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Student number

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Name _____

Date _____

Attempt/Time taken _____

GCSE CHEMISTRY

Topic Paper: 7.3 Synthetic and naturally occurring polymers
Part 1

Time allowed: 35 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

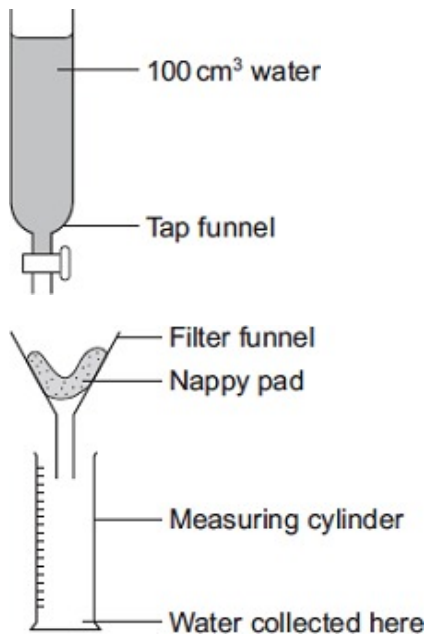
- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
 - is clear, logical, sensibly structured
 - fully meets the requirements of the question
 - shows that each separate point or step supports the overall answer.



32 Marks

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 cm³ 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, C₂H₄



How are hydrocarbons cracked?

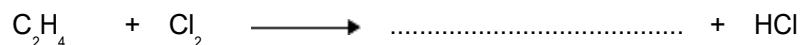
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(2)



- (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.

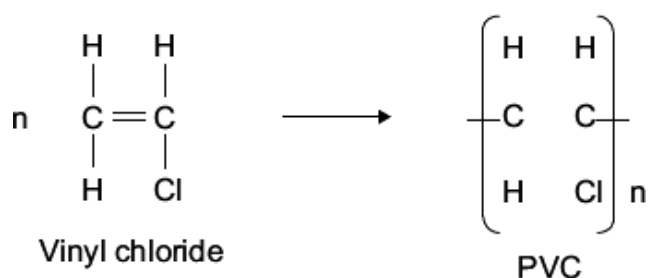
Complete the chemical equation by writing in the formula of the product vinyl chloride.



(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.



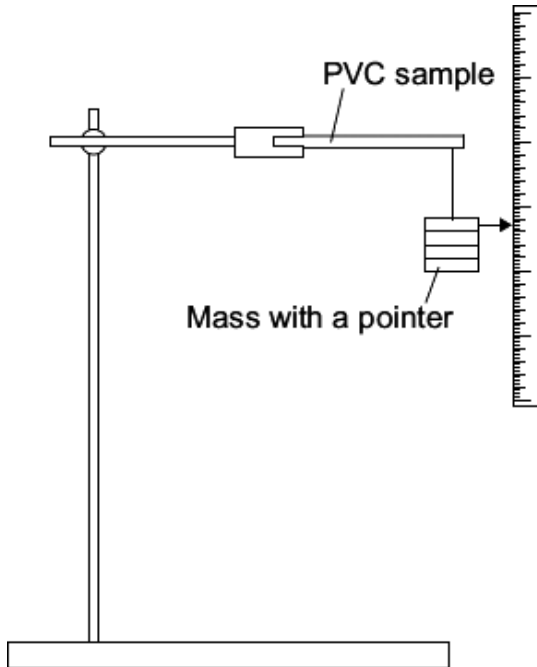
(1)



- (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. Most plastic bags are made from poly(ethene).

Poly(ethene) is a polymer made from ethene.

Ethene is made by cracking saturated hydrocarbons from crude oil.

- (a) Use words from the box to complete the sentences about cracking.

alkanes	alkenes	catalyst	fuel	gas
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Cracking involves heating the to make a vapour.

The vapour is either passed over a hot or mixed with steam and heated to a very high temperature so that thermal decomposition reactions happen.

(2)



- (b) Poly(ethene) molecules are made from ethene molecules by a polymerisation reaction.

Describe what happens in a polymerisation reaction.

.....
.....
.....
.....

(2)

- (c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

There are millions of plastic bags in use. After use most of these plastic bags are buried in landfill sites. The amount sent to landfill could be reduced if the plastic bags:

- could be reused
- could be recycled by melting and making into new plastic products
- could be burned to release energy

Use the information above and your knowledge and understanding to give the positive and negative environmental impacts of using these methods to reduce the amount of plastic bags sent to landfill.

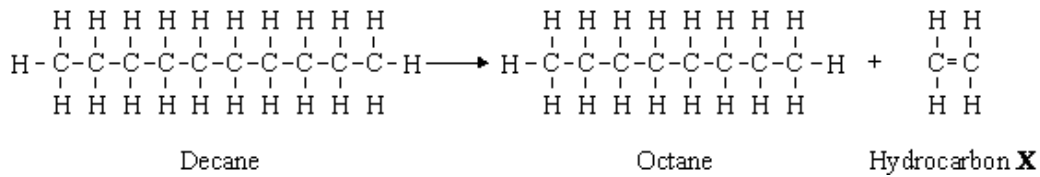
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(6)

(Total 10 marks)



Q4. 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)