



## Mark Scheme (Results)

October 2024

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

| Question Number | Answer                                                                                                                                                                                                                                                   | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Mark |                    |                      |   |                  |               |   |                  |           |   |                                            |                                         |                          |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------|----------------------|---|------------------|---------------|---|------------------|-----------|---|--------------------------------------------|-----------------------------------------|--------------------------|
| 1(a)(i)         | <p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"><li>• 6 points correct scores 4</li><li>• 4-5 points correct scores 3</li><li>• 3 points correct scores 2</li><li>• 2 points correct scores 1</li></ul> | <p>Example of completed table:</p> <table><tr><td></td><th>Identity of cation</th><th>Colour of flame test</th></tr><tr><td>x</td><td>Ba<sup>2+</sup></td><td>(apple) green</td></tr><tr><td>y</td><td>Mg<sup>2+</sup></td><td>no colour</td></tr><tr><td>z</td><td>Ca<sup>2+</sup><br/>OR<br/>Sr<sup>2+</sup></td><td>yellow-red / brick red<br/>(crimson) red</td></tr></table> <p>TE on correct flame colours for incorrect <b>Group II</b> metals<br/>Penalise names and incorrect charges once only (allow TE for subsequent flame colours – max 2 points)<br/>Allow Be<sup>2+</sup> for Y – no colour for flame test<br/>Allow colourless for no colour<br/>Allow orange-red for Ca<sup>2+</sup> (not orange alone)<br/>Allow scarlet for Sr<sup>2+</sup><br/>Ignore descriptors on colours e.g. pale<br/>Ignore names/formulae of salts<br/>Ignore state symbols even if incorrect<br/>Do not award blue-green for barium or white for magnesium<br/>Do not award red for calcium</p> |      | Identity of cation | Colour of flame test | x | Ba <sup>2+</sup> | (apple) green | y | Mg <sup>2+</sup> | no colour | z | Ca <sup>2+</sup><br>OR<br>Sr <sup>2+</sup> | yellow-red / brick red<br>(crimson) red | <p>(4)</p> <p>Expert</p> |
|                 | Identity of cation                                                                                                                                                                                                                                       | Colour of flame test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |                    |                      |   |                  |               |   |                  |           |   |                                            |                                         |                          |
| x               | Ba <sup>2+</sup>                                                                                                                                                                                                                                         | (apple) green                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                    |                      |   |                  |               |   |                  |           |   |                                            |                                         |                          |
| y               | Mg <sup>2+</sup>                                                                                                                                                                                                                                         | no colour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |                    |                      |   |                  |               |   |                  |           |   |                                            |                                         |                          |
| z               | Ca <sup>2+</sup><br>OR<br>Sr <sup>2+</sup>                                                                                                                                                                                                               | yellow-red / brick red<br>(crimson) red                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                    |                      |   |                  |               |   |                  |           |   |                                            |                                         |                          |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                       | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Mark                            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 1(a)(ii)        | <p>A description that makes reference to the following points:</p> <ul style="list-style-type: none"> <li>• add (dilute) nitric acid / <math>\text{HNO}_3</math> <b>and</b> silver nitrate / <math>\text{AgNO}_3</math>(solution)</li> <li>• (chloride will form a) white precipitate</li> <li>• precipitate will dissolve in <b>dilute</b> (aqueous) ammonia/<math>\text{NH}_3</math>/<math>\text{NH}_4\text{OH}</math> solution</li> </ul> | <p>(1) Allow acidified silver nitrate<br/>Do not award M1 if extra reagents are added</p> <p>(1) Accept solid, ppte., ppt etc.<br/>Ignore incorrect formulae<br/>Do not award chlorine ion<br/>Do not award M2 if silver chloride or chloride ions / <math>\text{HCl}</math> are added in M1</p> <p>(1) Allow chloride dissolves<br/>Allow <b>dilute</b> (aqueous) ammonia hydroxide<br/>Ignore concentrated ammonia</p> <p>Marks are independent but M3 must be after M1</p> | <p>(3)</p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Mark                            |
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| 1(b)(i)         | <p>A description that makes reference to the following points:</p> <ul style="list-style-type: none"> <li>heat the same number of moles of each carbonate (in a test tube over a Bunsen burner) (1)</li> <li>(clamp the test tube so it remains at a) fixed height over the same flame (1)</li> <li>connect the test tube to a delivery tube (in)to limewater (1)</li> <li>(observe the limewater and) record the time for a precipitate to first appear (1)</li> </ul> | <p>M2 and M3 can be shown in a labelled diagram, but if marks are awarded then diagram and text must not contradict.</p> <p>Allow same mass/amount<br/>Allow spirit burner<br/>Do not award cotton wool<br/>Ignore equal test tubes<br/>Do not award same concentration of carbonates</p> <p>Allow test tube is fixed to stand above a heat source<br/>Allow keep heat intensity the same<br/>Ignore tripod</p> <p>Ignore gas syringes and collection over water<br/>Ignore thermometers</p> <p>Allow cloudiness for precipitate</p> | <p>(4)</p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                             | Additional Guidance                                                                                                                                                         | Mark                            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 1(b)(ii)        | <p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> <li>a Bunsen flame may not reach the required temperature (to decompose the carbonate)</li> </ul> | <p>Allow school equipment will not reach the required temperature (allow examples of equipment)<br/>Ignore school laboratory cannot transfer enough thermal energy/heat</p> | <p>(1)</p> <p><b>Expert</b></p> |

