

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the May/June 2015 series

9701 CHEMISTRY

9701/34

Paper 3 (Advanced Practical Skills 2),
maximum raw mark 40

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.

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| Question | Indicative material | Mark | Total |
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| 1 (a) (i) | Initial and final burette readings and titre unambiguously recorded in rough and accurate titrations. (2×2 accurate boxes) | 1 | |
| (ii) | Headings and units correct for accurate titration and headings match readings. <i>Initial/final (burette) reading/volume or Reading/volume at start/finish and Titre or Volume/FB 2 added/used [not “difference”] and Units: (cm³) or /cm³ or in cm³ or cm³ by every entry</i> | 1 | |
| (iii) | All accurate burette readings to 0.05 cm ³ Do not award this mark if: <i>50.(00) is used as an initial burette reading; more than one final burette reading is 50.(00); any burette reading is greater than 50.(00).</i> | 1 | |
| (iv) | Two accurate titres within 0.10 cm ³ . <i>Do not award if 3rd titre > 0.10 cm³ away from any other unless a further titration is also carried out which is within 0.1 cm³ of any other. Do not award the mark if any ‘accurate’ burette readings (apart from initial 0) are given to zero dp.</i> | 1 | |
| <p><i>Examiner checks and corrects titre subtractions where necessary. Examiner selects the best mean titre using a hierarchy: two identical titres within 0.05 cm³, two or more titres within 0.10 cm³ etc. Examiner subtracts (corrected) candidate’s titre from Supervisor’s titre.</i></p> | | | |
| | <p>Award V, VI and VII if $\delta < 0.20 \text{ cm}^3$. Award V and VI if $0.20 < \delta < 0.40 \text{ cm}^3$. Award V if $0.40 < \delta < 0.60 \text{ cm}^3$. <i>Spread penalty: if the two ‘best’ titres are $\geq 0.50 \text{ cm}^3$ apart, cancel one of the Q marks</i></p> | 1 1 1 | [7] |
| (b) | <p>Candidate must average two (or more) titres that are all within 0.20 cm³. Working must be shown or ticks must be put next to the two (or more) accurate readings selected. The mean should normally be quoted to 2 dp rounded to the nearest 0.01. Example: 26.667 must be rounded to 26.67.</p> <p>Two special cases where the mean may not be to 2 dp: allow mean to 3 dp only for 0.025 or 0.075 e.g. 26.325; allow mean to 1 dp if all accurate burette readings were given to 1 dp and the mean is exactly correct. e.g. 26.0 and 26.2 = 26.1 is correct but 26.0 and 26.1 = 26.1 is incorrect.</p> <p>Note: The candidate’s mean will sometimes be marked as correct even if it is different from the mean calculated by the examiner for the purpose of assessing accuracy.</p> | 1 | [1] |
| (c)(i)(ii) | (answer to (b) × 0.1) / 1000 and (ii) = (i) and answer to 3 or 4 sf | 1 | |

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| Question | Indicative material | Mark | Total |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|
| (iii) | (c)(ii) $\times 1000/25$ and answer expressed to 3 or 4 sf. | 1 | |
| (iv) | Correct expression is shown (c)(iii) $\times 1000/5.91$ | 1 | [3] |
| (d) | 15 – (c)(iv) $\times 100/15$ or 15 – (c)(iv) $\times 100/(c)(iv)$ | 1 | [1] |
| Total | | | [12] |
| 2 (a) | I (Table of) results with unambiguous headings (not weight) showing <ul style="list-style-type: none"> • 4 balance readings • 4 thermometer readings • 2 \times mass FB 3 added • 2 $\times \Delta T$ | 1 | |
| | II All balance readings recorded to the same number of dp (at least one dp) and thermometer readings to .0 or .5°C (<i>minimum 2 of each</i>) | 1 | |
| | III Masses of FB 3 used between the limits given in the question (2.9(0) to 3.1(0) g and 4.9(0) to 5.1(0) g) | 1 | |
| Examiner corrects thermometer readings to the nearest 0.5°C, checks subtractions then calculates $\Delta T_1 \times m_2 / \Delta T_2 \times m_1$ where ΔT_1 is the smaller temperature fall. | | | |
| | Award IV if ratio falls between 0.85 and 1.15 Award IV and V if ratio falls between 0.95 and 1.05 | 1 1 | [5] |
| (b) (i) | mean mass correctly calculated from weighings to 2 dp | 1 | |
| (ii) | mean temperature fall correctly calculated from thermometer readings to 1 dp <i>Do not award if values used for calculating mean are from incorrect subtractions.</i> | 1 | [2] |
| (c) (i) | Correctly calculates (b)(i) / 53.5 | 1 | |

