



Mark Scheme (Results)

October 2018

Pearson Edexcel International
Advanced Subsidiary Level
In Chemistry (WCH03)
Paper 01 Chemistry Laboratory Skills I

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:

- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.

() means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.

Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.

ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Question Number	Acceptable Answers	Reject	Mark
1(a)(i)	<p>M1 Dip (clean) nichrome and wire / platinum and wire ALLOW NiCr for nichrome loop / rod for wire OR Silica rod</p> <p>ALLOW Any recognisable spellings eg platignum (Wooden) splint (in place of a wire) (1)</p> <p>M2 in (concentrated) hydrochloric acid / HCl(aq) ALLOW any mention of HCl(aq) e.g. cleaning or mixing solid and acid or making a paste HCl for HCl(aq) (1)</p> <p>IGNORE Dilute</p> <p>M3 then dipped in solid and placed in (hot / roaring / blue-cone) (Bunsen) flame ALLOW salt / compound / substance / paste / solution for 'solid' On / over / under / near / show / above / run through for 'in' (1)</p> <p>IGNORE inoculating / flame-test (wire)</p>	<p>Nickel / chrome / chromium</p> <p>spatula</p> <p>Other acids</p> <p>Just 'Bunsen'</p> <p>Fire / burn in the Bunsen flame</p> <p>Just 'metal'</p>	(3)

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	Strontium(ion) / Sr ²⁺	Sr / Ca ²⁺	(1)

Question Number	Acceptable Answers	Reject	Mark
1(b)(i)	White and precipitate ALLOW White solid / crystals / suspension / cloudy white	Any other colour with white e.g. creamy / yellow	(1)

Question Number	Acceptable Answers	Reject	Mark
1(b)(ii)	$\text{Sr}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{SrSO}_4(\text{s})$ Equation (1) State symbols dependent on correct equation or near miss. Eg $\text{Sr}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{SrSO}_4(\text{s})$ (1) ALLOW Any Group 2 ion from calcium down		(2)

Question Number	Acceptable Answers	Reject	Mark
1(c)	X H_2O / water (1) Y $\text{Sr}(\text{NO}_3)_2$ / strontium nitrate (1) Z SrO / strontium oxide (1) (Brown gas) NO_2 / nitrogen dioxide IGNORE N_2O_4 / dinitrogen tetroxide (1) (Gas that relights glowing splint) O_2 / oxygen (1) If both name and formula given both must be correct ALLOW lithium or any Group 2 nitrate for Y, and oxide for Z	Nitrogen oxide	(5)

Question Number	Acceptable Answers	Reject	Mark
1(d)(i)	(Heat to) constant mass / until no change in mass ALLOW Weight for mass (Heat) until no more brown gas is given off OR (Heat) until the splint no longer lights	Just 'no more gas given off' Testing for water	(1)

Question Number	Acceptable Answers	Reject	Mark
1(d)(ii)	<p>Correct answer with or without working scores 3</p> <p>All other acceptable nitrates eg $\text{Ca}(\text{NO}_3)_2 \cdot 7\text{H}_2\text{O}$, $\text{Mg}(\text{NO}_3)_2 \cdot 8\text{H}_2\text{O}$, $\text{LiNO}_3 \cdot 12\text{H}_2\text{O}$ $\text{Ba}(\text{NO}_3)_2 \cdot \text{H}_2\text{O}$ score 3</p> <p>Method 1 (0.0100 mol W weighs 2.836 g so $M_r = \frac{2.836}{0.010} =) 283.6$ (1)</p> <p>$(\text{Sr}(\text{NO}_3)_2 \cdot x\text{H}_2\text{O}) \quad M_r \text{Sr}(\text{NO}_3)_2 = 211.6$ (1)</p> <p>$283.6 - 211.6 = 72 \quad x = 72/18 = 4$ Formula is $\text{Sr}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ (1)</p> <p>ALLOW $\text{Sr}(\text{NO}_3)_2(\text{H}_2\text{O})_4$</p> <p>Method 2 Mass of N and O lost = $0.02 \times (14 + 32) + 0.01 \times 16 = 1.08$ (g) (1)</p> <p>Mass of water lost = $2.836 - 1.080 - 1.036$ = 0.072 (g) (1)</p> <p>Number of mol of water lost = $\frac{0.072}{18}$ = 0.04 (1)</p> <p>Formula is $\text{Sr}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ (1)</p> <p>Allow internal TE for incorrect amounts of nitrogen dioxide and/or oxygen</p> <p>Allow TE for any nitrate</p>		(3)

