Mark Scheme (Results)

October 2024

Pearson Edexcel International Advanced Subsidiary Level In Chemistry (WCH13) Paper 01: Practical Skills in Chemistry 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.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities. Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr>
<td>1(a)(i)</td>
<td>An answer that makes reference to the following points:

• 6 points correct scores 4

• 4-5 points correct scores 3

• 3 points correct scores 2

• 2 points correct scores 1</td>
<td>Example of completed table:

<table>
<tr><th></th><th>Identity of cation</th><th>Colour of flame test</th></tr>
<tr><td>X</td><td>Ba^{2+}</td><td>(apple) green</td></tr>
<tr><td>Y</td><td>Mg^{2+}</td><td>no colour</td></tr>
<tr><td>Z</td><td>Ca^{2+}
OR
Sr^{2+}</td><td>yellow-red / brick red
(crimson) red</td></tr>
</table>

TE on correct flame colours for incorrect Group II metals
Penalise names and incorrect charges once only (allow TE for subsequent flame colours – max 2 points)
Allow Be^{2+} for Y – no colour for flame test
Allow colourless for no colour
Allow orange-red for Ca^{2+} (not orange alone)
Allow scarlet for Sr^{2+}
Ignore descriptors on colours e.g. pale
Ignore names/formulae of salts
Ignore state symbols even if incorrect
Do not award blue-green for barium or white for magnesium
Do not award red for calcium</td>
<td>(4)

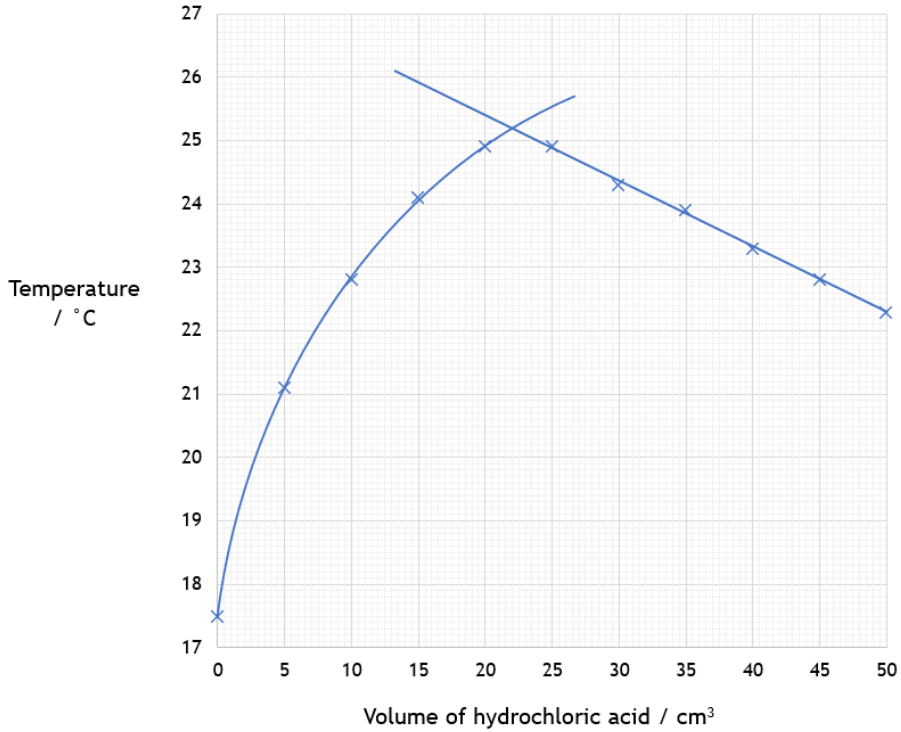
Expert</td>
</tr>
</table>

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	A description that makes reference to the following points: • add (dilute) nitric acid / HNO_3 **and** silver nitrate /$AgNO_3$(solution) **(1)** • (chloride will form a) white precipitate **(1)** • precipitate will dissolve in **dilute** (aqueous) ammonia/NH_3/NH_4OH solution **(1)**	Allow acidified silver nitrate Do not award M1 if extra reagents are added Accept solid, ppte., ppt etc. Ignore incorrect formulae Do not award chlorine ion Do not award M2 if silver chloride or chloride ions / HCl are added in M1 Allow chloride dissolves Allow **dilute** (aqueous) ammonia hydroxide Ignore concentrated ammonia Marks are independent but M3 must be after M1	**(3)** **Expert**

