

# Synthetic Polymers

## Question Paper

Level	GCSE
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Single Award (Paper 2C)
Topic	Chemistry in Industry
Sub-Topic	Synthetic Polymers
Booklet	Question Paper

**Time Allowed:** 37 minutes

**Score:** /31

**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.

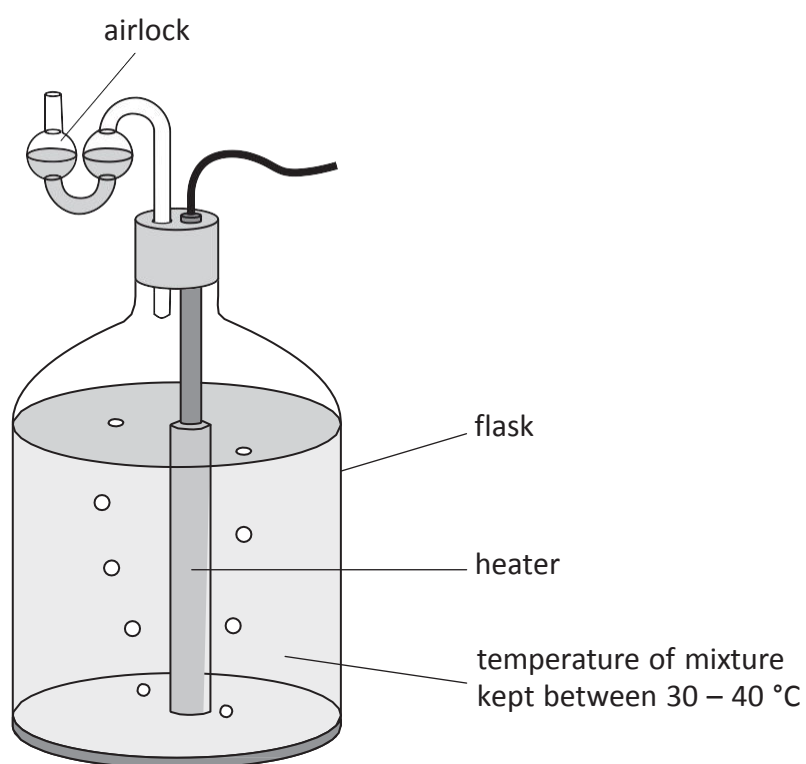
Dissolve 1.5 kg of sugar in 5 dm<sup>3</sup> of warm water.

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.



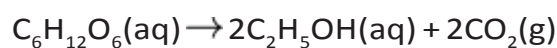
(a) Sugar contains sucrose,  $C_{12}H_{22}O_{11}$

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)

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

(1)

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

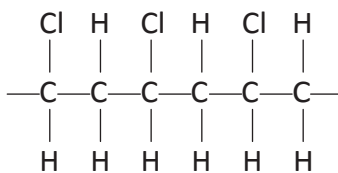
(1)

(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 (a) Plastic bags used to store food are made from a polymer.

Ethene is the monomer used to make the polymer for some plastic bags.

(i) Name the polymer that is made from ethene.

(1)

(ii) Use a word from the box to complete the sentence about ethene.

chromatography	condensing	cracking	crystallising
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(1)

Ethene is made by breaking down large hydrocarbon molecules into smaller hydrocarbon molecules, using a process called.....

(b) The hydrocarbons used to make ethene are called alkanes.

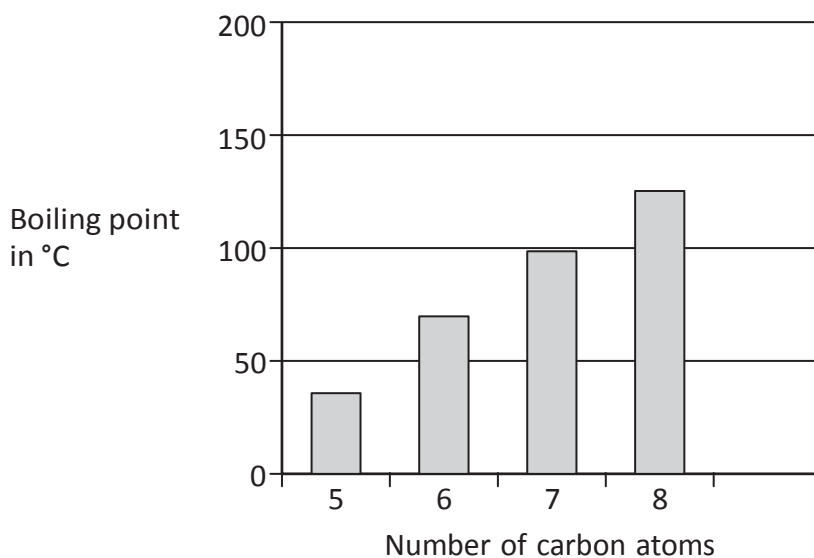
They are obtained from crude oil.

The boiling point of an alkane is related to the number of carbon atoms in the molecule.

<b>Number of carbon atoms in molecule</b>	5	6	7	8	9
<b>Boiling point in °C</b>	36	69	99	125	151

(i) Use the data in the table to complete the bar chart.

(2)



(ii) What is the relationship between the boiling point of an alkane and the number of carbon atoms in its molecule?

(1)

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(c) Many plastic bags are not biodegradable.

Used plastic bags can be

**A** buried underground, which is called landfill

or

**B** burned to release energy, which also produces large amounts of gases.

Suggest which of these methods of disposal is better for the environment, giving two reasons for your choice.

(2)

Choice .....

Reason 1 .....

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Reason 2 .....

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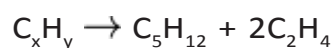
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**(Total for Question 2 = 7 marks)**



(c) The equation for one reaction that could occur in process 2 is



(i) Deduce the formula of  $C_xH_y$  (1)

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(ii) Give the name of the compound  $C_5H_{12}$  (1)

.....  
(iii) Draw the displayed formula of  $C_2H_4$  (1)

(d) The structural formula of chloroethene formed in process 3 is  $CH_2=CHCl$

The polymer formed in process 4 is poly(chloroethene).

Draw the **displayed** formula for the repeat unit of poly(chloroethene).

(2)



(e) Poly(chloroethene) is formed by addition polymerisation.

Nylon is formed by condensation polymerisation.

(i) How does condensation polymerisation differ from addition polymerisation? (1)

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(ii) Poly(chloroethene) and nylon do not biodegrade easily.

What is meant by the term **biodegrade**? (2)

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(iii) What feature of addition polymers makes it difficult for them to biodegrade? (1)

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(Total for Question 3= 13 marks)