

# Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in  
Chemistry (5CH3H) Paper 01  
Unit C3: Chemistry in Action

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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.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- 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.

## **Quality of Written Communication**

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate 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.

Question Number	Answer	Acceptable answers	Mark
<b>1(a)(i)</b>	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	capital letters; numbers must be subscripts ignore structural formulae such as CH <sub>3</sub> COOCH <sub>2</sub> CH <sub>3</sub> i.e. must have just C <sub>4</sub> , H <sub>8</sub> and O <sub>2</sub> in any order.	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(a)(ii)</b>	ethanol + ethanoic acid → ethyl ethanoate + water (2) LHS= 1 mark [allow acetic acid]; RHS= 1 mark [allow ethyl acetate] Allow = for arrow. Fully correct formula equation = 2 (part mark not possible with formulae)		<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(a)(iii)</b>	no vapour/ little vapour (given off) / it is not a gas / it is a solid (not vapour) OR small amount/ concentration in sweets	allow gas for vapour allow ethyl ethanoate is in a liquid state	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)(i)</b>	<b>D</b> soap		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)(ii)</b>	A description linking <ul style="list-style-type: none"> <li>filter / decant off water (1)</li> <li>(then) wash/rinse (1)</li> </ul> Can only score second mark if first marking point awarded	ignore anything before filtering that would not contaminate soap but do not allow to evaporate water/ heat BEFORE filtering ignore anything after washing, including drying	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(c)</b>	<b>C</b> unsaturated molecules in the liquid oil become saturated		<b>(1)</b>

Total for Question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
<b>2(a)(i)</b>	<b>C</b> iodide, I <sup>-</sup>		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(a)(ii)</b>	<p>A description linking two points from</p> <ul style="list-style-type: none"> <li>flame test / description of flame test mentioning <b>in</b> flame (1)</li> <li>sodium gives a <b>yellow</b> flame (1)</li> <li>potassium gives a {lilac/purple/violet} flame (1)</li> </ul>	<p>description can be using (nichrome) wire or damp splint Ignore: hold over/ around/under/above flame</p> <p>Ignore: yellow-orange, orange or any other colour</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(b)(i)</b>	<p>A description linking</p> <ul style="list-style-type: none"> <li>blue (1)</li> <li>precipitate / solid (1)</li> </ul> <p>Marked independently.</p> <p>If further, incorrect observations given, use list principle</p>	<p>allow appropriate qualifiers: e.g. 'light blue' but <b>not</b> other colours eg green-blue</p> <p>allow ppt</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(b)(ii)</b>	<p><math>\text{Cu}^{2+} + 2\text{OH}^- \rightarrow \text{Cu}(\text{OH})_2</math> (3)</p> <p>Identifies <math>\text{Cu}^{2+}</math> on <b>LHS</b> <u>and</u> <math>\text{Cu}(\text{OH})_2</math> on <b>RHS</b> in equation format (1)  <math>\text{OH}^-</math> formula on <b>LHS</b> (1)            These two marks are independent and can be scored even if additional ions, correct or incorrect, are given</p> <p>balancing correct symbols (1)            This mark is only awarded for a fully correct ionic equation with no additional ions</p>	<p>allow multiples            accept <math>\text{Cu}^{2+}(\text{OH}^-)_2</math>            allow <math>\text{Cu}^{++}/\text{Cu}^{+2}</math>            reject incorrect symbols such as <math>\text{cu}^{2+}</math>, <math>\text{Oh}^-</math> etc.            ignore: state symbols            allow = instead of <math>\rightarrow</math></p>	<b>(3)</b>

