

Alkenes

Question Paper

Level	GCSE
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Single Award (Paper 2C)
Topic	Organic Chemistry
Sub-Topic	Alkenes
Booklet	Question Paper

Time Allowed: 61 minutes

Score: /51

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	70%	60%	55%	50%	<50%

1 This is a recipe for making plum wine.

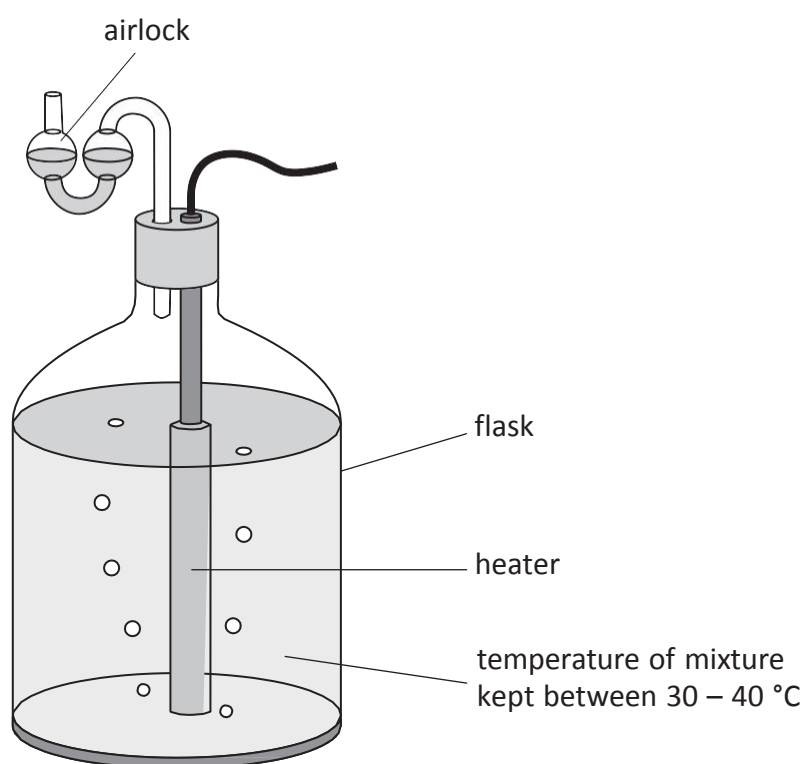
Dissolve 1.5 kg of sugar in 5 dm³ of warm water.

Add yeast and 8 kg of plums.

Pour the mixture into a flask.

Leave the flask for several weeks until the reaction has stopped.

Remove the solid yeast and pour the clear liquid into bottles.



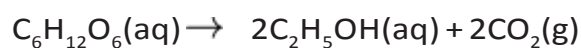
(a) Sugar contains sucrose, $C_{12}H_{22}O_{11}$

When yeast is added, water reacts with sucrose to form glucose, $C_6H_{12}O_6$

Write a chemical equation for this reaction.

(1)

(b) The glucose is then converted into ethanol by the yeast



(i) How would you know when the reaction has stopped? (1)

.....

(ii) How could the solid yeast be removed from the mixture? (1)

.....

(c) Ethanol can be converted into chloroethene, $\text{CH}_2=\text{CHCl}$, in three stages.

Stage 1 Ethanol is dehydrated to form ethene, $\text{CH}_2=\text{CH}_2$

Stage 2 Ethene is converted into 1,2-dichloroethane, $\text{CH}_2\text{ClCH}_2\text{Cl}$

Stage 3 1,2-dichloroethane is converted into chloroethene and hydrogen chloride

(i) Why is the reaction in **Stage 1** described as dehydration? (1)

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(ii) Identify the catalyst used in the reaction in **Stage 1**. (1)

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(iii) Suggest the name or formula of the substance used to react with ethene in **Stage 2**. (1)

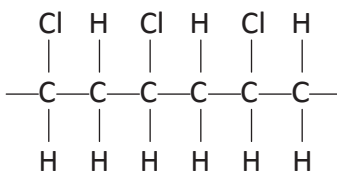
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(iv) Write a chemical equation for the reaction in **Stage 3**. (1)

.....

(d) Chloroethene can be used to make the polymer poly(chloroethene), also known as PVC.

The displayed formula for part of the PVC molecule is



(i) Draw a displayed formula for a chloroethene molecule.

(1)

(ii) Describe, in terms of structure and bonding, what happens when chloroethene molecules are converted into poly(chloroethene).

