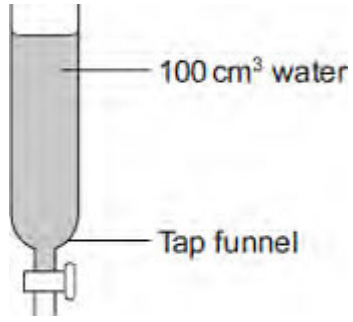
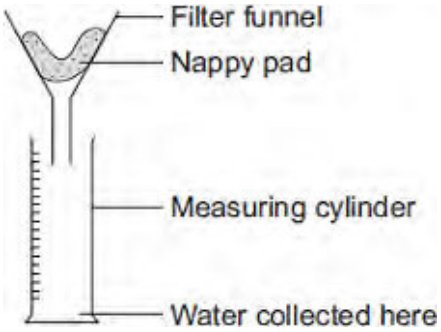
Q1. Disposable nappies for babies need to absorb as much water as possible.
Disposable nappies have a pad containing a special polymer called a hydrogel.
Hydrogels absorb water.

A company called Aqanaps compared the water absorption of its nappy pads with nappy pads made by other companies.



- A scientist from Aqanaps poured 100 cm^3 of water onto the pad of one of their nappies.
- He measured the volume of water that passed through.
- He did the test three times using a new nappy pad for each test.



- The scientist then repeated the procedure using the nappy pads from three other companies, **A**, **B** and **C**.

The results are shown in the table.

Company	**Volume of water collected in cm^3**		
	Pad 1	**Pad 2**	**Pad 3**
Aqanaps	55	57	55
A	47	46	39
B	65	63	64
C	38	39	38

(a) (i) Choose **one** result in the table that should be tested again.

Result: Company ..... Pad .....

Explain why you chose this result.

.....

.....

.....

(2)

(ii) Suggest **one** variable that should be controlled in this investigation.

.....

.....

(1)

(iii) Suggest **one** possible cause of error in this investigation.

.....

.....

(1)

(b) (i) The Aqanaps company studied the results. The company concluded that it should increase the amount of hydrogel used in its nappy pads.

Give **two** reasons why the company decided to increase the amount of hydrogel used in its nappy pads.

1 .....

.....

2 .....

.....

(2)

(ii) Suggest **one** disadvantage for the company if it increases the amount of hydrogel used in its nappy pads.

.....

.....

(1)
(Total 7 marks)

Q2. The raw materials used to make the polymer polyvinyl chloride (PVC) are crude oil and sea salt (sodium chloride).

(a) There are three main stages in the production of PVC.

(i) **Stage 1** Cracking of hydrocarbons from crude oil produces ethene, C_2H_4

$C_{10}H_{22} \longrightarrow C_8H_{18} + C_2H_4$

How are hydrocarbons cracked?

.....

.....

.....

.....

(2)

(ii) **Stage 2** Electrolysis of sodium chloride solution produces chlorine.
Ethene from **Stage 1** is then reacted with this chlorine.
One of the hydrogen atoms in each ethene molecule is replaced by a chlorine atom to produce vinyl chloride.

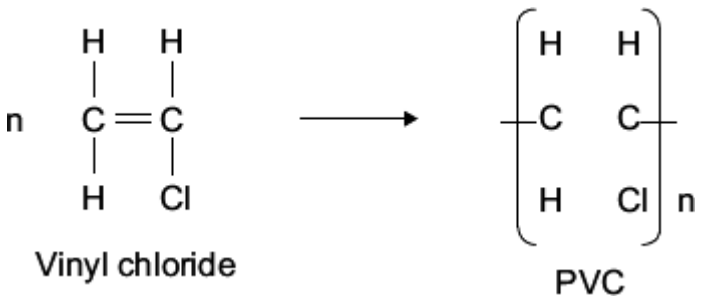
Complete the chemical equation by writing in the formula of the product vinyl chloride.

$C_2H_4 + Cl_2 \longrightarrow$ ..... $+ HCl$

(1)

(iii) **Stage 3** Polymerisation of vinyl chloride produces polyvinyl chloride (PVC).

