

Name:

Date:

C7 - Test 6  
ORGANIC CHEMISTRY  
Advanced

**GCSE**

CHEMISTRY

AQA - Triple Science

Mark

Grade

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### Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

### Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

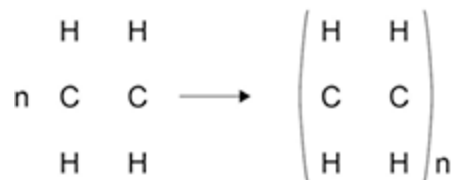
### Information

- The marks for the questions are shown in brackets

1.

Ethene is used to produce poly(ethene).

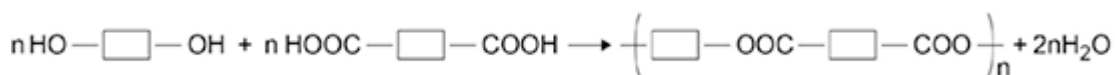
- (a) Draw the bonds to complete the displayed formulae of ethene and poly(ethene) in the equation.



(2)

- (b) Polyesters are made by a different method of polymerisation.

The equation for the reaction to produce a polyester can be represented as:



Compare the polymerisation reaction used to produce poly(ethene) with the polymerisation reaction used to produce a polyester.

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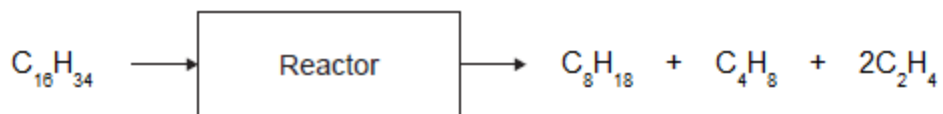
(4)

(Total 6 marks)

2.

Poly(butene) is a polymer made from crude oil in two stages.

- (a) The first stage in making poly(butene) is to break down large hydrocarbon molecules from crude oil into smaller hydrocarbon molecules, as shown in the figure below.



- (i) The products contain two types of hydrocarbon with different general formulae.

Name the two types of hydrocarbon.

\_\_\_\_\_

(1)

- (ii) Describe the conditions in the reactor.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2)

- (iii) Suggest why air must **not** enter the reactor.

\_\_\_\_\_  
\_\_\_\_\_

(1)

- (iv) Suggest a method that can be used to separate butene ( $\text{C}_4\text{H}_8$ ) from the other hydrocarbons.

\_\_\_\_\_

(1)

- (b) The second stage is to use butene ( $\text{C}_4\text{H}_8$ ) to produce poly(butene).

- (i) Draw the displayed structure of a butene ( $\text{C}_4\text{H}_8$ ) molecule.

(1)

(ii) Describe how molecules of butene ( $C_4H_8$ ) form poly(butene).

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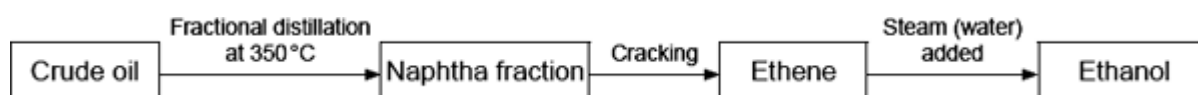
(2)

(Total 8 marks)

3.

Petrol sold in most countries now contains at least 5% ethanol.  
The production of ethanol, for use as a fuel, is being increased.

The flow diagram shows how ethanol can be produced from crude oil.



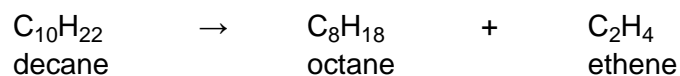
(a) Why does crude oil need to be fractionally distilled?

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(1)

(b) Hydrocarbons, such as decane, in the naphtha fraction are cracked to produce ethene.  
The balanced chemical equation shows the cracking of decane.



(i) Describe how cracking is done.

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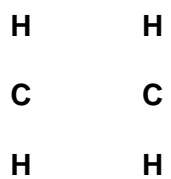
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(2)

- (ii) Complete the structural formula of ethene by drawing lines to represent each covalent bond.

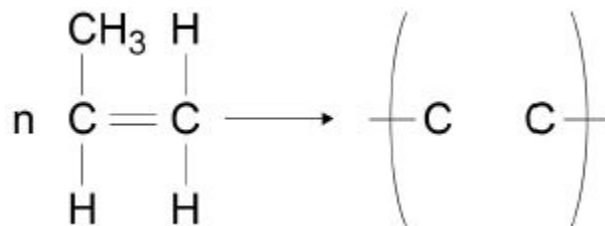


(1)



(b) Poly(propene) is produced from propene.

