Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

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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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.

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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 Correct headings and units given on page 4. (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** $\geqslant$ 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 $^{500}/_{time}$ for at least 3 expts. All recorded to a minimum of 2 sf.	**1**

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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 cm^3**) **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 depth 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 ΔT / 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 $^{mass}/_{248.2}$ **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 $^{ans\textbf{(ii)}}/_{ans\textbf{(i)}}$ **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 $Ba(NO_3)_2$ **and** HCl or HNO_3 (or names) **Reject** Ba^{2+} **OR** acidified $KMnO_4$ / potassium manganate(VII) / potassium permanganate / $K_2Cr_2O_7$ / potassium dichromate **OR** add **named** acid and test any gas with acidified $KMnO_4$ paper / $K_2Cr_2O_7$ 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**

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