(Total for Question 1 = 12 marks)

| /Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mark                                                                                         |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 2(a)(i)          | <div data-bbox="353 268 651 300"> <ul style="list-style-type: none"> <li>two lines of best fit</li> </ul> </div> <div data-bbox="943 268 981 300">(1)</div> <div data-bbox="353 1198 824 1230"> <ul style="list-style-type: none"> <li>reading of volume at intersection</li> </ul> </div> <div data-bbox="943 1198 981 1230">(1)</div> <div data-bbox="353 1313 875 1382"> <ul style="list-style-type: none"> <li>calculation of maximum temperature change</li> </ul> </div> <div data-bbox="943 1345 981 1377">(1)</div> | <div data-bbox="1010 233 1402 264"><u>Example of a completed graph</u></div> <div data-bbox="1010 280 1906 1015"> <p>The graph shows a curve representing temperature change as a function of volume of hydrochloric acid. The y-axis is labeled 'Temperature / °C' and ranges from 17 to 27. The x-axis is labeled 'Volume of hydrochloric acid / cm³' and ranges from 0 to 50. The curve starts at (0, 17.5), rises to a peak at (22.0, 25.2), and then falls. A straight line of best fit is drawn through the data points, intersecting the curve at the peak. The intersection point is at approximately (22.0, 25.2).</p> </div> <div data-bbox="1010 1046 1890 1150"> <p>NB lines do not need to be extrapolated beyond the intercept<br/> Comment: Allow the right-hand straight line to be a curve but no M1 for a straight line on the left-hand side</p> </div> <div data-bbox="1010 1190 1487 1262"> <p>22.0 (cm<sup>3</sup>)<br/> Accept values between 20.0 and 23.0</p> </div> <div data-bbox="1010 1302 1442 1374"> <p>(25.2 – 17.5 =) 7.7<br/> Allow values between 7.5 and 7.9</p> </div> | <div data-bbox="2007 233 2045 264">(3)</div> <div data-bbox="1973 304 2074 336">Expert</div> |

| Question Number | Answer                                                                                                                  | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                          | Mark                                   |
|-----------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 2(a)(ii)        | <ul style="list-style-type: none"> <li>moles of hydrochloric acid</li> <li>concentration of sodium hydroxide</li> </ul> | <p><b>(1)</b> <u>Example of calculation</u><br/> <math>(22 \times 2.0) \div 1000 = 0.044</math> (mol)<br/> Allow answers in the range 0.040 – 0.046<br/> TE on 2(a)(i)<br/> Ignore SF</p> <p><b>(1)</b> <math>0.044 \div 0.025 = 1.76</math> (mol dm<sup>-3</sup>)<br/> Allow answers in the range 1.60 – 1.84<br/> TE from M1 to M2<br/> Ignore SF<br/> If given, units must be correct</p> | <p><b>(2)</b></p> <p><b>Expert</b></p> |

