OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

AS Level Chemistry B (Salters)
H033/02 Chemistry in depth

PRACTICE MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 70

This document consists of 16 pages

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:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

   b. 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 **1(d)** and **3(f)**.

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

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.

Question			Answer	Marks	Guidance
1	(a)		Compound **C**: but-1-ene ✓ **C** decolourises bromine water (**B** does not) ✓	2	**IGNORE** spaces and presence or absence of dashes
	(b)		<table><tr><td>x = 120°</td><td>3 areas of electron density (around the C)</td></tr><tr><td>y = 109.5°</td><td>4 areas of electron density (around the C)</td></tr></table> ✓✓ Idea of positioning to minimise repulsion. ✓	3	**ALLOW** y = 108–110° **For the first 2 marking points:** 1 mark for each correct row or column. **ALLOW** sets/groups of electrons for areas of electron density **DO NOT ALLOW pairs** of electrons for x **DO NOT ALLOW** repel as much as possible
	(c)		Idea of lack of free rotation ✓ (Compound **C** does not show *E*/*Z* isomerism because) one of the carbons has 2 Hs / 2 of the same atom/group ✓	2	

Question			Answer	Marks	Guidance
	(d)*		*Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks)** **Method:** Clear method for measuring temp change of known volume of water by known mass of fuel that could be followed by another. **Processing:** Calculating energy transferred to water **AND** idea of scaling up for 1 mole of fuel. *The descriptions of the method and data processing are clear and logically structured fully covering all aspects.* **Level 2 (3–4 marks)** **Method:** Ideas of heating measured volume of water and measuring temperature changes. **Processing:** Energy transferred to water found, but less clear on converting to energy per mole. *The descriptions of the method and data processing are presented with some structure. The information is in the most-part relevant.* **Level 1 (1–2 marks)** **Method:** Idea of heating water and measuring temperature change. **Processing:** Idea that heat is transferred from burning fuel to heat water.	**6**	**Indicative scientific points may include** **Method:** Clear and logical steps to measure: • temp change of water • known volume of water • burning measured mass of fuel • using appropriate equipment, (spirit burner, calorimeter). **Processing:** • Use of $E = mc\Delta T$ for energy transferred. • Scaling up for 1 mole of fuel. • Use of $n = m/M$ • Energy per mole = Energy transferred/moles. .

Question			Answer	Marks	Guidance
			The information is basic and communicated in an unstructured way. **0 marks** No response or no response worthy of credit.		
	(e)		**Any two from** ✓✓ Incomplete combustion Evaporation of fuel from wick of the burner Not carried out under standard conditions.	**2**	One mark for each valid reason.
	(f)	**(i)**	$6C(s) + 7H_2(g) + 9½\ O_2(g)$ ✓ → $6CO_2(g) + 7H_2O(l)$ $C_6H_{14}(l) + 9½\ O_2(g)$	**1**	Species **AND** state symbols required.
		(ii)	**FIRST CHECK ANSWER ON THE ANSWER LINE** $\Delta_f H^e$ (C_6H_{14}) = –197 (kJ mol^{-1}) award 2 marks $\Delta_f H^e(C_6H_{14}) = 6\Delta_c H^e$(carbon) + $7\Delta_c H^e$(hydrogen) – $\Delta_c H^e$ (hexane) = (6 × –393) + (7 × –286) + 4163 ✓ = –197 (kJ mol^{-1}) ✓	**2**	**ECF** on incorrect equation e.g. +4270 scores 1 mark, no multiples but correct signs +197 scores 1 mark, **ECF** on incorrect signs
			Total	**18**	

