

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	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>

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<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	Mark
<b>1(c)</b>	<b>C</b> unsaturated molecules in the liquid oil become saturated	<b>(1)</b>

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<b>2(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 <b>ignore 'optimum'</b> { temp/pressure/pH}</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(a)(ii)</b>	<b>B</b> fractional distillation		<b>(1)</b>

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<b>2(a)(iii)</b>	$\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2 \text{C}_2\text{H}_5\text{OH} + 2 \text{CO}_2$ <p>(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 C<sub>2</sub>H<sub>6</sub>O/ CH<sub>3</sub>CH<sub>2</sub>OH for C<sub>2</sub>H<sub>5</sub>OH</p> <p>reject CO<sub>2</sub> / CO<sup>2</sup></p> <p>allow multiples</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(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</p> <p><u>ignore incorrect catalyst</u></p> <p>ignore hot / heat</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>2(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>

Question Number	Answer	Acceptable answers	Mark
<b>3(a)</b>	add yeast, temperature of 35°C		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(b)</b>	C <sub>2</sub> H <sub>4</sub> (1) + H <sub>2</sub> O (1) → C <sub>2</sub> H <sub>5</sub> OH award one mark max if incorrectly balanced	allow correct molecular formula C <sub>2</sub> H <sub>6</sub> O allow H <sub>4</sub> C <sub>2</sub> correct multiples ignore state symbols	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(c)(i)</b>	A description linking any two from <ul style="list-style-type: none"> <li>• same <b>general</b> formula (1)</li> <li>• same functional group (1)</li> <li>• (consecutive) compounds differ by CH<sub>2</sub> (1)</li> <li>• gradual variation in physical properties (1)</li> </ul> <ul style="list-style-type: none"> <li>• {similar / same} chemical {properties / reactions} (1)</li> </ul>	allow C <sub>n</sub> H <sub>2n+1</sub> OH (2) allow C <sub>n</sub> H <sub>2n</sub> or any correct general formula (2)  ignore same properties/physical properties  allow a correct trend, e.g. bp increases with number of carbon atoms (1)	<b>(2)</b>

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<b>3(c)(ii)</b>	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{O}-\text{H} \\   \\ \text{H} \end{array}$	allow -OH allow correct dot and cross diagram	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(d)(i)</b>	oxidation		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>3(d)(ii)</b>	A description including any two from <ul style="list-style-type: none"> <li>• effervescence/fizzing/bubbling (1)</li> <li>• solid disappears (1)</li> <li>• colourless solution (1)</li> </ul>	ignore incorrectly named gases ignore gas given off/evolved allow magnesium floats on surface of acid  allow solid dissolves (1)  ignore solution <u>turns</u> colourless ignore clear	<b>(2)</b>

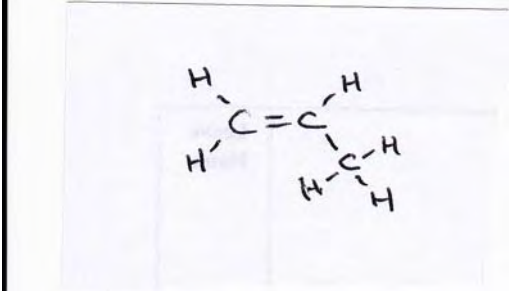
Question Number	Answer	Acceptable answers	Mark
<b>4(a)</b>	$C_2H_4 + H_2O \rightarrow C_2H_5OH$ $C_2H_4$ as <b>reactant</b> (1) rest of equation correct conditional on $C_2H_4$ as a reactant (1)	do not allow $H_2O$ / $H^2O$ /lower case h/HOH  allow $C_2H_6O$ for ethanol ignore state symbols	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(b)</b>	A description including any two from <ul style="list-style-type: none"> <li>• dissolve sugar in water /sugar solution (1)</li> <li>• (add) yeast (1)</li> <li>• warm / any temperature or range within 15 to 40°C (1)</li> <li>• anaerobic / {no/little} {air/oxygen} c enter the apparatus (1)</li> </ul>	allow glucose solution ignore carbohydrate  allow room temperature ignore heat unless specified temperature ignore optimum temperature  do not allow just 'sealed container' ignore fractional distillation	<b>(2)</b>