Total for Question 2 = 8 marks

Question Number	Answer	Acceptable answers	Mark
<b>3(a)(i)</b>	<p>A description including two of the following</p> <ul style="list-style-type: none"> <li>dissolve the sugar/aqueous solution (1)</li> <li><b>warm</b>/ 25-40°C (1)</li> <li>in absence of air / no oxygen/ anaerobic / attach airlock (1)</li> <li>pH neutral / slightly acidic /4-7</li> <li><b>sterile</b> conditions</li> </ul> <p>ignore any mention of pressure</p>	<p>ignore incorrect answers</p> <p>ignore heat / hot allow any temperature or range within 25-40 allowed</p> <p>ignore clean etc ignore 'optimum' {temp/pressure/pH}</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(a)(ii)</b>	<b>B</b> fractional distillation		<b>(1)</b>

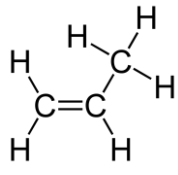
Question Number	Answer	Acceptable answers	Mark
<b>3(a)(iii)</b>	<p><math>C_6H_{12}O_6 \rightarrow 2 C_2H_5OH + 2 CO_2</math> (2)</p> <p>correct formulae (<u>with no others</u>) (1)</p> <p>balancing <u>the three</u> formulae (1)</p> <p>ignore state symbols</p>	<p>allow <math>C_2H_6O</math>/ <math>CH_3CH_2OH</math> for <math>C_2H_5OH</math> reject <math>CO_2</math> / <math>CO^2</math></p> <p>allow multiples</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(b)(i)</b>	<p>Any two of</p> <ul style="list-style-type: none"> <li>(reacts with) steam (1)</li> <li>catalyst/phosphoric acid (1)</li> <li><b>high temperature</b> / 200°C - 450°C (1)</li> <li><b>high</b> pressure/ 50-100 atm (1)</li> </ul>	<p>allow reacts with water <u>ignore incorrect catalyst</u> ignore hot / heat</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(b)(ii)</b>	<p>An explanation linking any three of</p> <p>LAND: country needs land for: farming / food / crops / homes /not enough land to grow sugar crop for fermentation (1)</p> <p>OIL SUPPLY: (reliable supply of) crude oil for <b>ethene</b> (1)</p> <p>SPEED: fermentation slow/batch; hydration continuous/ fast (1)</p> <p>PURITY: hydration makes {pure(r) ethanol / high concentration} (1)</p> <p>ATOM ECONOMY: higher atom economy for ethene process (1)</p>	<p>ignore incorrect responses</p> <p>ignore land needed for growing yeast</p> <p>ignore cheaper/easier</p> <p>ignore yield</p>	<b>(3)</b>

Total for Question 3 = 10 marks



Question Number	Answer	Mark
<b>4(a)</b>	 <p>any 3 carbon molecule <b>and</b> <u>one</u> C=C (1) fully correct molecule with <u>all bonds</u> (2)</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(b)(i)</b>	<b>A</b> 333 dm <sup>3</sup>		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(b)(ii)</b>	<p>An explanation linking</p> <ul style="list-style-type: none"> <li>• <u>all / three</u> gases present/ <u>nitrogen, hydrogen and ammonia</u> (1)</li> <li>• ammonia decomposes/ ammonia turns back to reactants/ reaction goes both ways / reversible (1)</li> </ul>	<p>reject ammonium</p> <p>ignore incomplete reaction assume that "both reactions" refer to forward and backward reaction allow <b>dynamic</b> equilibrium</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(b)(iii)</b>	<p>An explanation linking</p> <ul style="list-style-type: none"> <li>• increased / higher {yield / amount of ammonia} (1)</li> <li>• because fewer (gas) molecules/ moles on RHS/ 4 mole(cule)s on left and 2 on right/ decreased volume on RHS/equilibrium shifts to RHS/ equilibrium shifts in forward direction (1)</li> </ul>	<p>mark independently ignore "high yield"</p> <p>reject answers referring to exothermic or endothermic ignore any references to rate</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(b)(iv)</b>	<p>An explanation to include</p> <ul style="list-style-type: none"> <li>• <b>rate</b> increased/ time to reach equilibrium reduced (1)</li> <li>• because gas molecules closer / more concentrated (1)</li> <li>• so increased <b>collision rate</b> / more <b>collisions</b> <u>in a given time</u> / more <u>frequent collisions</u>(1)</li> </ul>	<p>mark independently</p> <p>ignore any refs to equilibrium ignore 'time is faster'/ allow 'quicker'</p> <p>allow atoms/ particles instead of molecules; allow more molecules present (in same container) do not allow 'more collisions'</p>	<b>(3)</b>