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| Question | Indicative material | Mark | Total |
|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|
| (ii) | Correct overall expression $25 \times 4.2 \times \mathbf{(b)(ii)}$ $\mathbf{(c)(i)} \times 1000$ <ul style="list-style-type: none"> • fully correct = 2 marks • one error = 1 mark • two errors = 0 marks (+ 1000 may be awarded from use to reach final answer) | 1 1 | |
| | Sign is + and final answers to (i) and (ii) are to 2–4 sf | 1 | [4] |
| (d) (ii) | Expression $(1.0/\text{smaller } \Delta T) \times 100$ or correct answer | 1 | [1] |
| (e) (i) | Advantages: any one of two values to check concordance/check whether further experiments should be carried out/find out whether mass added is proportional to ΔT /compare the two answers | 1 | |
| (ii) | No improvement as T drops so no heat loss (by convection)/as reaction is endothermic OR Improvement as prevents heat gain from surroundings | 1 | [2] |
| Total | | | [14] |
| FB 4 = MnCl₂(aq); FB 5 = MgSO₄(aq) ; FB 6 = NH₄Fe(SO₄)₂ (s) | | | |
| 3 (a) | Correct observations for FB 4 and FB 5 in (i) Correct observations for FB 4 and FB 5 in (ii) and correct observations for FB 4 and FB 5 in (iii) . | 2 1 | |

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| test | FB 4 | FB 5 |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------|
| (i) NH ₃ | off-white / pale brown / beige / buff ppt and insoluble in excess / ppt turns (dark) brown/darkens | white ppt insol in excess |
| (ii) AgNO ₃ | white ppt (if excess used then insoluble) | no change / no ppt / no reaction |
| (iii) BaCl ₂ /Ba(NO ₃) ₂ | no change / no ppt / no reaction | white ppt (if excess used then insoluble) |

| Question | Indicative material | Mark | Total |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------|
| 3 (a) (iv) | FB 4: manganese(II)/Mn ²⁺ and chloride/Cl ⁻ (If cream ppt with Ag ⁺ allow bromide/Br ⁻) | 1 | |
| (v) | FB 5: Mg ²⁺ , Al ³⁺ , and SO ₄ ²⁻ , SO ₃ ²⁻ (or names) | 1 | |
| (vi) | selects NaOH and uses it in excess FB 5: magnesium/Mg ²⁺ from white ppt insoluble in excess | 1 1 | [7] |
| (b) (i) | Transition metal (as coloured) | 1 | |
| (ii) | Any two of: <ul style="list-style-type: none"> (pale purple) solid / crystals melt / dissolve / turn to liquid / form liquid or solution any brown or qualified brown (liquid or solid not gas) condensation / liquid / water (further up tube) / water vapour / steamy fumes (not white fumes) (gas) turns (red) litmus blue (then back to red) | 1 | |
| (iii) | yellow / (light) brown (solution) (formed) | 1 | |
| (iv) | brown / rust / red-brown ppt and gas / NH ₃ turns (damp) (red) litmus blue | 1 | |
| (v) | (solution darkens) dark blue / blue-black / black colour | 1 | |
| (vi) | Fe ³⁺ and NH ₄ ⁺ | 1 | |
| (vii) | redox / oxidation and reduction / oxidation of I ⁻ / reduction of Fe ³⁺ | 1 | |
| | | | [Total: 14] |