(3)

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(Total for Question 1 = 11 marks)

2 This information was taken from a label on a packet containing a pizza.

Nutritional information (per ½ pizza)	
Energy	1260 kJ
Protein	14.0 g
Carbohydrate	370 g
sugars	62 g
Fat	106 g
saturated	50 g
unsaturated	56 g

(a) (i) Which type of fat contains a double carbon to carbon ($C=C$) bond? (1)

.....
(ii) The colour of bromine water is orange.

State the final colour of the mixture after bromine water is shaken with (2)

an unsaturated fat

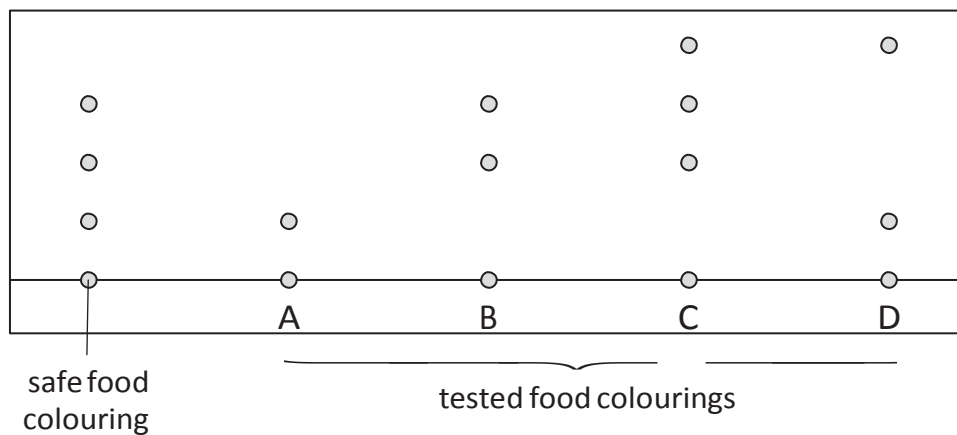
a saturated fat

(iii) What type of reaction takes place when bromine reacts with a compound containing a $C=C$ bond? (1)

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- (b) In February 2005, some companies had to remove their pizzas from sale because the food colourings in them were found to contain the artificial dye called Sudan 1, which is known to cause cancer.

The chromatogram shows how the dyes in the colourings were detected and identified.



- (i) Which one of the food colourings, A, B, C or D, is made up of only one dye? (1)

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- (ii) Identify the food colourings that may have contained Sudan 1. (1)

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- (iii) Explain how the chromatogram shows that the five food colourings are different from each other. (1)

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(Total for Question 2 = 7 marks)

3 Fractional distillation and cracking are important steps in processing crude oil.

(a) Place ticks (✓) in the columns to show which statements apply to each step.
You may place a tick in one column, in both columns or in neither column.

The first one has been done for you.

(5)

Statement	Fractional distillation	Cracking
Crude oil is heated	✓	
A catalyst may be used		
Alkenes are formed		
Decomposition reactions occur		
Fuels are obtained		
Separation is the main purpose		

(b) The formula $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ represents one of the compounds in crude oil.

(i) Give the molecular formula of this compound.

(1)

.....
(ii) Give the displayed formula of this compound.

(1)

(iii) Give the empirical formula of this compound.

(1)

.....
(iv) Give the name of this compound.

(1)

.....
(v) Give the general formula of the homologous series that contains this compound.

(1)

.....

(c) The products of the complete combustion of hydrocarbons are carbon dioxide and water.

(i) Balance the equation to show the complete combustion of ethene (C₂H₄).

(2)

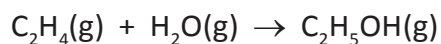


(ii) Draw a dot and cross diagram to show the bonding in an ethene molecule.

Show only the outer electrons in each atom.

(2)

(d) Ethanol can be manufactured by the hydration of ethene. The equation for this reaction is



(i) Identify the catalyst and state the temperature used in this process.

(2)

Catalyst.....

Temperature.....

(ii) A 20 mol sample of ethanol was produced using this reaction.

Deduce the amount, in moles, of ethene needed and the volume, in dm^3 , that this amount of ethene would occupy at room temperature and pressure.

Assume that all of the ethene is converted into ethanol and that the molar volume of ethene is 24 dm^3 at rtp.

(3)

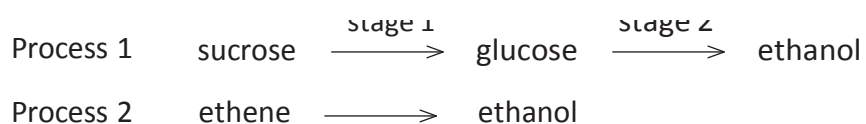
Amount of ethene mol

Volume of ethene

Volume = dm^3

(Total for Question 3 = 19 marks)

4 (a) Ethanol can be manufactured by two different processes.