Complete the structure of poly(propene) in the equation.



(3)

(c) Carpets are made from:

- poly(propene)
- wool
- a mixture of poly(propene) and wool.

Poly(propene) wears out more slowly than wool.

A mixture of poly(propene) and wool to make carpets is more sustainable than using just poly(propene) or just wool.

Suggest why.

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(2)

Polymer fibres are used to make firefighter uniforms.

The table below shows some properties of two polymer fibres.

Property	Polymer fibres	
	Poly(propene)	Polyester
Density in g/cm <sup>3</sup>	0.90	1.38
Melting point in °C	165	260
Flame resistance	Poor	Good
Water absorption	Low	High





(b) Which gas is produced when sodium reacts with ethanol?

Tick (✓) **one** box.

Carbon dioxide

Carbon monoxide

Hydrogen

Oxygen

(1)

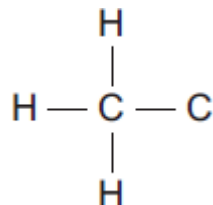
(c) Ethanoic acid ( $\text{CH}_3\text{COOH}$ ) can be produced from ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ ).

(i) What type of reaction produces ethanoic acid from ethanol?

\_\_\_\_\_

(1)

(ii) Complete the displayed structure of ethanoic acid.



(1)

(iii) Solutions of ethanoic acid and hydrochloric acid with the same concentration have different pH values.

Explain why the solution of ethanoic acid has a higher pH than the solution of hydrochloric acid.

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\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(2)

(d) Ethanol and ethanoic acid react in the presence of a catalyst to form an ester.

(i) Name the ester made from ethanol and ethanoic acid.

\_\_\_\_\_

(1)

(ii) What type of chemical is used as a catalyst in this reaction?

\_\_\_\_\_

(1)

(iii) Esters are used in perfumes because they smell pleasant and are volatile.

What does volatile mean?

\_\_\_\_\_

(1)

(Total 10 marks)

6.

(a) PEX is a material that is used as an alternative to copper for hot water pipes. PEX is made from poly(ethene).

(i) Describe how ethene forms poly(ethene).

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

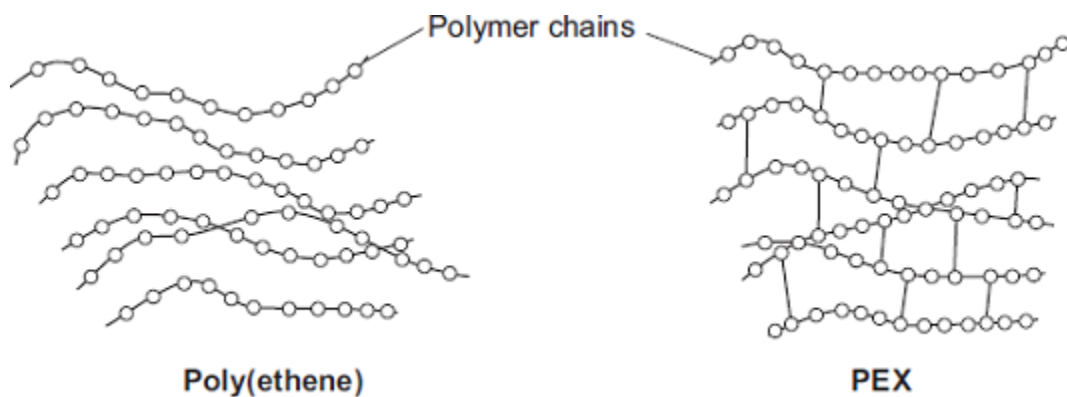
(2)

(ii) PEX is a shape memory polymer. What property does a shape memory polymer have?

\_\_\_\_\_  
\_\_\_\_\_

(1)

(iii) The simplified structures of poly(ethene) and PEX are shown.



Poly(ethene) is a thermoplastic that softens easily when heated.  
Suggest and explain how the structure of PEX changes this property.

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(3)

(b) Copper is a suitable material to use for hot water pipes.  
PEX is now used as an alternative material for hot water pipes.

Copper is extracted from its ore by a series of processes.

