



Exampro GCSE Chemistry

C1 Chapter 5 Higher

Name:

Class:

Author:

Date:

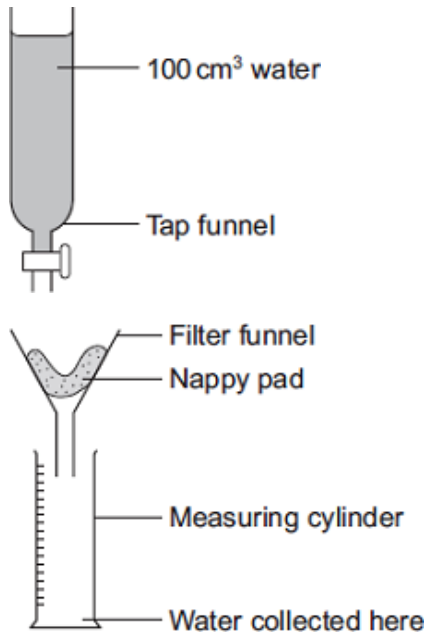
Time: 56

Marks: 56

Comments:

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.

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.....

(2)

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

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.....

(1)

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

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(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

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2

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(2)

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

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(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



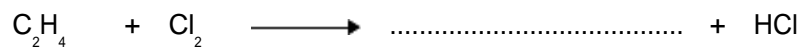
How are hydrocarbons cracked?

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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.

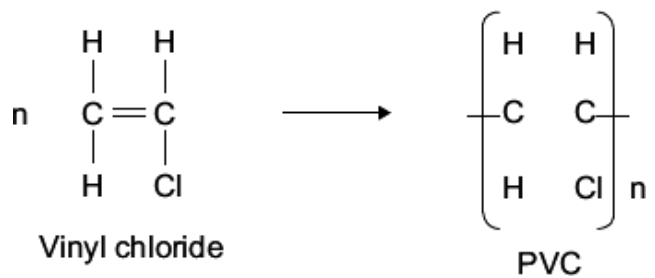
Complete the chemical equation by writing in the formula of the product vinyl chloride.



(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.

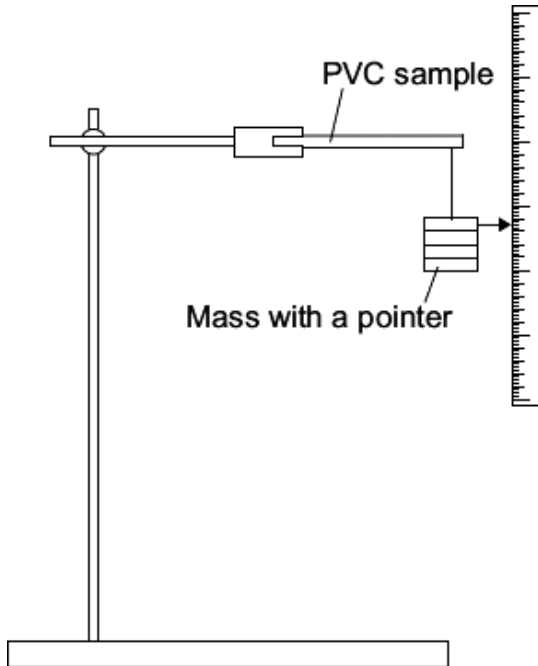


(1)

- (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.

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(1)

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

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(1)

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

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(2)

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

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(1)

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

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(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.

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(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:

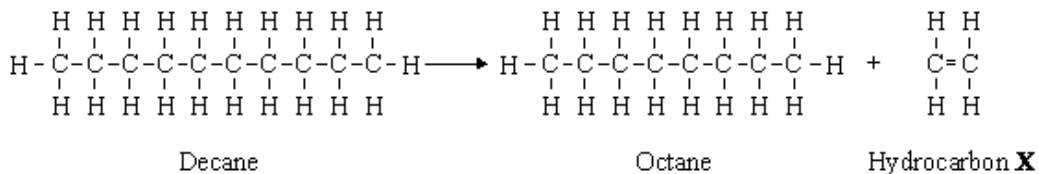
- could be reused
- could be recycled by melting and making into new plastic products
- could be burned to release energy

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)

Q5. (a) The hydrocarbon $C_{16}H_{34}$ was heated strongly in the absence of air.

This is one of the reactions which took place:



This type of reaction is carried out because there is a greater demand for the products than for the original hydrocarbon.

