



Cambridge Pre-U

CHEMISTRY

9791/04

Paper 4 Practical

May/June 2022

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.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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.

Question	Answer	Marks
1(a)	<p>I tabulates initial burette readings, final burette readings and volume of FA 2 added. (1)</p> <p>II appropriate headings and units for titration results; in cm^3 or (cm^3) or / cm^3 (1)</p> <p>III all accurate burette readings and the volumes of FA 2 added are given to the nearest 0.05 cm^3 (1)</p> <p>IV two or more uncorrected titres within 0.20 cm^3 (1)</p> <p>V, VI, VII Examiner calculates $\delta = \text{supervisor value} - \text{corrected candidate value}$ Award V, VI and VII if $\delta \leq 0.20$ Award V and VI only if $0.20 < \delta \leq 0.30$ Award V only if $0.30 < \delta \leq 0.50$ (3)</p>	7
1(b)	Selects titres within 0.20 cm^3 , calculates the correct mean and gives answer to the same number of decimal places as the most precise burette reading.	1
1(c)(i)	shows correct working: $\mathbf{1(b)} / 1000 \times 0.0100$ (1) correctly calculates: $\frac{1}{2} \times 150 / 25 \times \text{ans}$ (1)	2
1(c)(ii)	correctly calculates: $\text{ans}\mathbf{1(c)(i)} \times 1000 / 50$ (1)	1
1(c)(iii)	$0.0200 \text{ mol dm}^{-3}$	1
1(c)(iv)	correctly calculates rate = $[\text{ans}\mathbf{1(c)(iii)} - \text{ans}\mathbf{1(c)(ii)}] / 90$ (1) units: $\text{mol dm}^{-3} \text{ s}^{-1}$ (1)	2
1(d)(i)	mol of $\text{H}_2\text{SO}_4 = 0.0125 \text{ mol}$ (1) conc of $\text{NaHCO}_3 = 0.417 \text{ mol dm}^{-3}$ (1)	2
1(d)(ii)	to stop the reaction as H^+ is the catalyst (1)	1

Question	Answer	Marks
1(d)(iii)	sodium hydrogencarbonate is in excess OR total volume is then made up in a volumetric flask (1)	1

Question	Answer	Marks
FA 3 = citric acid		
2(a)	I unambiguous headings for each entry AND masses in g or / g or (g); temperature in °C (1)	3
	II all temperatures recorded to at least 0.5 °C (1)	
	III compare ΔT to supervisor and award if within 1.0 °C (1)	
2(b)(i)	correct answer for $\Delta T \times 4.2 \times 30$ (1)	1
2(b)(ii)	correct answer AND correct units of either J mol^{-1} or kJ mol^{-1} (1)	1
2(c)	At least one mark from: to reduce heat gain: carry out in a vacuum flask use a graphical method insulated; Any one mark from the following: (to reduce temp error:) more accurate thermometer, increased mass of compound, reduced volume of water, use of graphical method; (to improve measurement of volume:) measure with burette etc.; (to improve measurement of mass:) weigh added mass by difference;	2

Question	Answer	Marks
2(d)(i)	records temp rise OR records both temperature readings (1)	1
2(d)(ii)	selects reagent to test for acid: carbonate solution, AND correct observation (1) identifies COOH (1)	2

Question	Answer	Marks
FA 4 = NaNO₃; FA 5 = FeCl₃/ H⁺(aq); FA 6 = Na₂S₂O₃(aq)		
3(a)	observe melting (1) lit splint and oxygen identified (1)	2
3(b)(i)	gas produced that turns damp red litmus turns blue (1)	1
3(b)(ii)	adds acid and observes no reaction OR KMnO ₄ and observes no reaction (1) identifies nitrate (1)	2
3(c)(i)	solution darkens (1) on standing purple / dark solution becomes (almost) colourless (1) add NaOH gives a (dirty) green ppt (1)	3
3(c)(ii)	purple colour / dark solution is a complex involving thiosulfate as a ligand (1) Fe ²⁺ has formed from Fe ³⁺ (1)	2

Question	Answer	Marks
3(c)(iii)	(faint) white ppt (on adding a few drops) OR yellow / brown <u>solution</u> to a black ppt on standing (1) no change on adding ammonia (1)	2