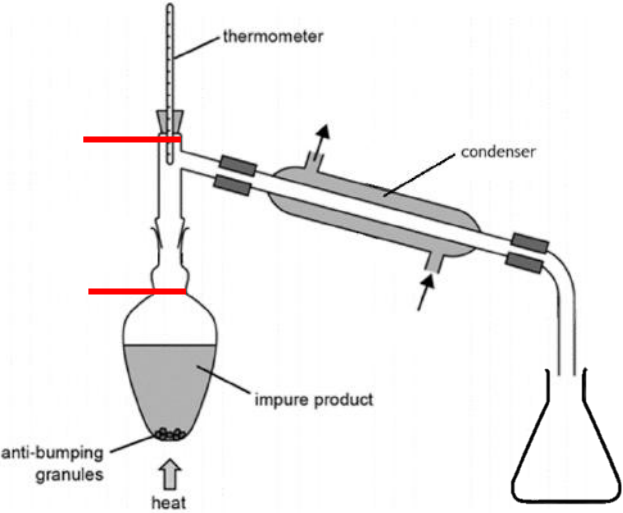
| Question Number | Answer                                                                                                                                                                                                                                 | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Mark                                   |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 2(a)(iii)       | <ul style="list-style-type: none"> <li>stating or using the equation</li> <li>substitution into the equation</li> <li>calculation of enthalpy per mole</li> <li>conversion to kJ mol<sup>-1</sup><br/>and<br/>negative sign</li> </ul> | <p><b>(1)</b> <u>Example of calculation</u><br/> <math>\Delta H = (-)mc\Delta T</math></p> <p><b>(1)</b> <math>-(22 + 25) \times 4.18 \times 7.7 = (-)1512.7</math> (J)<br/> Allow answers in the range 1410 – 1593<br/> TE on 2(a)(i) or answer -17.5</p> <p><b>(1)</b> <math>1512.7 \div 0.044 = (-)34380</math> (J mol<sup>-1</sup>)<br/> Allow answers in the range 30652 – 36200<br/> TE on 2(a)(ii) and M1</p> <p><b>(1)</b> -34.4 (kJ mol<sup>-1</sup>)<br/> Allow answers in the range -32.7 to -36.2<br/> TE on M2</p> <p>Ignore SF except 1SF<br/> TE throughout<br/> Correct answer with some working scores 4</p> | <p><b>(4)</b></p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                               | Additional Guidance                                                                                                                                                                                                                                                  | Mark                                   |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| <b>2(b)</b>     | <p>An answer that makes reference to two of the following points:</p> <ul style="list-style-type: none"> <li>• heat loss (to the environment) (1)</li> <li>• the total volume increases so the temperature change is less even though the same amount of heat is evolved (1)</li> <li>• the solution is added in (small) portions OR the solution is added too slowly (1)</li> </ul> | <p>Ignore non-standard conditions</p> <p>Allow incomplete mixing / not stirred</p> <p>Ignore heat capacity/ density are different to water</p> <p>Ignore incomplete reaction, evaporation and impurities</p> <p>Do not award incomplete combustion (lose 1 mark)</p> | <p><b>(2)</b></p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                                  | Additional Guidance                                                                                                             | Mark                                   |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 2(c)(i)         | <p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> <li>• (restart the experiment and) add the estimated volume to the end-point in one portion</li> </ul> | <p>Allow add acid in smaller portions (near the end-point)</p> <p>Allow acid in smaller intervals</p> <p>Ignore dilute acid</p> | <p><b>(1)</b></p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                                                                                  | Additional Guidance                                                                                                                                  | Mark                                   |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 2(c)(ii)        | <p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> <li>• add insulation / lid to reduce heat loss</li> </ul> <p><b>OR</b></p> <p>add acid quickly</p> <p><b>OR</b></p> <p>add acid in larger portions</p> | <p>Ignore draught shield/shielding</p> <p>Allow increased mixing/swirling</p> <p>Ignore digital thermometer</p> <p>Ignore increase concentration</p> | <p><b>(1)</b></p> <p><b>Expert</b></p> |