Question			Answer	Marks	Guidance
2	(a)		Fully labelled diagram to show heating of sample and collection of gas ✓ Means of measurement of volume of CO_2 ✓ Fair test: equal masses of limestone **OR** similar heating conditions ✓ More $CaCO_3$ will give off more CO_2 **AW** ✓	**4**	Collection of gas should be over water or in a gas syringe
	(b)	**(i)**	**FIRST CHECK ANSWER ON THE ANSWER LINE** amount of CO_2 = 0.101(214) mol award 2 marks Use of correct units (T = 1123 K, $V = 9.00 \times 10^{-3}$ m^3, P = 105 000 Pa)✓ Substitution into ideal gas equation and evaluation $(9.00 \times 10^{-3} \times 105\,000)/(8.314 \times 1123) = 0.101(214)$ (mol) ✓	**2**	**ALLOW** 3 or more sf **ALLOW ECF** from first mark to second
	(b)	**(ii)**	**FIRST CHECK ANSWER ON ANSWER LINE** percentage purity = 67.5% award 2 marks mass $CaCO_3$ = 0.10124 × 100.1 evaluated (= 10.13 g) ✓ % purity = 67.5 (= 10.13 × 100/15.0), evaluated to 3 sig figs ✓	**2**	**ALLOW** ecf from **(b)(i)**, e.g. mass = 13.39 % purity = 89.2 (failure to convert T) **ALLOW** 67.4 from using rounded answer to **(b)(i)** Answer **must** be to 3 sig figs (correctly rounded) for second mark.
	(c)	**(i)**	Both (elements) are in Group 2 / have the same no. of electrons in the outer shell / have 2 electrons in the outer shell ✓	**1**	

Question			Answer	Marks	Guidance
	(c)	(ii)	Magnesium ions have a higher charge density/smaller radius so distort/polarise the carbonate ion more ✓ Decomposition (of magnesium carbonate) occurs at a lower temperature/more easily/more quickly ✓	2	Idea of smaller ions distorting the CO_3^{2-} more **ALLOW** magnesium carbonate has a lower thermal stability **ORA**
	(d)		$n(MgSO_4)$ (= 12.22/120.4) = 0.1015 (mol) ✓ $n(H_2O)$ (= (25.00 – 12.22)/18.0) = 0.71 (mol) ✓ Ratio 1 : 7 so x = 7 ✓	3	**ALLOW** M_r of hydrated salt (= 25.0/0.1015) = 246.3 ✓ $n(H_2O)$ (= (246.3 – 120.4)/18.0) = 7 ✓ Final answer without working does not score.
	(e)		$S(g) \rightarrow S^+(g) + e^-$ Equation **AND** state symbols ✓ (S has the higher IE because) More protons in the nucleus of sulfur ✓ Electrons in same shell / elements in same period / similar radius ✓ Outer electron attracted to the nucleus more strongly in S ✓	4	**ALLOW** e for e^- **IGNORE** state symbol on the electron **ORA** throughout
			Total	18	

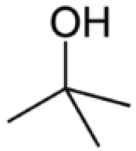
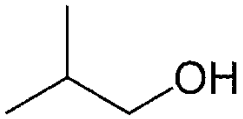
Question			Answer	Marks	Guidance
3	(a)		Rate of forward reaction = rate of reverse reaction ✓ overall concentrations of substances constant (despite forward and reverse reactions occurring) ✓	2	**IGNORE** closed system
	(b)		(Position of) eqm shifts to the right **OR** more ClO^- forms ✓	1	
	(c)		(Value is high) (position of) eqm is to the right ✓	1	**ALLOW** reaction goes (almost) to completion
	(d)		**FIRST CHECK ANSWER ON THE ANSWER LINE** $[Cl^-] = 1.96 \times 10^{-3}$ mol dm^{-3} award 2 marks ($[ClO^-] = [Cl^-]$) $[Cl^-] = \sqrt{(3.10 \times 10^{10} \times (1.00 \times 10^{-5})^2 \times 1.24 \times 10^{-6})}$ ✓ evaluation (1.96×10^{-3} mol dm^{-3}) ✓	2	**ALLOW ECF** on incorrect expression (stated or implied by calculation) as long as K_c and both concentrations are involved.
	(e)	(i)	$2ClO^- \rightarrow 2Cl^- + O_2$ ✓	1	**IGNORE** state symbols **ALLOW** halves and multiples
	(e)	(ii)	Selects suitable scale **AND** axes (including correct labels) ✓ Points plotted ✓ line of best fit excluding anomaly ✓ Concentration 20.90% by mass ✓	4	**ALLOW** graph plotted in landscape format More than half the graph paper should be used Line does not include point for 6 days **ALLOW** 20.75–21.00 3 or more sig figs
	(e)	(iii)	Mol. mass of NaClO = 74.5 **AND** conversion of % by mass to grams per dm^3 ✓ Answer to **(ii)** × 10 / 74.5 (= 2.81 mol dm^{-3}) evaluated **AND** no longer effective ✓	2	**ALLOW ECF** from **(e)(ii)** **ALLOW ECF** from incorrect M_r

