be recorded to allow some comparison between MgCO_3 and CaCO_3.</p> <p><i>The method is basic and unstructured. Although relevant apparatus is labelled/referred to it lacks detail and accuracy. The observations/measurements are relevant but do not supply sufficient evidence to ensure a fair comparison.</i></p> <p>0 marks No response or no response worthy of credit.</p>		
(ii)	The ratio of charge on ion to its volume ✓	1	ALLOW charge/volume ALLOW size instead of volume
(iii)	Magnesium carbonate is less thermally stable than calcium carbonate (because) the smaller magnesium (Mg^{2+}) ion ✓ distorts the (large) carbonate (CO_3^{2-}) ion ✓	2	ORA

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Question		Answer	Marks	Guidance
	(iv)	<p>FIRST CHECK THE ANSWER ON THE ANSWER LINE</p> <p>minimum temperature = 674 K award 3 marks</p> <p>$\Delta_{\text{sys}}S = 27 + 214 - 66 = +175 \text{ J mol K}^{-1} \checkmark$</p> <p>Minimum temperature is where $\Delta_{\text{sys}}S = \Delta_{\text{surr}}S$</p> <p>$-\frac{118000}{T} = 175 \checkmark$</p> <p>$T = 11800 / 175 = 674 \text{ K} \checkmark$</p>	3	<p>ALLOW ECF from first marking point</p> <p>Correct unit required for mark. ALLOW 401 °C</p>
(b)	(i)	$(\frac{100}{24000} \times 84.3 =) 0.351 \text{ g} \checkmark$	1	
	(ii)	The volume of gas collected will be smaller \checkmark (because) the molar mass/ M_r of calcium carbonate is bigger than that of magnesium carbonate so a smaller number of moles of calcium carbonate is contained (in the same mass) \checkmark	2	
		Total	15	

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Question			Answer	Marks	Guidance
3	(a)	(i)	$\% \text{ error} = \frac{2 \times 0.5}{88.0 - 17.5} \times 100 = \frac{1.0}{70.5} \times 100$ $= 1.4 \% \checkmark$	1	Mark is for the answer, not the working out.
		(ii)	<p>FIRST CHECK THE ANSWER ON THE ANSWER LINE</p> <p>enthalpy change of combustion = -960 OR -961 (kJ mol⁻¹) award 3 marks</p> <p><i>ΔH calculation from experiment</i></p> <p>From results table (or from (i)) $\Delta T = 88.0 - 17.5 = 70.5$ °C $q = 100 \times 4.18 \times 70.5 = 29469$ J OR 29.469 kJ ✓</p> <p>From results table mass of ethanol = $20.33 - 18.92 = 1.41$ g M_r of ethanol = 46.0 Amount of ethanol = $\frac{1.41}{46.0} = 0.0307$ mol ✓</p> <p>$\Delta H = 29.469/0.0307 = -960$ OR -961 (kJ mol⁻¹) ✓</p>	3	<p>ALLOW 0.0306521 as this depends on rounding</p> <p>ECF from first marking point and second marking point</p>
	(b)	(i)	<p>A different number of moles of alcohol are burnt ✓ The alcohols have different enthalpy changes of combustion ✓</p>	2	
		(ii)	<p>Use the same start and end temperatures of water ✓ (Assume) the same proportion of energy transferred to the surroundings is transferred to the water (AW) ✓</p>	2	ALLOW use same temperature change of water
	(c)		<p>Black solid is carbon ✓ Due to incomplete combustion (of the fuel) ✓</p>	2	
Total				10	