(i) What is the general name for compounds such as sucrose and glucose? (1)

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(ii) What type of reaction occurs in stage 2? (1)

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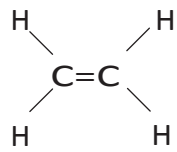
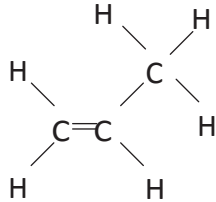
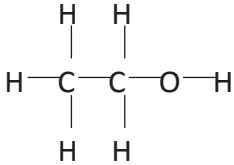
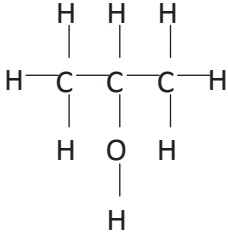
(iii) What is the catalyst used in stage 2? (1)

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(iv) What type of reaction occurs in process 2? (1)

.....

(b) The table shows the displayed formulae of four organic compounds.

ethene	propene
	
ethanol	compound D
	

Ethanol and compound D are members of the homologous series of alcohols.

(i) The first member of this homologous series is methanol.

Draw the displayed formula of methanol.

(1)

(ii) Suggest the name of compound D.

(1)

(c) In industry, the conversion of propene to compound D uses the same conditions as those used in the conversion of ethene to ethanol.

Identify a suitable catalyst and temperature for these conversions.

(2)

catalyst

temperature °C

(d) Ethene and acetylene can both be used for welding metals.

The equations for the reactions of these gases in welding are



One problem with using hydrocarbons as fuels is incomplete combustion.

(i) Incomplete combustion is a bigger problem with ethene than with acetylene.

Suggest why.

(1)

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(ii) One of the gases produced during incomplete combustion is dangerous to humans.

Identify this gas and explain how it is dangerous.

(3)

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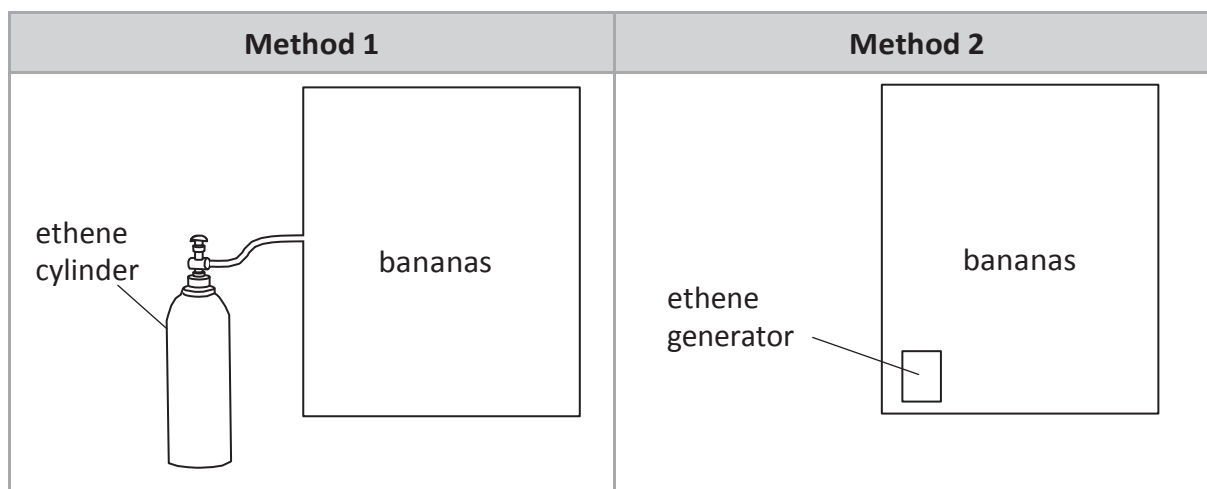
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(e) Ethene can be used to ripen bananas.

Bananas are placed in a large container and ethene is added. The ethene can be added in two different ways.



(i) In method 1, ethene is stored under pressure and passed through a pipe into the container.

Suggest one risk in using this method.

(1)

(ii) In method 2, the generator contains a known quantity of ethanol that is slowly decomposed to ethene using a catalyst.

Write a chemical equation for this decomposition.

(1)

(Total for Question 4 = 14 marks)