Question Number	Answer		Additional Guidance	Mark
1(b)(i)	A description that makes reference to the following points:		M2 and M3 can be shown in a labelled diagram, but if marks are awarded then diagram and text must not contradict.	(4) Expert
	• heat the same number of moles of each carbonate (in a test tube over a Bunsen burner)	(1)	Allow same mass/amount Allow spirit burner Do not award cotton wool Ignore equal test tubes Do not award same concentration of carbonates	
	• (clamp the test tube so it remains at a) fixed height over the same flame	(1)	Allow test tube is fixed to stand above a heat source Allow keep heat intensity the same Ignore tripod	
	• connect the test tube to a delivery tube (in)to limewater	(1)	Ignore gas syringes and collection over water Ignore thermometers	
	• (observe the limewater and) record the time for a precipitate to first appear	(1)	Allow cloudiness for precipitate	

Question Number	Answer		Additional Guidance	Mark
1(b)(ii)	An answer that makes reference to the following point:			(1)
	• a Bunsen flame may not reach the required temperature (to decompose the carbonate)		Allow school equipment will not reach the required temperature (allow examples of equipment) Ignore school laboratory cannot transfer enough thermal energy/heat	Expert

(Total for Question 1 = 12 marks)

/Question Number	Answer	Additional Guidance	Mark
2(a)(i)	• two lines of best fit **(1)** • reading of volume at intersection **(1)** • calculation of maximum temperature change **(1)**	<u>Example of a completed graph</u>  NB lines do not need to be extrapolated beyond the intercept Comment: Allow the right-hand straight line to be a curve but no M1 for a straight line on the left-hand side 22.0 (cm^3) Accept values between 20.0 and 23.0 (25.2 – 17.5 =) 7.7 Allow values between 7.5 and 7.9	**(3)** **Expert**

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	• moles of hydrochloric acid **(1)** • concentration of sodium hydroxide **(1)**	Example of calculation $(22 \times 2.0) \div 1000 = 0.044$ (mol) Allow answers in the range 0.040 − 0.046 TE on 2(a)(i) Ignore SF $0.044 \div 0.025 = 1.76$ (mol dm^{-3}) Allow answers in the range 1.60 − 1.84 TE from M1 to M2 Ignore SF If given, units must be correct	**(2)** **Expert**

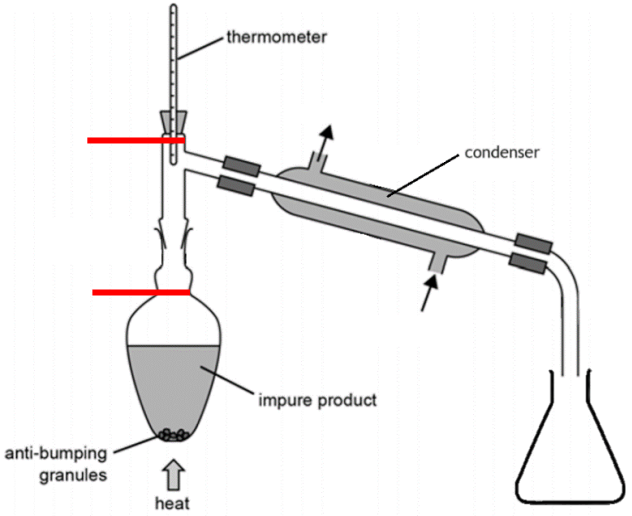
Question Number	Answer	Additional Guidance	Mark
2(a)(iii)	• stating or using the equation **(1)** • substitution into the equation **(1)** • calculation of enthalpy per mole **(1)** • conversion to kJ mol^{-1} **and** negative sign **(1)**	Example of calculation $\Delta H = (-)mc\Delta T$ $-(22 + 25) \times 4.18 \times 7.7 = (-)1512.7$ (J) Allow answers in the range 1410 − 1593 TE on 2(a)(i) or answer −17.5 $1512.7 \div 0.044 = (-)34380$ (J mol^{-1}) Allow answers in the range 30652 − 36200 TE on 2(a)(ii) and M1 −34.4 (kJ mol^{-1}) Allow answers in the range −32.7 to −36.2 TE on M2 Ignore SF except 1SF TE throughout Correct answer with some working scores 4	**(4)** **Expert**

Question Number	Answer	Additional Guidance	Mark
2(b)	An answer that makes reference to two of the following points: • heat loss (to the environment) **(1)** • the total volume increases so the temperature change is less even though the same amount of heat is evolved **(1)** • the solution is added in (small) portions **(1)** OR the solution is added too slowly	Ignore non-standard conditions Allow incomplete mixing / not stirred Ignore heat capacity/ density are different to water Ignore incomplete reaction, evaporation and impurities Do not award incomplete combustion (lose 1 mark)	**(2)** **Expert**