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Question			Answer	Marks	Guidance
4	(a)	(i)	25/50/100 cm ³ measuring cylinder ✓	1	Capacity of measuring cylinder MUST be given DO NOT ALLOW pipette or burette or syringe
		(ii)	To allow hydrogen to escape ✓ To prevent air getting in (and oxidising Fe ²⁺ to Fe ³⁺) ✓	2	IGNORE to stop spray escaping
		(iii)	FIRST CHECK THE ANSWER ON THE ANSWER LINE percentage of iron = 98.1% award 4 marks Select appropriate titres $\frac{22.50 + 22.55 + 22.45}{3} = 22.50$ ✓ $n(\text{MnO}_4^-) = 22.50 \times \frac{0.02}{1000} = 0.00045$ (mol) ✓ $n(\text{Fe}^{2+})$ in 250 cm ³ = 0.00045 × 5 × 10 = 0.0225 (mol) ✓ % iron = $\frac{0.0225 \times 55.8}{1.28} \times 100 = 98.1\%$ ✓	4	ALLOW ECF from incorrect selection of data ALLOW 98% or 98.09%
	(b)	(i)	FIRST CHECK THE ANSWER ON THE ANSWER LINE concentration = 0.14 (g dm ⁻³) award 3 marks Mass of Mn = $\frac{2}{100} \times 0.25 = 0.005$ g ✓ $n(\text{KMnO}_4)$ in 100 cm ³ = $n(\text{Mn}) = 0.005/54.9 = 0.000091$ mol ✓ concentration of KMnO ₄ = 0.000091 × 158 × 10 = 0.14 (g dm ⁻³) ✓	3	ALLOW ECF from first marking point ALLOW 0.144 (g dm ⁻³)

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Question		Answer	Marks	Guidance
	(ii)	(Larger mass of KMnO_4 dissolved so) smaller weighing error ✓	1	

Specimen

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Question	Answer	Marks	Guidance
	<p>(iii)* <i>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</i></p> <p>Level 3 (5–6 marks) Applies knowledge of colorimetry to give a detailed step by step method to allow the production of suitable calibration curve over a suitable range of data. Detail about the dilutions and filters required will be included.</p> <p><i>The method is detailed, clear and logically structured. The measurements are carefully considered to ensure the calibration curve covers the appropriate range.</i></p> <p>Level 2 (3–4 marks) Applies knowledge of colorimetry to give steps which allow the production of a suitable calibration curve from the 2% Mn solution over a suitable range of data.</p> <p><i>The method is suitable and in a logical order. Measurements are included to allow an appropriate calibration curve to be produced. Response may lack the fine details of dilution/appropriate filter.</i></p> <p>Level 1 (1–2 marks) Applies knowledge of colorimetry to give a basic set of steps to produce a calibration curve from the 2% Mn solution.</p> <p><i>The method is basic and unstructured. There is little or no detail in the description of steps</i></p> <p>0 marks No response or no response worthy of credit.</p>	6	<p>Indicative scientific points may include:</p> <p>Steps (<i>italics indicate details that would differentiate higher level from lower level answers</i>):</p> <ul style="list-style-type: none"> • Dilute 2% Mn solution <i>using burettes and pipettes</i> • To include range 0.1 to 0.4% <i>includes volumes to achieve dilution (these could include 2 cm³ of 2% + 8 cm³ of water to give 0.4%, or details of a serial dilution,)</i> • Mix each dilution thoroughly <i>to ensure standard solution</i> • Makes a zero reading (on the colorimeter) <i>using water/base solvent</i> • Selects an appropriate filter/wavelength <i>chooses green-blue filter OR sets (spectrophotometer) to green-blue</i> • Measures absorbance of diluted solutions <i>ensure each sample is in a clean cuvette</i> • Plot absorbance against dilution <i>and draw line of best fit</i>

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Question		Answer	Marks	Guidance
	(iv)	The line should be drawn through the zero-zero point ✓	1	
	(v)	0.17% ✓	1	ALLOW between 0.16 and 0.18%
(c)	(i)	Titration 4 ✓ (because) it requires the smallest volume of KMnO_4 solution ✓	2	
	(ii)	The solution contains nitric acid/potassium iodate(VII) that would also oxidise Fe^{2+} ✓	1	ALLOW the solution contains other oxidising agents
	(d)	Use the solution in an electrochemical cell ✓	1	
		Total	23	