



Practice Paper P2

A level

H433/03 Practical Skills in Chemistry

MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 60

Final

MARKING INSTRUCTIONS**PREPARATION FOR MARKING****RM ASSESSOR**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM 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.
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

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 RM Assessor 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 RM Assessor 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 RM Assessor **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 RM Assessor 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 **1c** and **3a**.

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

12. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

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

13. Subject-specific Marking Instructions

INTRODUCTION

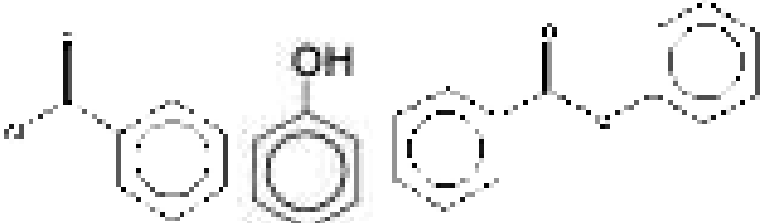
Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- 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	AO element	Guidance
1	(a)			1	1.1	ALLOW any recognisable structure ALLOW Kekule structures
	(b)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 50.5(0)-51.0 (%) award three marks Correct use of masses from table for both phenol used (5.02 g) and phenyl benzoate formed (5.34 g) ✓ Correct calculation for moles used (0.0534) and hence mass for 100% conversion (moles x 198) = 10.57 ✓ Correct % yield calculation $5.34 \div 10.57 \times 100 = 50.50(\%)$ ✓	3	2.8 x3	ALLOW ecf's after first step ALLOW three or more sf ALLOW moles of phenol used (0.0534) and moles of phenyl benzoate formed = $5.34/198$ OR 0.270 % yield (= $0.0270/0.0534 \times 100$) = 50.56% evaluated
		(ii)	ANY one of: Reaction did not go to completion/incomplete reaction Loss of solid in transfer between apparatus AW ✓	1	2.5	ALLOW side reactions occur/ by-products formed ALLOW specific side reactions e.g. benzoyl chloride formed benzoic acid in the water solvent/ benzoate ions in the alkaline conditions
		(iii)	Melts over temperature range/Lower mp indicates presence of impurities / very close to literature value so level of impurities small AW ✓	1	3.2	ALLOW statements such as 'sharpness (small range) suggests near purity'

Question		Answer	Marks	AO element	Guidance
	(c)*	<i>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</i> Level 3 (5–6 marks) Description <u>and</u> detailed explanation of most stages in the recrystallization. AND Specifies some of the desirable properties of a suitable solvent. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Description of most stages in the recrystallisation with a limited explanation of the steps. AND Specifies some of the desirable properties of a suitable solvent. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Limited description of stages in the recrystallisation with detailed explanation of some of the stages. AND Specifies some of the desirable properties of a suitable solvent. <i>The information is basic and communicated in an unstructured way. The information is supported by limited</i>	6	3.3 3.4	Indicative scientific points may include: Description of steps in recrystallisation - dissolves organic solid in a minimum volume of (suitable) hot solvent - filters hot solution - cools solution - re-filters - allows crystals to dry Explanation of steps - vacuum filtration used so solution remains hot - insoluble impurities removed - crystals formed when solution cools vacuum filtered again; soluble impurities go through in solution - washed with cold solvent (minimises further loss of product but ensures any soluble impurities left washed through) - Crystals left to either air dry or in oven at a temperature lower than mp of solid Desirable properties of a suitable solvent - solid should be very soluble in solvent chosen at high temps, but not very soluble at low temps - soluble impurities remain in solution even at low temps

			<i>evidence and the relationship to the evidence may not be clear.</i> 0 marks No response or no response worthy of credit			
			Total	12		

Question			Answer	Marks	AO element	Guidance
2	(a)	i	difficult to match colour with exact pH value using UI soln.✓	1	2.7	ALLOW AW
		ii	use two (buffer) solutions of known pH✓	1	2.7	IGNORE refs to temperature adjustment IGNORE specific pH values quoted
	(b)	i	$\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}^+$	1	1.2	ALLOW $\text{CH}_3\text{COOH} + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}_3\text{O}^+$
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = $1.58\text{--}1.78 \times 10^{-5}$ (mol dm⁻³) and some signs of working/lines on graph award four marks Just correct evaluation without apparent use of graph award three marks. volume at half-neutralisation using graph = 12.5cm^3✓ value of pH from graph at half neutralisation pH = pK_a = 4.75-4.8 ✓ convert pK_a to K_a = K_a ($10^{-4.8}$) = $1.58\text{--}1.78 \times 10^{-5}$ (mol dm⁻³) ✓	4	2.8 x2 3.3 x2	#If there are no signs of working on graph allow only a maximum of 3 marks.  (first calculation mark – taking line up at 12.5cm^3 and second for crossing horizontally to pH 4.8). ALLOW values that round to a range of $1.6\text{--}2.0 \times 10^{-5}$ ALLOW 2sig figs or more
	(c)	i	Solution that resists change in pH on addition of (small quantities) acid or alkali ✓ Addition of salt means high concn. of base and acid species✓ addition of acid results in H⁺ removed by reaction with CH₃COO⁻ ✓ addition of alkali results in OH⁻ removed by reaction with H⁺ ions and CH₃COOH further ionises to replace them ✓	4	1.1 2.1 x3	
		ii	No (pH) change ✓ ratio of concentration of acid to salt remains the same ✓	2	2.7 x2	

