

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)

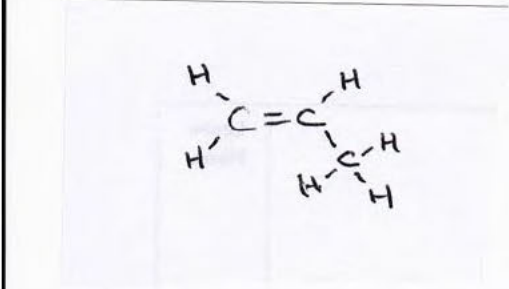
Question Number	Answer	Acceptable answers	Mark
4(a)	$C_2H_4 + H_2O \rightarrow C_2H_5OH$ C ₂ H ₄ as reactant (1) rest of equation correct conditional on C ₂ H ₄ as a reactant (1)	do not allow H ₂ O / H ² O /lower case h/HOH allow C ₂ H ₆ O for ethanol ignore state symbols	(2)

Question Number	Answer	Acceptable answers	Mark
4(b)	A description including any two from <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) 	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	(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 CH_2 same general formula all have {OH/hydroxyl group} 	<p>general formula is $\text{C}_n\text{H}_{2n+1}\text{OH}$ (2)</p> <p>allow increase by {CH_2/1 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)