Total for Question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
<b>5(a)</b>	$\text{CaCl}_2 = 40 + 35.5 + 35.5$ (=111) (1)  THEN $\text{moles} = 11.1 / 111$ (= 0.1) (1) $\text{conc} = \text{moles} \times 1000/500$ (=0.2) (1)  OR $\text{mass conc} = 11.1 \times 1000/500$ (=22.2) (1) $\text{conc} = \text{mass conc}/111$ (= 0.2) (1)	<u>0.2 scores 3</u>  ecf: 11.1 / Mr  ecf: mass conc / 111	<b>(3)</b>

Question Number	Answer	Acceptable answers	Mark
<b>5(b)(i)</b>	A description linking <ul style="list-style-type: none"> <li>• <b>pipette</b> (1)</li> <li>• one practical point eg draw liquid <u>up to line</u>/ use pipette filler/ rinse first / read at eye level (1)</li> </ul>	<b>ignore</b> burette etc for 1 <sup>st</sup> mpt if using measuring cylinder/ burette allow suitable practical point eg read at eye level/ add dropwise from burette near 25 cm <sup>3</sup> (1) ignore as 2 <sup>nd</sup> point: transfer liquid to flask / safety precautions	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>5(b)(ii)</b>	<b>D</b> 25.20 cm <sup>3</sup>		<b>(1)</b>

Question Number	Indicative Content	Mark
<b>QWC</b>	<p data-bbox="197 315 293 349"><b>*5(c)</b></p> <p data-bbox="331 315 1305 349">A description / explanation including some of the following points</p> <p data-bbox="331 389 400 423"><b>soft</b></p> <ul data-bbox="379 423 783 562" style="list-style-type: none"> <li>• add soap (solution)</li> <li>• shake/ mix</li> <li>• lather (immediately)</li> <li>• no scum/ no precipitate</li> </ul> <p data-bbox="331 602 600 636"><b>permanent hard</b></p> <ul data-bbox="379 636 1219 882" style="list-style-type: none"> <li>• add soap (solution)</li> <li>• shake</li> <li>• no lather / less than with soft water</li> <li>• scum/ precipitate</li> <li>• boiled sample</li> <li>• same results / boiling does not change</li> <li>• becomes soft after ion exchange but not after boiling</li> </ul> <p data-bbox="331 922 592 956"><b>temporary hard</b></p> <ul data-bbox="379 956 1086 1202" style="list-style-type: none"> <li>• add soap (solution)</li> <li>• shake</li> <li>• no lather / less than with soft water</li> <li>• scum/ precipitate</li> <li>• <b>boiled</b> sample</li> <li>• after boiling precipitate / (lime)scale formed</li> <li>• lather (immediately)</li> </ul> <p data-bbox="331 1243 1259 1276">credit quantitative approaches e.g. titration with soap solution</p>	<b>(6)</b>