Question			Answer	Marks	AO element	Guidance
	(d)	i	phenolphthalein as equivalence point in alkaline conditions ✓ Methyl orange would already have changed colour ✓	2	3.4 x2	
		ii	Methyl orange dissociates more because water at pH 7 ✓ Yellow at this pH so In^- in excess ✓	2	2.6 x2	ALLOW answers in terms of pK_a and pH. Methyl orange, lower pK_a , so higher K_a more dissociated.
			Total	17		

Question		Answer	Marks	AO element	Guidance
3	a*	<i>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</i> Level 3 (5–6 marks) Description and a detailed explanation linking the rate of evaporation and the type and strength of imb in the liquids. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Description and an attempt at an explanation linking the rate of evaporation and the type and strength of imb in the liquids. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) A basic description of link between rate of evaporation, absorption of energy and cooling effect OR An explanation linking the rate of evaporation and the type and strength of imb in the liquids. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i> 0 marks No response or no response worthy of credit	6	3.1 x3 3.2 x3	Indicative scientific points may include: Description - liquid drops evaporate at different rates - evaporation endothermic process/enthalpy change of evaporation positive - greater rate of evaporation, greater temp.drop - liquids evaporate faster from left to right Explanation - the stronger the imbs the slower the rate of evaporation - water and ethanol can both H-bond - water forms two H-bonds per molecule, ethanol one - propanone has pd:pd as strongest imb - alkanes have id:id strongest imb - order of strength is H-bonds>pd:pd>id:id - branched isomer(2-methybutane) molecules can't get as close to each other as straight isomer (pentane), therefore id:id weaker

Question			Answer	Marks	AO element	Guidance
	(b)	i	Reduce heat <u>exchange/AW</u> with surroundings	1	1.1	DO NOT ALLOW reduce heat loss/gain on own IGNORE insulation
		ii	More energy used in breaking A-A (and B-B) bonds than 'given back' when A-B bonds form ✓ This suggests A-B bonds are weaker than A-A (and B-B) bonds ✓	2	3.2 x2	
		iii	Intermolecular bonds broken and made all of similar strength/A-A,B-B,A-B imbs have similar strength✓	1	3.2	
	(c)	i	FIRST CHECK THE ANSWER ON ANSWER LINE If both answers = 12 (cm ³) award three marks Mass of each liquid = 0.15 x M _r (trichloromethane=17.9(25); methyl ethanoate=11.1) ✓ Vol = mass ÷ density (17.925÷1.48=12.11; 11.1÷0.93=11.9) ✓ Appropriate sig figs(2) ... =12 (cm ³) and 12 (cm ³) ✓	3	2.8 x3	
		ii	Burette	1	3.4	ALLOW graduated pipette
		iii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 2.9(...) or 3 (kJmol ⁻¹) award three marks E = m x c x ΔT for each (trichloromethane 17.925 x 0.96 x 11.0 = 189.2(88)J) (methyl ethanoate 11.1 x 2.10 x 11.0 = 256.4(1)J) ✓ Total energy transfer (189.2(88) + 256.4(1) = 445.6(98)J ✓ per mole (of H-bond) = 445.6(98) ÷ 0.15= 2971.3(2)Jmol ⁻¹ = 2.9/3(kJmol ⁻¹) ✓	3	3.1 x3	
			Total	17		

Question			Answer	Marks	AO element	Guidance
4	(a)	i	did not mix/invert sulfamic acid solution ✓ solution more concentrated at bottom ✓	2	2.7 x2	
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.87 (mol dm ⁻³) award four marks takes average of two concordant results (=21.825)✓ calculates moles of hydroxide (= 2.183 x 10 ⁻³)✓ uses eqn to determine moles of acid (=2.183 x 10 ⁻²) ✓ calculates concn. (i.e. mol per dm ³) to 2sig figs = 0.87 (mol dm ⁻³) ✓	4	3.4 2.8 x3	
		iii	solid absorbs water so mass/ concentration of sodium hydroxide actually dissolved is less ✓ titre value therefore greater giving high result ✓	2	2.8 3.1	
	(b)	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 98.6/99 award four marks moles of CO ₂ produced 146/24000 = 6.083 x10 ⁻³ ✓ uses eqn. to determine moles of acid (above ans. x2) = 1.217 x 10 ⁻² ✓ 1.217 x 10 ⁻² moles = 1.20g ✓ scales mass up to give mass of 1 mole of acid i.e. 1.20/1.217 x 10 ⁻² =98.6(03)✓	4	2.8	
		ii	1/146 x 100 = 0.68(...)/0.7 (%)✓	1	2.4	DO NOT ALLOW ecf's
		iii	some of gas lost when putting on bung OR some of gas dissolves	1	3.2	
			Total	14		