**(Total for Question 2 = 13 marks)**

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                   | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Mark                            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 3(a)            | <p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> <li>condenser (labelled with name) and arrows to indicate the flow of water</li> <li>flask (not conical) connected to diagonal condenser with no gaps and unsealed collecting vessel</li> <li>thermometer with bulb in correct position, anti-bumping granules and heat source / just arrow</li> </ul> | <p>Example of a diagram:</p>  <p>Thermometer should end within the two red lines<br/> Ignore lines across the joints in the apparatus<br/> Ignore fractionating columns<br/> Entrance and exit of the condenser must be open<br/> Please give benefit of doubt on unlabelled anti-bumping granules<br/> Allow water in/out labels in place of arrows<br/> Allow water in/out labels that contradict direction of arrows<br/> Allow attempts at 3D drawing<br/> Allow water bath/electric heater<br/> Do not award fire for heat</p> | <p>(3)</p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                  | Additional Guidance                                                                                                                        | Mark                              |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 3(b)(i)         | <p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> <li>there are no C=C bonds (in the product)</li> </ul> | <p>Accept the product is saturated / not unsaturated<br/> Allow the product is not an alkene<br/> Do not award “no double bonds” alone</p> | <p>(1)</p> <p><b>Graduate</b></p> |

| Question Number | Answer                                                                                                                                                                      | Additional Guidance                                                                                                                                                | Mark                              |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 3(b)(ii)        | <p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> <li>(Fehling’s test shows the final product is) not an aldehyde</li> </ul> | <p>Allow does not contain –CHO<br/> Allow reflux does not produce aldehydes<br/> Ignore speculation about other compounds<br/> Ignore comments about oxidation</p> | <p>(1)</p> <p><b>Graduate</b></p> |

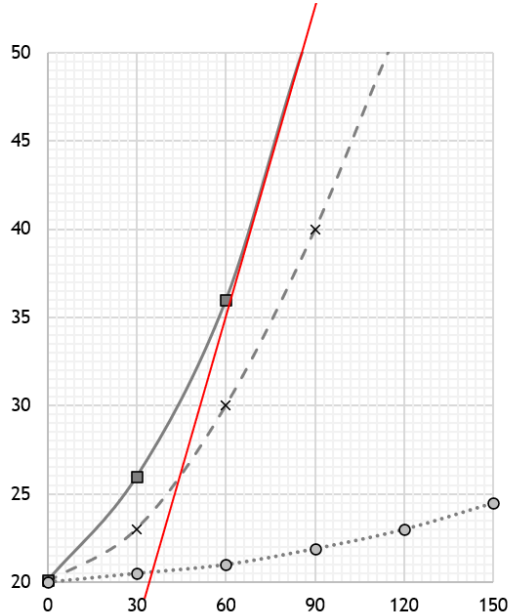
| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                            | Mark                            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 3(c)(i)         | <p>An answer that makes reference to four of the following points:</p> <ul style="list-style-type: none"> <li>• (original liquid) was not a ketone (as it was oxidised) (1)</li> <li>• (original liquid) has been oxidised (1)</li> <li>• a ketone would (only) be the final product if the purified liquid was a <b>secondary</b> alcohol (1)</li> <li>• the original liquid could have been a <b>primary</b> alcohol / aldehyde (1)</li> <li>• (the final product could be a) carboxylic acid (1)</li> </ul> | <p>Allow not a ketone as there was a colour change (or converse)</p> <p>Allow not tertiary alcohol</p> <p>Allow 2° alcohol</p> <p>Allow “not enough evidence to be sure of identity of final product”<br/>Allow names of specific carboxylic acids<br/>Ignore carbonic acid</p> <p>Ignore all confirmatory tests and colour changes (even if incorrect)<br/>Ignore references to tertiary</p> <p>All marks are independent</p> | <p>(4)</p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                                                            | Additional Guidance                                     | Mark                            |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------|
| 3(c)(ii)        | <p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none"> <li>• <b>boiling</b> temperature (from the distillation) (1)</li> <li>• can be compared to published values (1)</li> </ul> | <p>Accept boiling point</p> <p>Allow data book etc.</p> | <p>(2)</p> <p><b>Expert</b></p> |