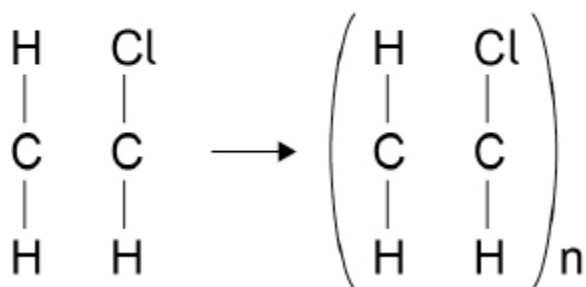
- 1 The low-grade copper ore is powdered and concentrated.
- 2 The concentrated powdered copper ore is blown into a furnace with air to produce impure, molten copper. (This furnace is heated to 1100 °C using a hydrocarbon fuel.)
- 3 Oxygen is blown into the impure, molten copper to remove any sulfur. The molten copper is cast into rectangular slabs.
- 4 The final purification of copper is done by electrolysis.



(b) **Figure 1** shows the equation for the formation of poly(chloroethene).

Complete **Figure 1**.

**Figure 1**



(3)

(c) Poly(chloroethene) is the only product.

What type of polymer is poly(chloroethene)?

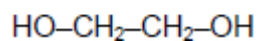
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(1)

Ethanediol reacts with butanedioic acid to produce a polyester and a small molecule.

(d) **Figure 2** shows the structural formula of ethanediol.

**Figure 2**



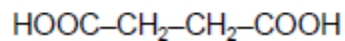
Name the functional group present in ethanediol.

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(1)

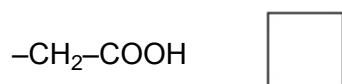
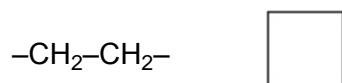
- (e) **Figure 3** shows the structural formula of butanedioic acid.

**Figure 3**



Which formula represents the carboxylic acid functional group?

Tick (✓) **one** box.

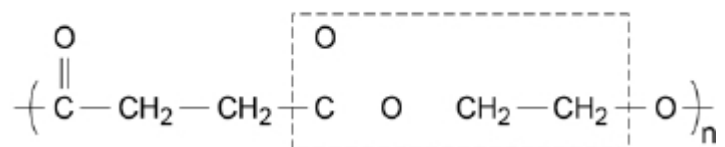


(1)

- (f) **Figure 4** shows part of the structure of the polyester.

Complete the box in **Figure 4**.

**Figure 4**



(2)

- (g) Name the small molecule produced when ethanediol reacts with butanedioic acid.

\_\_\_\_\_

(1)

Starch, proteins and DNA are naturally occurring polymers.

- (h) Name the monomers from which starch and proteins are produced.

Starch \_\_\_\_\_

Proteins \_\_\_\_\_

(2)

(i) Describe the structure of DNA.

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(2)  
(Total 14 marks)

**8.**

Crude oil is a fossil fuel.

(a) Describe how crude oil is separated into fractions.

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(4)

- (b) Fuel oil is one of the fractions from crude oil.

Power stations burn fuel oil to generate electricity. The waste gases from the combustion of fuel oil contain carbon dioxide, water vapour, sulfur dioxide and oxides of nitrogen.

The waste gases are passed through a suspension of limestone in water. Limestone is mainly calcium carbonate.

Suggest how the use of a suspension of limestone decreases one of the environmental impacts that the waste gases would cause.

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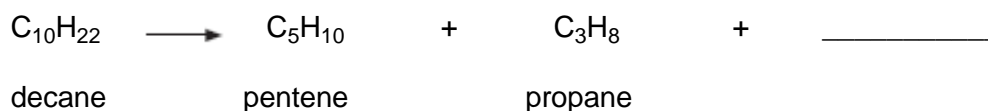
(3)

- (c) Some fractions from crude oil contain large hydrocarbon molecules.

- (i) Hydrocarbon molecules, such as decane, can be cracked to produce smaller, more useful molecules.

Write the correct formula of the third product to complete the chemical equation.

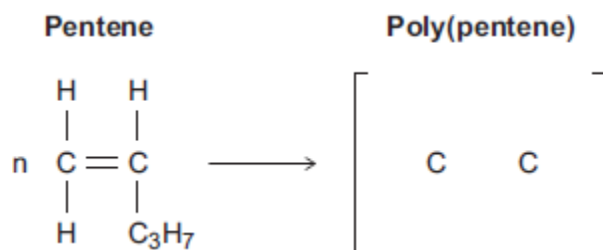
You do not need to give the name of this product.



(1)

- (ii) Pentene is used to produce poly(pentene).

Complete the equation and the displayed structure of poly(pentene).



(3)



(iii) Some polymers are described as smart polymers.

Suggest **one** property of a smart polymer that is different to that of an ordinary polymer.

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(1)

(Total 12 marks)