Suggest **two** reasons for this.

1

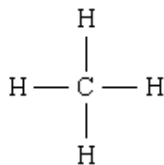
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2

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(2)

(b) A molecule of the compound methane, CH_4 , can be shown like this:

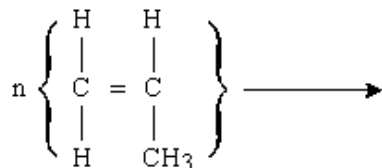


Draw a molecule of the compound ethene, C_2H_4 .

(2)

(c) Small molecules of substances called monomers can be joined together in polymerisation, eg. ethene poly \longrightarrow (ethene).

(i) Complete the equation below to show formation of the polymer from the monomer propene.



(1)

(ii) Suggest the name of the polymer formed.

.....

(1)
(Total 6 marks)

Q6. Supermarkets in the UK have been advised by the Government to stop giving plastic bags to customers. The Government states that this is because plastic bags use up resources that are not renewable and that the manufacture of plastic bags produces carbon dioxide. Most of these plastic bags are made from poly(ethene). The table shows methods to deal with large numbers of used plastic bags.

Method	Description of what happens to the plastic bag
Reused	used again by the customer
Recycled	collected, transported, washed and melted to make new plastic items
Burned	collected, transported and burnt to release heat energy
Dumped	mixed with other household waste, collected, transported and disposed of at a landfill site

Use the information and your knowledge and understanding to briefly give **one advantage and one disadvantage** for each of these methods.

Reused

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Recycled

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Burned

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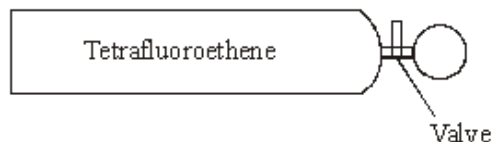
Dumped

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(4)
(Total 4 marks)

Q7. In 1939 Roy Plunkett opened the valve on a new cylinder of tetrafluoroethene gas. No gas came out!



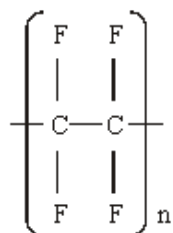
He cut the cylinder open and found that the gas had changed into a white solid. This solid was an addition polymer.

(a) Give the name of the addition polymer that formed inside the cylinder.

.....

(1)

(b) The structure of this polymer can be represented by the diagram below.



Draw the structure of the monomer, tetrafluoroethene, from which it is formed.

(2)

(c) Describe how this addition polymer forms from monomers.

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(3)

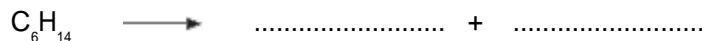
(Total 6 marks)

Q8. Ethanol (C₂H₅OH) is produced from ethene or from sugar cane.

The two different methods to produce ethanol are summarised in the table.

Ethanol from sugar cane is a batch process	Ethanol from crude oil is a continuous process
Sugar cane plants are crushed and soaked in water for one day.	Crude oil is distilled to separate the naphtha fraction.
The sugar solution is separated by filtration.	The naphtha fraction is cracked when the vaporised hydrocarbons are passed over a hot catalyst.
Yeast is added to the sugar solution and fermented for three days.	The ethene produced is separated by distillation.
The solution of water and ethanol produced is separated by filtration.	Ethene is reacted with steam in the presence of a catalyst.
Distillation of this solution produces a 50% solution of ethanol.	This hydration reaction produces 100% ethanol.

(a) Complete and balance an equation for the cracking of the hydrocarbon C₆H₁₄ to produce ethene.



(2)

(b) What is **seen** when the sugar solution and yeast are fermented?

.....
.....

(1)

- (c) Evaluate the issues involved with the production of ethanol from sugar cane compared with the production of ethanol from crude oil.
You should explain why each issue you describe is important.