(Total for Question 1 = 16 marks)

Question Number	Acceptable Answers	Reject	Mark
2(a)(i)	Hydrogen chloride / HCl ALLOW HCl (g) or (aq) Hydrochloric acid		(1)

Question Number	Acceptable Answers	Reject	Mark
2(a)(ii)	Droplets (of hydrochloric acid) form ALLOW Because hydrogen chloride is (very)soluble / dissolves in water / ionises in water	Just 'forms hydrochloric acid' Just mixes with moist air / reacts with water HCl condenses HCl absorbs water	(1)

Question Number	Acceptable Answers	Reject	Mark
2(b)(i)	alcohol ALLOW -OH / OH / O-H OR Hydroxy(I) IGNORE Primary and / or secondary, 1° and / or 2°	Any mention of tertiary alcohol / 3° Just 'primary alcohol' Just 'secondary alcohol' OH ⁻ Hydroxide	(1)

Question Number	Acceptable Answers	Reject	Mark
2(b)(ii)	Cr ³⁺ / Cr(H ₂ O) ₆ ³⁺	Cr	(1)

Question Number	Acceptable Answers	Reject	Mark
2(c)	<p>Any two from</p> <p>Effervescence / bubbles / fizzing (1)</p> <p>Sodium disappearing / dissolving</p> <p>ALLOW</p> <p>Solid disappearing / dissolving (1)</p> <p>White solid forming (1)</p> <p>ALLOW</p> <p>White precipitate</p> <p>IGNORE gets warm / floats or sinks/ vigorous reaction</p> <p>If more than 2 observations are given, any incorrect answer negates a mark already given for a correct answer.</p>	<p>Just 'gas produced'</p> <p>Sodium melts</p>	(2)

Question Number	Acceptable Answers	Reject	Mark
2(d)	<p>60 $C_3H_8O^+$ / $C_3H_7OH^+$ (1)</p> <p>31 CH_2OH^+ / CH_3O^+ (1)</p> <p>+ can be anywhere</p> <p>ALLOW</p> <p>Displayed formulae</p> <p>Full structural formulae</p> <p>Absence of positive charge 1 max</p> <p>Use of negative charge 1 max</p>		(2)

Question Number	Acceptable Answers	Reject	Mark
2(e)	<p>P $CH_3CH_2CH_2OH$ (1)</p> <p>Q $CH_3CHOHCH_3$ (1)</p> <p>ALLOW</p> <p>Skeletal/displayed formulae</p> <p>Ignore connectivity unless horizontal -H-O</p> <p>If P and Q are reversed score (1)</p>	<p>Ethanoic acid</p> <p>$C_2H_4O_2$</p>	(2)

(Total for Question 2 = 10 marks)

Question Number	Acceptable Answers	Reject	Mark
3(a)(i)	<p>Any two from:</p> <p>no heat / energy lost</p> <p>ALLOW (Much) less heat / energy is lost/ transferred (to the surroundings) (1)</p> <p>No need to calculate the energy change</p> <p>ALLOW Energy change can be measured directly (1)</p> <p>No need to consider heat capacity / mass of solution OR No need to consider heat capacity of solution / of calorimeter (1)</p> <p>IGNORE More accurate / less error/ more precise/ safer/polystyrene non-renewable/ reactants cannot escape/heat more uniform</p>	No risk of catching fire	(2)

Question Number	Acceptable Answers	Reject	Mark
3(a)(ii)	<p>Enthalpy change</p> $= (-) \frac{1260}{0.1} \quad (1)$ $= - 12600 \text{ J mol}^{-1}$ $/- 12.6 \text{ kJ mol}^{-1}$ <p>Answer, sign and units (1)</p> <p>ALLOW J / mol kJ / mol J mol⁻¹ kJ mol⁻¹</p> <p>IGNORE SF except 1SF</p> <p>Unit and sign mark is dependent on the correct calculation.</p> <p>Correct answer (with sign and units) with no working scores (2)</p>		(2)

Question Number	Acceptable Answers	Reject	Mark
3(b)(i)	<p>M1 0.1 mol of hydrated salt contain 0.1 x 5 mol of water (1)</p> <p>M2 0.5 mol of water has mass 0.5 x 18 = 9 (g) / volume = 9 (cm³) (1)</p> <p>M3 Volume of water required = 100 - 9 = 91 (cm³) (1)</p> <p>Correct answer with no / wrong working (3)</p> <p>Note if M1 calculation is not done, M2 and M3 are available for.</p> <p>M2 5 X 18 = 90 (g) / 90 (cm³) of water (1)</p> <p>M3 Volume of water required = 100 - 90 = 10(cm³) (1)</p>	<p>cm⁻³ cm g</p> <p>cm⁻³ cm g</p>	(3)