(Total for Question 3 = 11 marks)

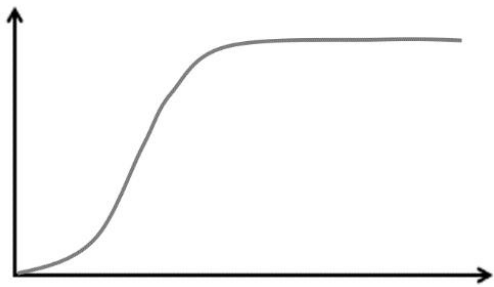
| Question Number | Answer                                                                                                                                                                                                                              | Additional Guidance                                                                                                                                                         | Mark                            |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 4(a)            | <p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> <li>x-axis label: "Time / s"</li> <li>y-axis label: "Volume (of H<sub>2</sub>O<sub>2</sub> and foam) / cm<sup>3</sup>"</li> </ul> | <p>Allow units in brackets throughout</p> <p>(1) Allow seconds for s</p> <p>(1) Allow height /cm</p> <p>Allow 1 mark for both labels in correct locations without units</p> | <p>(2)</p> <p><b>Expert</b></p> |

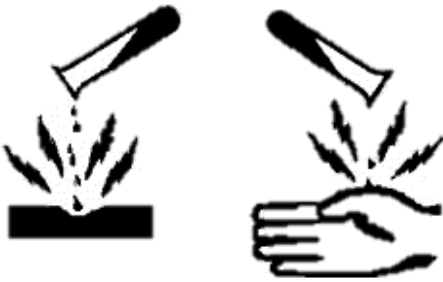
| Question Number | Answer                                                                                                                                                                   | Additional Guidance                                                                                                                                                                                                                                                                            | Mark                            |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 4(b)(i)         | <p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> <li>the line (for PbO<sub>2</sub>) has the steepest gradient</li> </ul> | <p>Accept (throughout the experiment) for any given time the volume for PbO<sub>2</sub> is higher</p> <p>Allow steepest slope/line/graph</p> <p>Allow largest volume in the smallest time</p> <p>Allow specific volume reached before the others</p> <p>Ignore just fastest / fastest rate</p> | <p>(1)</p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                                                                                                   | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mark                            |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 4(b)(ii)        | <p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> <li>tangent drawn at steepest point / use of data points from the graph above 36 cm<sup>3</sup> (1)</li> <li>rate calculated (1)</li> <li>correct units (1)</li> </ul> | <p><u>Example of a tangent</u></p>  <p>Do not award M1 if volume used is bigger than 30 unless a tangent is drawn<br/> <math>30 \text{ cm}^3 \div 50 \text{ s}</math></p> <p>(1) 0.6(0)<br/>         (Allow 0.52 to 0.68)<br/>         M2 dependent on M1</p> <p>(1) cm<sup>3</sup> s<sup>-1</sup><br/>         Accept cm<sup>3</sup> / s<br/>         Allow dm<sup>3</sup>s<sup>-1</sup> with value conversion<br/>         TE from (a)<br/>         M3 is independent of M1 and M2</p> | <p>(3)</p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                     | Additional Guidance                                                                                                                                                                                                                                                                            | Mark                                   |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 4(b)(iii)       | <p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> <li>that part of the graph is extrapolated from the earlier points / from 60 s</li> </ul> | <p>Allow the height of the foam is difficult to measure (accurately)</p> <p>Allow only two readings were taken (to find the shape of the graph)</p> <p>Allow more readings need to be taken after 60 s</p> <p>Allow extrapolation is difficult</p> <p>Allow a description of extrapolation</p> | <p><b>(1)</b></p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                                      | Additional Guidance                                                                                                                                                                                                                                                                                                                            | Mark                                   |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 4(c)(i)         | <p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> <li>the catalyst may not be fully mixed with the (H<sub>2</sub>O<sub>2</sub>) solution at