



Cambridge
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CHEMISTRY

9701/33

Paper 3 Advanced Practical Skills 1

May/June 2019

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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This document consists of **9** printed pages.

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	I Constructs a table for results 4 columns, 2 rows (or vice versa) No data needed for this mark.	1
	II <u>Correct headings and units given on page 4.</u> (Volume of) FA 1 and (Volume of distilled) water in cm ³ or / cm ³ or (cm ³) (reject ml) Time in seconds or /s or (s). Rate in s ⁻¹ or / s ⁻¹ or (s ⁻¹) (reject 1 / s) Ignore 500.	1
	III Precision of readings All times recorded to the nearest second and all volumes of FA 1 and water recorded to the nearest 0.05 cm ³ . A minimum of 4 experiments must be carried out and these must include volumes of FA 1 = 45.00 and 20.00 cm ³ for this mark.	1
	IV 3 additional volumes chosen with intervals not less than 5.00 cm ³ and all volumes of FA 1 ≥ 25.00 cm ³ (Allow 4 extra expts: 25, 30, 35, 40 cm ³)	1
	V In all 3 additional experiments water is added to make a total of 45.00 cm ³ (i.e. total FA 1 + water)	1
	VI Reaction times all decreasing as volume of FA 1 increases for all five experiments.	1
	Calculate the ratio t_{20} / t_{45} to 2 dp. If either/both expts 1 and 2 are omitted then VII and VIII are not available.	
	VII Award 1 mark for ratio between 2.10 and 2.60.	1
	VIII Award 2 marks for ratio between 2.20 and 2.50.	1
	IX All rates correctly calculated using $\frac{500}{\text{time}}$ for at least 3 expts. All recorded to a minimum of 2 sf.	1

Question	Answer	Marks
1(b)	I Rate on y-axis and volume of FA 1 on the x-axis and some numbers for scales and with unambiguous names or units.	1
	II Linear scales chosen so that the graph occupies more than half the available length for both axes (count origin if included only if used by a point or extrapolation to x- or y-axis) (7 vertical, 5 horizontal big squares used)	1
	III All points recorded and accurately plotted. (A point needed for all rates calculated, minimum 4 rates) If the point should be on a line it must be on the line. If the point should not be on a line it must not be on a line and must be correct to within half a small square.	1
	IV Line of best fit drawn (straight or smoothly curved line) Ignore points marked anomalous	1
1(c)	Answer must match candidate's graph. (Rate is) proportional (to conc of thiosulfate)	1
1(d)	I Shows use of: time for experiment 2 (20 cm³) and time +2 or –2 (or ± 2 or shows use of 2)	1
	II Shows use of: $\frac{500}{(\text{candidate time for expt 2}) + 2}$	1
1(e)(i)	Concludes: Time would be greater AND as <u>depth</u> of solution is less or sulfur is spread over a larger (cross-sectional) area.	1
1(e)(ii)	Concludes: Not enough S / ppt / solid is produced (to obscure insert)	1

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Question	Answer	Marks
2(a)	I Unambiguous headings for 3 masses and 3 temperatures AND Correct units.	1
	II Both balance readings recorded to the same dp AND Both thermometer readings recorded to either 0.0 or 0.5 °C	1
	III and IV Compare $\Delta T / m$ for candidate with that of supervisor. Award 2 marks if δ is within 0.15 of supervisor Award 1 mark if δ is within 0.30 of supervisor	2
2(b)(i)	Correctly calculates mass used AND Correctly calculates $\text{mass} / 248.2$ AND answer displayed to 3 or 4 sf	1
2(b)(ii)	Correctly calculates temperature change AND Correctly calculates $\Delta T \times 4.2 \times 25$ to a minimum of 2 sf	1
2(b)(iii)	Correctly uses $\text{ans(ii)} / \text{ans(i)}$ AND answer given to a minimum of 2 sf AND + sign AND appropriate units of kJ mol^{-1} or J mol^{-1}	1

Question	Answer	Marks
2(c)	Each correct suggestion = * Each correct explanation = * (Explanation must follow from available suggestion) 2 * = 1 mark, 3* = 2 marks Insulate the cup (or use a vacuum flask or use lid) * to prevent heat energy entering * Use a thermometer with smaller scale divisions / finer calibration / reads to more dp* to record the temperature with greater precision / increase accuracy (of temperature reading) * Use more FA 3 or less water * to make ΔT greater * Use burette or pipette (instead of measuring cylinder) * to record the volume with greater precision / increase accuracy (of volume reading) * Allow decrease in % error or increase accuracy only once as an explanation. If more than two suggestions given mark the first two only.	2
2(d)	Concludes: Solution was colder / lower temperature (so longer time/ lower rate)	1

Question	Answer	Marks
FA 4 is H_2SO_4 ; FA 5 is CuCO_3		
3(a)(i)	Fizzing / effervescence / bubbles	1
	Uses limewater to test for CO_2 AND records positive result for gas / CO_2 / fizz (if no fizz recorded then gas / CO_2 must be specified) Allowed observations: limewater turns milky/ cloudy white/ forms white ppt.	1
3(a)(ii)	BaCl_2 or $\text{Ba}(\text{NO}_3)_2$ and HCl or HNO_3 (or names) Reject Ba^{2+} OR acidified KMnO_4 / potassium manganate(VII) / potassium permanganate / $\text{K}_2\text{Cr}_2\text{O}_7$ / potassium dichromate OR add named acid and test any gas with acidified KMnO_4 paper / $\text{K}_2\text{Cr}_2\text{O}_7$ paper	1
	White ppt insoluble in acid OR remains purple (ignore colour of ppt) / remains orange OR paper remains purple / remains orange	1
3(a)(iii)	Concludes: H_2SO_4	1

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Question	Answer	Marks
3(b)(i)	Solid / it / FA 5 turns black / green to black (ppt is CON)	1
	Condensation / water vapour / steam / tube becomes wet	1
	Effervescence / fizzing / bubbling AND blue solution / liquid formed Reject dark blue / green-blue for colour of solution. Reject blue solid / ppt. Ignore any incorrect gas test results.	1
	(pale) blue ppt AND insoluble in excess	1
	(pale) blue ppt AND (soluble) in excess to dark / deep blue solution Reject ink blue	1
3(b)(ii)	Concludes: Thermal decomposition Allow dehydration if water observed on heating.	1
3(b)(iii)	Concludes: Cu^{2+} AND CO_3^{2-} This is a stand-alone mark. Allow Cu^{2+} AND OH^- only if condensation in (b)(i)	1