Question Number	Acceptable Answers	Reject	Mark
3(b)(ii)	<p>The reaction is endothermic/ temperature decreases (1)</p> <p>(Rather than waiting for the temperature to reach the original temperature) the mixture would just have to be heated back to its starting temperature</p> <p>ALLOW There is no need to wait for the temperature to fall (1)</p>		(2)

Question Number	Acceptable Answers	Reject	Mark
3(b)(iii)	Enthalpy change of hydration of sodium thiosulfate $= -12.6 - 43.1 \quad (1)$ $= -55.7 \text{ (kJ mol}^{-1}\text{)} \quad (1)$ Allow TE from 3(a)(ii) If equation reversed (+) 55.7 (kJ mol ⁻¹) scores 1 mark. No other TE allowed If the answer is given in joules, the units must be correct. IGNORE SF except 1 SF Correct answer with no / wrong working (2)		(2)

Question Number	Acceptable Answers	Reject	Mark
3(c)(i)	$\frac{0.1 \times 2}{3.0} \times 100 = (\pm)6.7\%$ IGNORE SF	6/6.6/6.66 etc	(1)

Question Number	Acceptable Answers	Reject	Mark
3(c)(ii)	The percentage uncertainty due to using the measuring cylinder is very small compared to the percentage uncertainty due to the thermometer OR The percentage uncertainty with a measuring cylinder is 1% which is less than the uncertainty of the thermometer (so the use of a burette is unnecessary) ALLOW TE from 3(c)(i)		(1)

(Total for Question 3 = 13 marks)

Question Number	Acceptable Answers	Reject	Mark
4(a)(i)	<p>To concentrate the solution</p> <p>OR</p> <p>(to drive off some water) so crystals form on cooling</p> <p>OR</p> <p>to produce a saturated solution</p> <p>OR</p> <p>to reach crystallisation point</p> <p>ALLOW</p> <p>To evaporate / remove some water</p> <p>To evaporate / remove excess water</p>	<p>Just 'to form crystals'</p> <p>Just 'remove / evaporate water'</p>	(1)

Question Number	Acceptable Answers	Reject	Mark
4(a)(ii)	<p>(Fractional / simple) distillation (1)</p> <p>They (the liquids in the mixture) have different boiling temperatures / points (so boil and are collected at different temperatures) (1)</p> <p>IGNORE</p> <p>references to intermolecular forces</p>	Solvent extraction	(2)

Question Number	Acceptable Answers	Reject	Mark
4(b)(i)	<p>With a small / minimum quantity (1)</p> <p>(ice) cold water (1)</p>		(2)

Question Number	Acceptable Answers	Reject	Mark
4(b)(ii)	<p>Sodium hydrogencarbonate / NaHCO₃ (solution)</p> <p>ALLOW</p> <p>Recognisable spellings e.g. hydrocarbonate</p> <p>Sodium carbonate / Na₂CO₃</p> <p>ALLOW</p> <p>Potassium instead of sodium compounds</p> <p>If both name and formula are given both must be correct</p>	Any hydroxide	(1)

Question Number	Acceptable Answers	Reject	Mark
4(c)(i)	Filtration / filter / filtering ALLOW Decanting Ignore crystallisation	Drying	(1)

Question Number	Acceptable Answers	Reject	Mark
4(d)(i)	Dried between filter papers ALLOW With filter paper / paper towel / tissue OR in a desiccator IGNORE leaving it ALLOW In an oven but ignore any reference to temperature e.g. heat in an oven / warm in an oven	Just 'paper' Any drying agent Just 'heating'	(1)

Question Number	Acceptable Answers	Reject	Mark
4(d)(ii)	Addition of (anhydrous) sodium sulfate / calcium chloride / magnesium sulfate / calcium sulfate ALLOW Sulphate for sulfate Na_2SO_4 / CaCl_2 / MgSO_4 / CaSO_4 Silica gel If the correct name and wrong formula are given no mark is awarded. If more than one substance is given, any incorrect answer negates a mark already given for a correct answer.	Anhydrous copper(II) sulfate / anhydrous cobalt(II) chloride / sulfuric acid / calcium hydroxide / sodium hydroxide / calcium carbonate	(1)

(Total for Question 4 = 11 marks)

TOTAL FOR PAPER: 50 MARKS