<b>Level</b>	<b>0</b>	No rewardable content
<b>1</b>	<b>1 - 2</b>	<ul style="list-style-type: none"> <li>• a limited description e.g. test and one result / when shaken with soap, soft water makes lather but no scum</li> <li>• the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>• spelling, punctuation and grammar are used with limited accuracy</li> </ul>
<b>2</b>	<b>3 - 4</b>	<ul style="list-style-type: none"> <li>• a simple description e.g. describe test and results to distinguish the soft water and the two samples that are hard water / when shaken with a small amount of soap, soft water makes a lather and no scum but the other waters make scum but no (less) lather</li> <li>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>• spelling, punctuation and grammar are used with some accuracy</li> </ul>
<b>3</b>	<b>5 - 6</b>	<ul style="list-style-type: none"> <li>• a detailed description e.g. describe test and results to identify all three of the samples / as 3-4 and boil the two hard water samples and repeat test. That which now gives a lather is temporarily hard</li> <li>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>• spelling, punctuation and grammar are used with few errors</li> </ul>

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
<b>6(a)(i)</b>	cathode  Reject anode		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>6(a)(ii)</b>	A description to include  ANODE/IMPURE COPPER/ +VE ELECTRODE <ul style="list-style-type: none"> <li>becomes smaller/ loses mass / loses copper / copper atoms form ions / copper is oxidised / copper (ions) enter solution (1)</li> </ul> CATHODE/ PURE COPPER/ -VE ELECTRODE <ul style="list-style-type: none"> <li>{red-brown/copper} deposit/ becomes larger / gains mass / gains copper / copper ions are reduced / copper (ions) from solution add to electrode (1)</li> </ul>	allow half equation          allow half equation	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>6(a)(iii)</b>	<b>D</b> reduction		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>6(a)(iv)</b>	An explanation linking  <b>ions</b> / cations / copper ions / anions / sulfate ions (1)  (are free to) <u>move</u> (in solution) (1)	<b>reject electrons</b> / atoms / molecules ignore 'charged particles'  allow flow 2 <sup>nd</sup> mark dependent on 1 <sup>st</sup> MP	<b>(2)</b>

Question Number		Indicative Content	Mark
<b>QWC</b>	<b>*6(b)</b>	<p>A description / explanation including some of the following points marks can be scored from diagrams incorrectly balanced equations can be used as evidence of reaction occurring but po not otherwise credited</p> <p><b>electrolysis process</b></p> <ul style="list-style-type: none"> <li>ions move when current passed</li> <li>negative ions move to anode</li> <li>overall decomposition of water</li> <li><math>2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2</math></li> </ul> <p><b>Anode/ positive electrode</b></p> <ul style="list-style-type: none"> <li>sulphate ions move to anode</li> <li>hydroxide ions move to anode</li> <li>hydroxide ions lose electrons/oxidation</li> <li>hydroxide ions form oxygen</li> <li>half equation: <math>4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-</math></li> <li>half volume gas at this electrode</li> <li>oxygen test: glowing splint in gas relights</li> </ul> <p><b>cathode/ negative electrode</b></p> <ul style="list-style-type: none"> <li>sodium ions move to cathode</li> <li>hydrogen ions move to cathode</li> <li>hydrogen ions gain electrons / reduction</li> <li>hydrogen ions form hydrogen</li> <li>half equation: <math>2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2</math></li> <li>double volume gas at this electrode</li> <li>hydrogen test: lit splint in gas burns/ pops</li> <li>hence double volume of hydrogen gas</li> </ul>	<b>(6)</b>
<b>Level</b>	<b>0</b>	No rewardable content	
<b>1</b>	<b>1 - 2</b>	<ul style="list-style-type: none"> <li>a limited description e.g. states which ions go to which electrode</li> <li>the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>spelling, punctuation and grammar are used with limited accuracy</li> </ul>	
<b>2</b>	<b>3 - 4</b>	<ul style="list-style-type: none"> <li>a simple explanation e.g. explain formation of one product</li> <li>the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>spelling, punctuation and grammar are used with some accuracy</li> </ul>	
<b>3</b>	<b>5 - 6</b>	<ul style="list-style-type: none"> <li>a detailed explanation e.g. explaining formation of BOTH products at electrodes</li> <li>the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>spelling, punctuation and grammar are used with few errors</li> </ul>	

Total for Question 6 = 12 marks