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	An answer that makes reference to the following point: • (restart the experiment and) add the estimated volume to the end-point in one portion	Allow add acid in smaller portions (near the end-point) Allow acid in smaller intervals Ignore dilute acid	**(1)** **Expert**

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	An answer that makes reference to the following point: • add insulation / lid to reduce heat loss **OR** add acid quickly **OR** add acid in larger portions	Ignore draught shield/shielding Allow increased mixing/swirling Ignore digital thermometer Ignore increase concentration	**(1)** **Expert**

(Total for Question 2 = 13 marks)

Question Number	Answer	Additional Guidance	Mark
3(a)	An answer that makes reference to the following points: • condenser (labelled with name) and arrows to indicate the flow of water **(1)** • flask (not conical) connected to diagonal condenser with no gaps and unsealed collecting vessel **(1)** • thermometer with bulb in correct position, anti-bumping granules and heat source / just arrow **(1)**	Example of a diagram:  Thermometer should end within the two red lines Ignore lines across the joints in the apparatus Ignore fractionating columns Entrance and exit of the condenser must be open Please give benefit of doubt on unlabelled anti-bumping granules Allow water in/out labels in place of arrows Allow water in/out labels that contradict direction of arrows Allow attempts at 3D drawing Allow water bath/electric heater Do not award fire for heat	**(3)** **Expert**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	An answer that makes reference to the following point: • there are no C=C bonds (in the product)	Accept the product is saturated / not unsaturated Allow the product is not an alkene Do not award "no double bonds" alone	**(1)** **Graduate**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	An answer that makes reference to the following point: • (Fehling's test shows the final product is) not an aldehyde	Allow does not contain −CHO Allow reflux does not produce aldehydes Ignore speculation about other compounds Ignore comments about oxidation	**(1)** **Graduate**

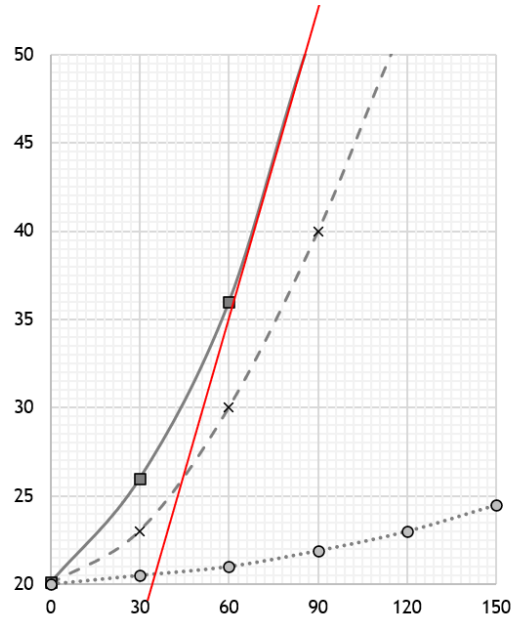
Question Number	Answer		Additional Guidance	Mark
3(c)(i)	An answer that makes reference to four of the following points:			**(4)** **Expert**
	• (original liquid) was not a ketone (as it was oxidised)	**(1)**	Allow not a ketone as there was a colour change (or converse)	
	• (original liquid) has been oxidised	**(1)**	Allow not tertiary alcohol	
	• a ketone would (only) be the final product if the purified liquid was a **secondary** alcohol	**(1)**	Allow 2° alcohol	
	• the original liquid could have been a **primary** alcohol / aldehyde	**(1)**		
	• (the final product could be a) carboxylic acid	**(1)**	Allow "not enough evidence to be sure of identity of final product" Allow names of specific carboxylic acids Ignore carbonic acid Ignore all confirmatory tests and colour changes (even if incorrect) Ignore references to tertiary All marks are independent	

Question Number	Answer		Additional Guidance	Mark
3(c)(ii)	An explanation that makes reference to the following points:			**(2)** **Expert**
	• **boiling** temperature (from the distillation)	**(1)**	Accept boiling point	
	• can be compared to published values	**(1)**	Allow data book etc.	

