

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

Question Number	Answer	Mark
1(a)(ii)	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)	(2)

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	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	(1)

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

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	A description linking <ul style="list-style-type: none"> filter / decant off water (1) (then) wash/rinse (1) 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	(2)

Question Number	Answer	Mark
1(c)	C unsaturated molecules in the liquid oil become saturated	(1)

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	<p>A description including two of the following</p> <ul style="list-style-type: none"> dissolve the sugar/aqueous solution (1) warm/ 25-40°C (1) in absence of air / no oxygen/ anaerobic / attach airlock (1) pH neutral / slightly acidic /4-7 sterile conditions <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>	(2)

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	B fractional distillation		(1)

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	$\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2 \text{C}_2\text{H}_5\text{OH} + 2 \text{CO}_2$ <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 C₂H₆O/ CH₃CH₂OH for C₂H₅OH</p> <p>reject CO₂ / CO²</p> <p>allow multiples</p>	(2)

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

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	<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 ethene (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>	(3)

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

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

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	A description linking any two from <ul style="list-style-type: none"> • same general formula (1) • same functional group (1) • (consecutive) compounds differ by CH₂ (1) • gradual variation in physical properties (1) <ul style="list-style-type: none"> • {similar / same} chemical {properties / reactions} (1) 	allow C _n H _{2n+1} OH (2) allow C _n H _{2n} 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)	(2)

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{O}-\text{H} \\ \\ \text{H} \end{array}$	allow -OH allow correct dot and cross diagram	(1)

Question Number	Answer	Acceptable answers	Mark
3(d)(i)	oxidation		(1)

Question Number	Answer	Acceptable answers	Mark
3(d)(ii)	A description including any two from <ul style="list-style-type: none"> • effervescence/fizzing/bubbling (1) • solid disappears (1) • colourless solution (1) 	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	(2)

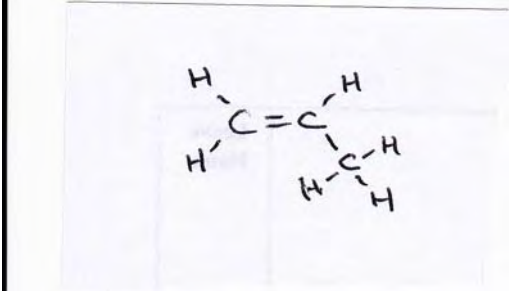
Question Number	Answer	Acceptable answers	Mark
4(a)	$\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$ <p>C_2H_4 as reactant (1)</p> <p>rest of equation correct conditional on C_2H_4 as a reactant (1)</p>	<p>do not allow H_2O / H^2O /lower case h/HOH</p> <p>allow $\text{C}_2\text{H}_6\text{O}$ for ethanol ignore state symbols</p>	(2)

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

Question Number	Answer	Acceptable answers	Mark
4(c)	<p>An explanation linking</p> <p>Marking point 1 – sugar- one from</p> <ul style="list-style-type: none"> • sugar obtained from { plants /crops/specific crop} (1) • (plenty of) land available to grow { plants /crops/specific crop} (for fermentation)(1) <p>Marking point 2 - ethene</p> <ul style="list-style-type: none"> • ethene obtained from { crude oil / fractional distillation /cracking} (1) <p>Marking point 3 – cost/energy – one from</p> <ul style="list-style-type: none"> • cannot afford to buy crude oil (1) • crude oil is too expensive (1) • more expensive to { use/buy/produce} ethene (1) • cheaper to use fermentation (1) 	<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 OR 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>	(3)

Question Number	Answer	Acceptable answers	Mark
4(d)	<p>An explanation including any two from</p> <ul style="list-style-type: none"> • formulae differ by CH₂ • same general formula • all have { OH/hydroxyl group} 	<p>general formula is C_nH_{2n+1}OH (2)</p> <p>allow increase by { CH₂/1 carbon and 2 hydrogens}</p> <p>do not allow incorrect general formula</p> <p>allow have similar chemical { 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>	(2)

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	D C ₄ H ₁₀		(1)

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	 <p>one 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 -CH₃</p> <p>do not allow two C=C in a molecule</p> <p>allow (1) for completely correct dot and cross diagram</p>	(2)

Question Number	Answer	Acceptable answers	Mark
5(b)	C oxidised		(1)

Question Number	Answer	Acceptable answers	Mark
5(c)(i)	<p>A description including two from</p> <ul style="list-style-type: none"> effervescence / fizzing / bubbles of gas (1) solid {disappears/clears} / (colourless) solution formed (1) 	<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>	(2)

Question Number	Answer	Acceptable answers	Mark
5(c)(ii)	<p>CH₃COOC₂H₅ / CH₃COOCH₂CH₃ / CH₃CO₂C₂H₅ / CH₃CO₂CH₂CH₃ / C₂H₅O₂CCH₃ / CH₃CH₂OOCCH₃ (1)</p> <p>H₂O (1)</p>	<p>allow displayed formulae/ C₄H₈O₂</p> <p>do not allow formulae ending in -COOH/-COO or any formula that does not show an ester</p> <p>do not allow H₂O / H²O / lower case h/HOH</p> <p>maximum (1) if additional incorrect balancing</p> <p>ignore state symbols</p>	(2)