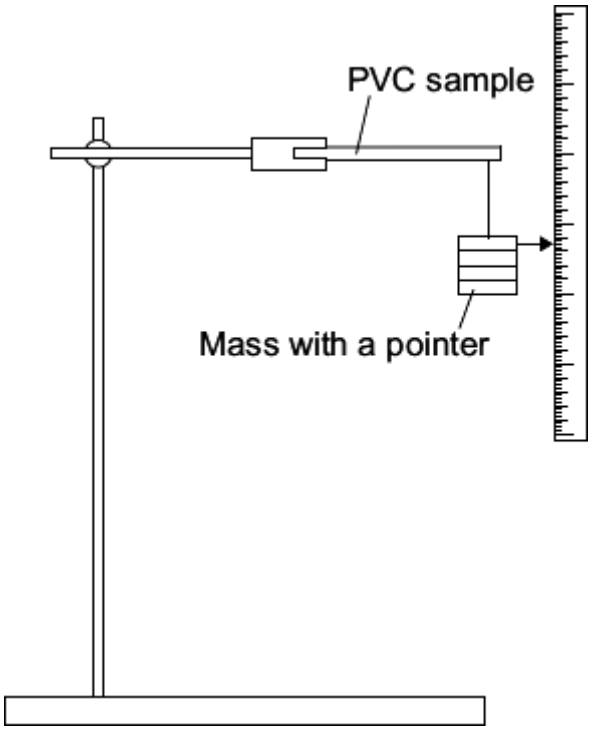
Complete the chemical equation by drawing in the missing bonds of the product, PVC.



(1)

(b) Unplasticised polyvinyl chloride (uPVC) is used to make door and window frames.
PVC with a plasticiser added is used to make cling film for wrapping food.
A plasticiser is a chemical compound.

A student investigated how the percentage of plasticiser added to PVC affected its flexibility.
The student measured the bending of PVC samples when a mass was added.



The student's results are shown in the table.

Sample of PVC	Percentage (%) of plasticiser added	Bending of PVC sample in mm				
		Test 1	Test 2	Test 3	Test 4	Mean
A	**0**	2	3	3	4	3

B	**5**	22	15	23	24	
C	**10**	27	27	29	29	28
D	**15**	34	35	35	36	35

(i) Each PVC sample should be the same size to make it a fair test.
Explain why.

.....

.....

(1)

(ii) The student repeated the test four times for each sample.
Explain why.

.....

.....

(1)

(iii) Calculate the mean value for sample **B**.

.....

.....

.....

.....

(2)

(iv) Each of the samples bent the most in test **4**.
Suggest a possible reason for this.

.....

.....

(1)

(c) Suggest why unplasticised polyvinyl chloride (uPVC) is used to make door and window frames.

.....

.....

(1)

(Total 10 marks)

Q3. Water sold in plastic bottles has a high 'carbon cost'.

The 'carbon cost' depends on the amount of carbon dioxide emitted in making and transporting the product.

The more carbon dioxide emitted, the higher the 'carbon cost'.

(a) Plastic water bottles are made from a polymer.
The polymer is made from ethene.
Ethene is made by cracking hydrocarbons.

(i) Name the polymer made from ethene.

.....

(1)

(ii) Ethene can be made by cracking the hydrocarbon pentane, C_5H_{12}.

$$C_5H_{12} \rightarrow C_2H_4 + C_3H_8$$

Explain why there is a 'carbon cost' for the process of cracking a hydrocarbon.

.....