(Total for Question 3 = 11 marks)

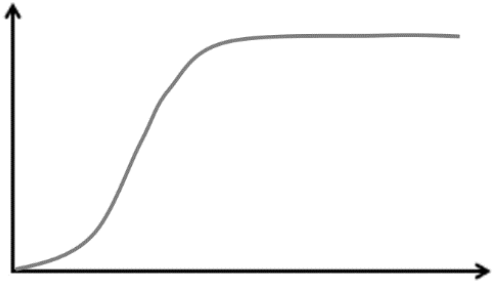
Question Number	Answer	Additional Guidance	Mark
4(a)	An answer that makes reference to the following points: • x-axis label: "Time / s" **(1)** • y-axis label: "Volume (of H_2O_2 and foam) / cm^3" **(1)**	Allow units in brackets throughout Allow seconds for s Allow height /cm Allow 1 mark for both labels in correct locations without units	**(2)** **Expert**

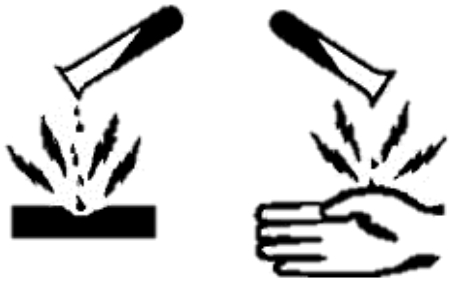
Question Number	Answer	Additional Guidance	Mark
4(b)(i)	An answer that makes reference to the following point: • the line (for PbO_2) has the steepest gradient	Accept (throughout the experiment) for any given time the volume for PbO_2 is higher Allow steepest slope/line/graph Allow largest volume in the smallest time Allow specific volume reached before the others Ignore just fastest / fastest rate	**(1)** **Expert**

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	An answer that makes reference to the following points: • tangent drawn at steepest point / use of data points from the graph above 36 cm^3 **(1)** • rate calculated **(1)** • correct units **(1)**	<u>Example of a tangent</u>  Do not award M1 if volume used is bigger than 30 unless a tangent is drawn 30 cm^3 ÷ 50 s 0.6(0) (Allow 0.52 to 0.68) M2 dependent on M1 $cm^3\ s^{-1}$ Accept cm^3 / s Allow dm^3s^{-1} with value conversion TE from (a) M3 is independent of M1 and M2	**(3)** **Expert**

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	An answer that makes reference to the following point: • that part of the graph is extrapolated from the earlier points / from 60 s	Allow the height of the foam is difficult to measure (accurately) Allow only two readings were taken (to find the shape of the graph) Allow more readings need to be taken after 60 s Allow extrapolation is difficult Allow a description of extrapolation	**(1)** **Expert**

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	An answer that makes reference to the following point: • the catalyst may not be fully mixed with the (H_2O_2) solution at first	Allow because there is an induction period / the catalyst doesn't work effectively straight away Allow the contact area for the reactant and catalyst increase during the reaction Allow the temperature increases, increasing the rate of reaction Allow the reaction is exothermic Ignore parallax errors	**(1)** **Expert**

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	An answer that makes reference to the following points: • initial similar shape to previous graph **(1)** • convex curve to plateau at maximum height **(1)**	Example of a curve:  i.e. slow initial rate that increases Do not award if line starts above the origin Allow multiple lines of the correct shape Allow a dip after the plateau has been reached Do not award M2 for a line that returns to the axis	**(2)** **Expert**

Question Number	Answer	Additional Guidance	Mark
4(d)(i)	An answer that makes reference to the following point: • corrosive symbol drawn	 Either one is acceptable for the mark (container, liquid dripping and a hand/block underneath showing some damage / zig zags)	**(1)** **Expert**

Question Number	Answer	Additional Guidance	Mark
4(d)(ii)	An answer that makes reference to the following points: • gloves	Ignore use a fume cupboard Ignore wear a mask Ignore tongs Ignore modifiers e.g. insulating gloves Ignore comments about volumes and other equipment Do not award “not touching the liquid”	**(1)** **Graduate**

Question Number	Answer	Additional Guidance	Mark
4(d)(iii)	An answer that makes reference to the following point: • dilute the peroxide/H_2O_2	 Allow lower/smaller concentration Ignore decrease amount/volume/mass	**(1)** **Graduate**

Question Number	Answer	Additional Guidance	Mark
4(d)(iv)	An answer that makes reference to the following point: • a suitable reason	 E.g. To stop the peroxide damaging the table / surface So that spills can be easily cleared up In case the foam spills over the top Ignore corrosive Ignore stop contact with skin Ignore references to stability / falling over Do not award references to acid	**(1)** **Expert**

(Total for Question 4 = 14 marks)

TOTAL FOR PAPER = 50 MARKS

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