Question	Answer	Marks	Guidance
(f)*	*Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks):** • There is a clear description of a catalyst **AND** explanation of the type of catalysis. • All the stages in the mechanism are fully explained **AND** the fact that C*l* radicals are regenerated is appreciated. Use of technical terms such as radical, propagation, regenerated etc. *There is a well-developed, correct description of both parts in each bullet point which is clear and logically structured. The information presented is relevant and correctly uses technical terms.* **Level 2 (3–4 marks):** • There is a clear description of a catalyst **AND** explanation of the type of catalysis. • All the stages in the mechanism are fully explained **OR** the fact that C*l* radicals are regenerated. *The description has some structure. The information presented is in the most-part relevant and correctly uses some technical terms.* **Level 1 (1–2 marks):** • There is a clear description of a catalyst **OR** explanation of the type of catalysis. • The explanation shows some understanding but may be lacking in detail or logical ordering and use of technical terms. *The description is basic and communicated in an*	**6**	**Indicative scientific points may include:** **Description:** A catalyst speeds up the reaction and is left unchanged at the end **OR** provides an alternative pathway with lower activation energy. **Type:** Homogeneous as catalyst and reactants are in the same physical state. **Formation of radicals:** C–C*l* bonds in CFCs broken by (lower energy) UV light **Mechanism:** $Cl\bullet + O_3 \rightarrow ClO\bullet + O_2$ $ClO\bullet + O \rightarrow Cl\bullet + O_2$ Overall: $O_3 + O \rightarrow 2O_2$ C*l*• radicals regenerated so catalyse the breakdown of many O_3 molecules.

Question			Answer	Marks	Guidance
			unstructured way. There is limited use of technical terms. **0 marks** No response or no response worthy of credit.		
			Total	**19**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>Test: Add (neutral) iron(III)chloride✓
Ester D: Purple colour AND
Ester E: stays orange/no effect✓</td><td>2</td><td>ALLOW reaction with bromine water ✓
Ester D goes colourless, ester E stays orange ✓
Observation dependent on getting correct test.</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Conditions: conc. HCl/conc. H_2SO_4 AND reflux/heat ✓

$CH_3COOH + C_3H_7OH \rightleftharpoons CH_3COOC_3H_7 + H_2O$
Acid and alcohol correct ✓
Completely correct ✓</td><td>3</td><td>ALLOW named acids
DO NOT ALLOW just ‘acid’

eqm sign not required
ALLOW any unambiguous representations of organic molecules.
IGNORE state symbols</td></tr>
<tr><td></td><td>(c)</td><td></td><td>(Fractional) distillation ✓</td><td>1</td><td></td></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><td>Skeletal Formula</td><td>  </td><td>  </td></tr>
<tr><td>Systematic name</td><td>methyl propan-2-ol</td><td>methyl propan-1-ol</td></tr>
<tr><td>Obs with Cr_2O_7/H^+</td><td>No effect/stays orange</td><td>(Changes from orange) to green</td></tr>
</table>
1 mark each formula

1 mark for each name AND observation</td><td>4</td><td>IF formulae are not skeletal, allow 1 mark for 2 structurally correct formulae.

ALLOW 1 mark for 2 correct names OR 2 correct observations
ALLOW 2-methyl propan-2-ol and 2-methyl propan-1-ol</td></tr>
</table>

Question			Answer	Marks	Guidance
	(e)		Product is butanoic acid ✓ Mass spectrum mol. mass is 88 ✓ IR broad peak at 2500–3200 cm^{-1} carboxylic O–H ✓ Original alcohol was butan-1-ol ✓ Conditions for the reaction (heat and) reflux ✓	5	**ALLOW** structural formula, C_3H_7COOH **IGNORE** formula
			Total	15	