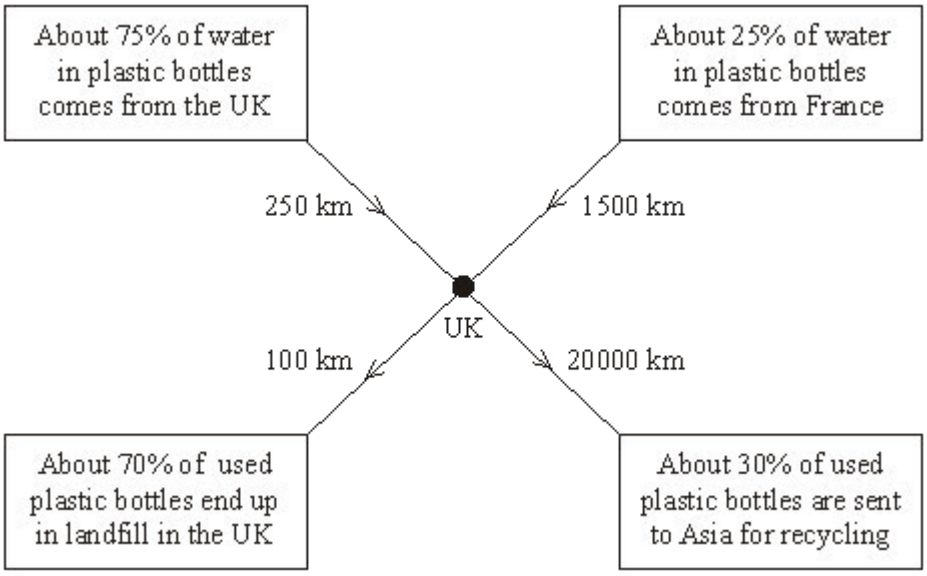
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(2)

(b) The diagram shows information about water sold in plastic bottles in the UK.
The diagram also shows the average distances that water and plastic bottles are transported.



Suggest how the high 'carbon cost' of water sold in plastic bottles could be reduced.

.....

.....

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.....

.....

.....

(3)

(Total 6 marks)

##

Modem window frames are often made from uPVC which contains the plastic poly(chloroethene).



(a) State why plastic window frames need no painting or maintenance.

.....

.....

(1)

(b) Poly(chloroethene) is a polymer formed by the *addition polymerisation* of chloroethene.

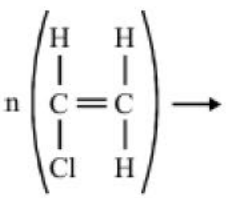
(i) Chloroethene is an unsaturated molecule. Why is this molecule said to be unsaturated?

.....

.....

(1)

(ii) Complete the diagram to represent how poly(chloroethene) is formed from chloroethene.



(3)

(iii) Explain what is meant by the term *polymerisation*.

.....

.....

.....

.....

(2)

(iv) Why is this an *addition polymerisation*?

.....

.....

(1)

(Total 8 marks)

Q5. (a) Alkenes can be made by cracking large alkane molecules.

(i) Explain how the cracking process is carried out.

.....

.....

.....

.....

(2)

(ii) Give a chemical test which would show the difference between an alkene and an alkane.

Test .....

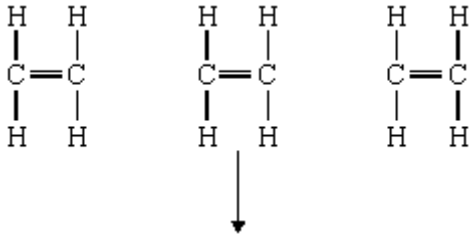
Result of test .....

.....

(2)

(b) Alkenes, such as ethene, can be made into polymers.

(i) Complete the following to show how the ethene molecules bond to form part of a polymer.



(1)

(ii) Name the polymer formed from ethene.

.....

(1)

(iii) Explain **one** important problem caused by the everyday use of this polymer.

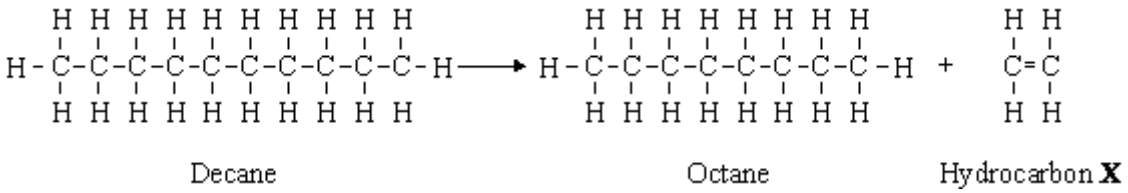
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(2)
(Total 8 marks)

Q6. The high demand for petrol (octane) can be met by breaking down longer hydrocarbons, such as decane, by a process known as cracking.



(a) Apart from heat, what is used to make the rate of this reaction faster?

.....

