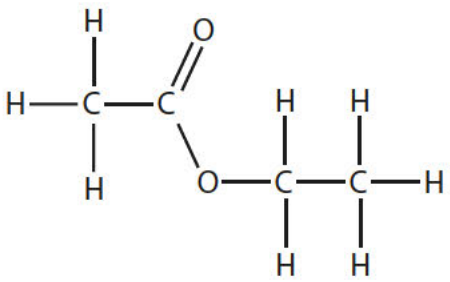
1 The structure of a molecule of an ester, ethyl ethanoate, is shown.



(a) (i) Give the molecular formula of this compound.

(1)

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(ii) Write the word equation for the reaction of ethanol with another compound to form ethyl ethanoate and another product.

(2)

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(iii) A hazard from the ethyl ethanoate fact sheet is shown in the box.

Exposure to the vapour of ethyl ethanoate can cause you to feel dizzy or to faint

Suggest why, despite this hazard, it is still safe to use ethyl ethanoate in sweets.

(1)

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(b) Vegetable oils and fats are esters.

One of these oils is boiled with concentrated sodium hydroxide solution.
The mixture is poured into concentrated sodium chloride solution.
A white solid is formed.

(i) What type of substance is the white solid?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** alcohol

☐ **B** fat

☐ **C** polyester

☐ **D** soap

(ii) The white solid is formed in a mixture with a solution of other substances.

Describe how a pure sample of the white solid can be obtained from this mixture.

(2)

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(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

Liquid oils can be converted into solid fats by hydrogenation.

In this reaction

(1)

☐ **A** a salt and water are formed

☐ **B** the liquid oil is reacted with oxygen gas

☐ **C** unsaturated molecules in the liquid oil become saturated

☐ **D** C═C bonds are formed

(Total for Question 1 = 8 marks)

2 (a) Ethanol is produced by the fermentation of glucose.

Yeast is needed for the fermentation reaction.

(i) State **two** other conditions for fermentation.

(2)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

A dilute solution of ethanol can be converted to a concentrated solution of ethanol by

(1)

☒ **A** filtration

☒ **B** fractional distillation

☒ **C** dehydration

☒ **D** cracking

(iii) Write the balanced equation for the fermentation of glucose, $C_6H_{12}O_6$.

(2)

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(b) In industry, ethene is converted to ethanol.

(i) State **two** conditions for this reaction.

(2)

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(ii) A country has large reserves of crude oil.

It is a relatively wealthy country with a large population but it has only a small amount of fertile land.

Explain why the country would prefer to produce its ethanol from ethene rather than by fermentation.

(3)

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(Total for Question 2 = 10 marks)

3 Ethanol is present in alcoholic drinks.

(a) Ethanol is produced by fermentation of carbohydrates.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The conditions used for fermentation are

(1)

- ☐ **A** add manganese(IV) oxide, temperature below 20 °C
- ☐ **B** add yeast, temperature of about 35 °C
- ☐ **C** add manganese(IV) oxide, temperature of 45 °C
- ☐ **D** add yeast, temperature above 60 °C

(b) Ethanol, C_2H_5OH, is also produced by the reaction of ethene with steam.

Write the balanced equation for this reaction.

(2)

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(c) Ethanol is a member of the homologous series, the alcohols.

(i) Describe what is meant by an **homologous series**.

(2)

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(ii) Draw the structure of a molecule of methanol, CH_3OH.

Show all the covalent bonds.

(1)

(d) When a bottle of wine is left open for a few days, ethanol in the wine changes into ethanoic acid.

(i) State the type of reaction that occurs when ethanol changes into ethanoic acid.

(1)

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(ii) Describe what you would **see** when a piece of magnesium ribbon is added to dilute ethanoic acid.

(2)

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(Total for Question 3 = 9 marks)

4 (a) Ethanol can be produced by reacting ethene with steam.

Write the balanced equation for this reaction.

(2)

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(b) Ethanol can also be produced by fermentation.

Describe how ethanol can be produced from sugar by fermentation.

(2)

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(c) A country has large amounts of available fertile land.
It has no reserves of crude oil.
It is not a wealthy country.

Explain why this country produces the ethanol it needs by fermentation rather than from ethene.

(3)

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(d) Ethanol is a member of the homologous series of alcohols.
The first three members of the series are

methanol	CH_3OH
ethanol	C_2H_5OH
propanol	C_3H_7OH

Use the formulae of these molecules to explain why these alcohols are members of the same homologous series.

(2)

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(Total for Question 4 = 9 marks)

5 (a) (i) Which of the following is the formula for a molecule of butane?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** C_3H_6

☒ **B** C_3H_8

☒ **C** C_4H_8

☒ **D** C_4H_{10}

(ii) Draw the structure of a molecule of propene, showing all covalent bonds.

(2)

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

Ethanol, C_2H_5OH, can be converted into ethanoic acid, CH_3COOH.

In this reaction, ethanol is

(1)

☒ **A** dehydrated

☒ **B** neutralised

☒ **C** oxidised

☒ **D** reduced

(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

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(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ ..... + ...

(Total for Question 5 = 8 marks)