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<b>4(c)</b>	<p>An explanation linking</p> <p>Marking point 1 – sugar- one from</p> <ul style="list-style-type: none"> <li>• sugar obtained from { plants /crops/specific crop} (1)</li> <li>• (plenty of) land available to grow { plants /crops/specific crop} (for fermentation)(1)</li> </ul> <p>Marking point 2 - ethene</p> <ul style="list-style-type: none"> <li>• ethene obtained from { crude oil / fractional distillation /cracking} (1)</li> </ul> <p>Marking point 3 – cost/energy – one from</p> <ul style="list-style-type: none"> <li>• cannot afford to buy crude oil (1)</li> <li>• crude oil is too expensive (1)</li> <li>• more expensive to { use/buy/produce} ethene (1)</li> <li>• cheaper to use fermentation (1)</li> </ul>	<p>ignore answers that just repeat the information in the question</p> <p>ignore vague answers such as carbon neutral/environmentally friendly</p> <p>for marking point 1 <b>OR</b> 2, allow plants renewable/{ crude oil/ethene} non-renewable (1)</p> <p>allow { little/no} { heat/energy} required for fermentation (1)</p> <p>allow { high temperature /high pressure} required for hydration of ethene (1)</p>	<b>(3)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(d)</b>	<p>An explanation including any two from</p> <ul style="list-style-type: none"> <li>• formulae differ by CH<sub>2</sub></li> <li>• same general formula</li> <li>• all have { OH/hydroxyl group}</li> </ul>	<p>general formula is C<sub>n</sub>H<sub>2n+1</sub>OH (2)</p> <p>allow increase by { CH<sub>2</sub>/1 carbon <b>and</b> 2 hydrogens}</p> <p>do not allow incorrect general formula</p> <p>allow have similar <b>chemical</b> { reactions /properties}/same functional group/OH from an incorrect general formula</p> <p>ignore 'hydroxide'/all end in (an)ol /all alcohols</p> <p>ignore physical properties</p> <p>maximum (1) if hydroxide ions /carboxyl group</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>5(a)(i)</b>	D C <sub>4</sub> H <sub>10</sub>		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>5(a)(ii)</b>	 <p><b>one</b> C=C in a molecule with three consecutive carbon atoms (1)</p> <p>rest of structure correct, ignore bond angles, conditional on first marking point(1)</p>	<p>allow -CH<sub>3</sub></p> <p>do not allow two C=C in a molecule</p> <p>allow (1) for completely correct dot and cross diagram</p>	<b>(2)</b>

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<b>5(b)</b>	C oxidised		<b>(1)</b>

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<b>5(c)(i)</b>	<p>A description including two from</p> <ul style="list-style-type: none"> <li>effervescence / fizzing / bubbles of gas (1)</li> <li>solid {disappears/clears} / (colourless) solution formed (1)</li> </ul>	<p>ignore {cloudy/white ppt} / 'gas formed' / colour change / name of gas / changes to a liquid</p> <p>(solid/sodium carbonate/it) dissolves (1)</p>	<b>(2)</b>

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<b>5(c)(ii)</b>	<p>CH<sub>3</sub>COOC<sub>2</sub>H<sub>5</sub> / CH<sub>3</sub>COOCH<sub>2</sub>CH<sub>3</sub> / CH<sub>3</sub>CO<sub>2</sub>C<sub>2</sub>H<sub>5</sub> / CH<sub>3</sub>CO<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub> / C<sub>2</sub>H<sub>5</sub>O<sub>2</sub>CCH<sub>3</sub> / CH<sub>3</sub>CH<sub>2</sub>OOCCH<sub>3</sub> (1)</p> <p>H<sub>2</sub>O (1)</p>	<p>allow displayed formulae/ C<sub>4</sub>H<sub>8</sub>O<sub>2</sub></p> <p>do not allow formulae ending in -COOH/-COO or any formula that does not show an ester</p> <p>do not allow H<sub>2</sub>O / H<sup>2</sup>O / lower case h/HOH</p> <p>maximum (1) if additional incorrect balancing</p> <p>ignore state symbols</p>	<b>(2)</b>