(1)

(b) Octane is a *hydrocarbon.*

(i) What does *hydrocarbon* mean?

.....

.....

(1)

(ii) Give the molecular formula of octane.

.....

(1)

(c) The hydrocarbon **X** is used to make poly(ethene).

(i) What is the name of **X**?

.....

(1)

(ii) What is the name of the process in which **X** is changed into poly(ethene)?

.....

(1)

(Total 5 marks)

Q7. This question is about hydrocarbons.

(a) Use **two** of the words in the box to complete the sentence.

air	finite	organic	renewable	sediment	water

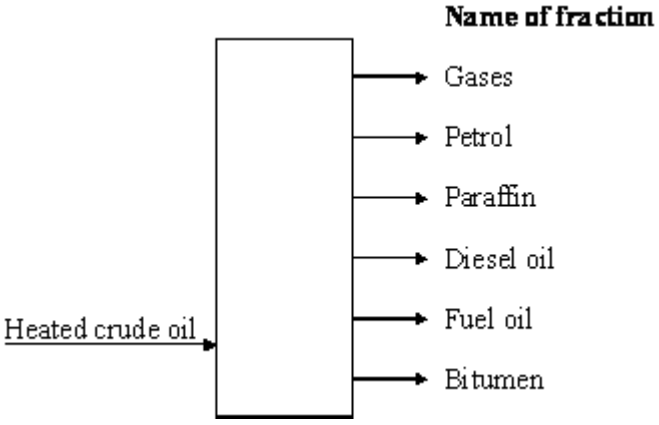
Crude oil is a mixture of hydrocarbons. It was formed from

..... materials that were trapped in

..... over a very long period of time.

(2)

(b) Petrol is separated from crude oil by fractional distillation.



(i) Which fraction has the lowest boiling point?

.....

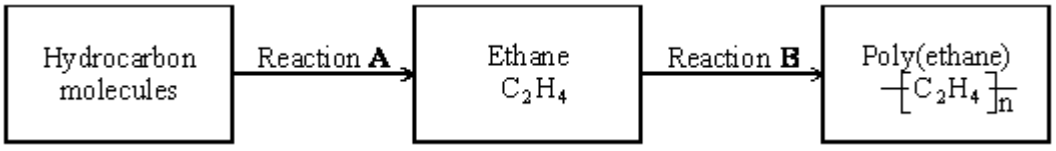
(1)

(ii) Which fraction has the highest density?

.....

(1)

(c) Some of the fractions containing larger hydrocarbon molecules are used to make plastics, such as poly(ethene).



(i) What type of chemical change is Reaction **A**?

.....

(1)

(ii) Explain what happens in Reaction **B**.

.....

.....

.....

.....

(2)

(d) Natural gas contains the hydrocarbon called methane. Some water heaters use methane as a fuel. People could die from breathing the fumes produced by heaters that have not been checked and serviced. Explain how these fumes are produced and why they are dangerous.

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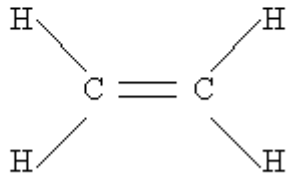
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(3)
(Total 10 marks)

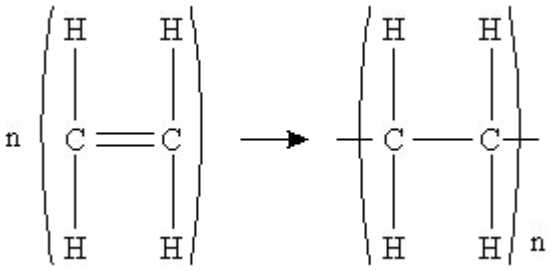
Q8. Propane and ethene are both important hydrocarbons.

	propane	ethene
formula	C_3H_8	
structure		

(a) **Complete the table** by adding the formula of the ethene molecule and the structure of the propane molecule.

(2)

(c) Ethene can be changed into a plastic. The equation shown below represents the reaction in which ethene is polymerised.



(i) What is the name of the plastic formed in this reaction?

.....

(1)

(ii) What type of polymerisation reaction is shown in the equation?

.....

(1)

(Total 4 marks)