first</li> </ul> | <p>Allow because there is an induction period / the catalyst doesn't work effectively straight away</p> <p>Allow the contact area for the reactant and catalyst increase during the reaction</p> <p>Allow the temperature increases, increasing the rate of reaction</p> <p>Allow the reaction is exothermic</p> <p>Ignore parallax errors</p> | <p><b>(1)</b></p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                                                                                                      | Additional Guidance                                                                                                                                                                                                                                                                                                                                                      | Mark                     |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 4(c)(ii)        | <p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> <li>initial similar shape to previous graph</li> <li>convex curve to plateau at maximum height</li> </ul> | <p>Example of a curve:</p>  <p>i.e. slow initial rate that increases<br/>Do not award if line starts above the origin<br/>Allow multiple lines of the correct shape</p> <p>Allow a dip after the plateau has been reached<br/>Do not award M2 for a line that returns to the axis</p> | <p>(2)</p> <p>Expert</p> |

| Question Number | Answer                                                                                                                                 | Additional Guidance                                                                                                                                                                                                          | Mark                            |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 4(d)(i)         | <p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> <li>corrosive symbol drawn</li> </ul> |  <p>Either one is acceptable for the mark<br/>(container, liquid dripping and a hand/block underneath showing some damage / zig zags)</p> | <p>(1)</p> <p><b>Expert</b></p> |

| Question Number | Answer                                                                                                                  | Additional Guidance                                                                                                                                                                                                       | Mark                              |
|-----------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 4(d)(ii)        | <p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> <li>gloves</li> </ul> | <p>Ignore use a fume cupboard<br/>Ignore wear a mask<br/>Ignore tongs<br/>Ignore modifiers e.g. insulating gloves<br/>Ignore comments about volumes and other equipment</p> <p>Do not award “not touching the liquid”</p> | <p>(1)</p> <p><b>Graduate</b></p> |

| Question Number | Answer                                                                                                                                                  | Additional Guidance                                                     | Mark                       |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------|
| 4(d)(iii)       | An answer that makes reference to the following point: <ul style="list-style-type: none"> <li>dilute the peroxide/H<sub>2</sub>O<sub>2</sub></li> </ul> | Allow lower/smaller concentration<br>Ignore decrease amount/volume/mass | (1)<br><br><b>Graduate</b> |

| Question Number | Answer                                                                                                                     | Additional Guidance                                                                                                                                                                                                                                                                       | Mark                     |
|-----------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 4(d)(iv)        | An answer that makes reference to the following point: <ul style="list-style-type: none"> <li>a suitable reason</li> </ul> | E.g.<br>To stop the peroxide damaging the table / surface<br>So that spills can be easily cleared up<br>In case the foam spills over the top<br><br>Ignore corrosive<br>Ignore stop contact with skin<br>Ignore references to stability / falling over<br>Do not award references to acid | (1)<br><br><b>Expert</b> |

(Total for Question 4 = 14 marks)

**TOTAL FOR PAPER = 50 MARKS**