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(5)
(Total 8 marks)

M1. (a) (i) **A and 3**
accept A and 39 1

anomalous result
independent mark
accept not close to other two volumes or correct comparison using the results
ignore does not fit the pattern 1

(ii) any **one** from:

- volume of water (used)
allow amount of water (used)
- time (for water to run through)
accept rate / speed (at which water runs through)
- temperature
- mass / surface area of pad
accept amount / size / volume / thickness of pad
- same filter funnel
ignore other equipment

1

(iii) any **one** from:

ignore human error unqualified

- incorrect / volume / amount of water added
- reading / volume / amount of water collected
- some water does not go through the pad
allow spillage / poorly placed pad
- not enough time allowed for water to drain through
accept rate / speed at which water is added
- pads (from one company) not identical / faulty

1

(b) (i) any **two** from:

- it was not the best (at absorbing the water)
accept correct descriptions of 'not the best' / third best or only better than B
- (needed) to absorb more (water)
allow not absorbing enough (water)
- to improve their image / sales
accept (needs) to absorb more (water) than A and C for 2 marks

2

- (ii) any **one** from:
- cost (more)
 - use (more) resources
 - use (more) energy
must relate to the company

1
[7]

- M2.** (a) (i) *if (fractional) distillation / hydrogenation mentioned as the method = max 1*
- heat / high temperature / hot / vaporise
allow thermal decomposition
ignore evaporation
*do **not** accept 'burns'*
*do **not** accept temperature < 100*
- 1
- catalyst **or** silica / alumina / porous pot
ignore other named catalyst
- or** steam
allow heat (the vapour) to a very high temperature / >800°C for 2 marks
- 1
- (ii) C_2H_3Cl
ignore attempts to balance equation
- 1
- (iii) single bonds between C – H, C – Cl **and** C – C
*do **not** accept symbols outside the bracket*
- 1
- (b) (i) so that the amount of plasticiser / (sample of) PVC is the independent / only variable that affects the bending / flexibility of the samples
allow because different sizes would give different results
accept because size is a control variable
ignore references to reliability / precision etc
- 1
- (ii) to improve the reliability (of the investigation)
accept to calculate a mean
*accept to check for anomalous results **or** to check the range of results*
ignore accuracy / precision etc
- 1

(iii) 23

*correct answer with or without working = 2 marks
if answer is incorrect*

allow $\frac{22+23+24}{3}$

or 21 for 1 mark

2

(iv) (PVC) sample had been stretched / used / tested in first three tests

accept higher temperature

allow worn or become weaker

ignore (human) error

ignore more flexible / softer

ignore intermolecular forces

1

(c) does not bend (easily / much)

ignore non-biodegradable / low maintenance

or it is not flexible **or** it is rigid

ignore sturdy / stronger / harder

1

[10]

M3. (a) alkanes

1

catalyst

1

substances must be in the order shown

(b) many (ethenes/monomers)

1

bond/join together

1

allow ethenes / monomers bond / join together to form very large molecules for 2 marks

- (c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

No relevant content.

0 marks

There is a brief description of a positive and a negative environmental impact involved with one or more methods used to reduce the amount of plastic bags sent to landfill.

Level 1 (1–2 marks)

There is some description of both positive and negative environmental impacts involved with at least 2 methods used to reduce the amount of plastic bags sent to landfill.

Level 2 (3–4 marks)

There is a clear, balanced and detailed description of both a positive and a negative environmental impact of using each of the 3 methods used to reduce the amount of plastic bags sent to landfill.

Level 3 (5–6 marks)

examples of the chemistry points made in the response

reuse:

reuse means less bags used so:

positive environmental impact

- saves raw materials / crude oil
- saves energy
- cuts down on CO₂ emissions
- less global warming

negative environmental impact

- could cause litter
- could still be sent to landfill

recycle:

bags bought can be recycled so:

positive environmental impact

- used to make new plastic bags / objects
- saves raw materials / crude oil
- saves energy compared to producing plastic bags from crude oil
- cuts down on CO₂ emissions
- less global warming

negative environmental impact

- collection point sites cause an eyesore / litter problem
- transportation to recycling plant releases carbon dioxide / causes global warming

burn:

bags can be burned so:

positive environmental impact

- could provide energy for heating buildings
- could provide energy for generating electricity

negative environmental impact

- increases CO₂ emissions
- increases global warming
- could release toxic gases

does not conserve raw materials / crude oil

[10]

M4. (a) catalyst

1

(b) (i) made up of **only** carbon and hydrogen

1

(ii) C₈H₁₈

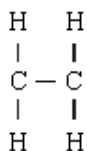
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- (c) (i) ethene 1
- (ii) polymerisation 1

[5]

- M5.** (a) smaller, more useful molecules more reactive (molecules)/(molecules) used to make plastics more easily ignited/better fuels produces unsaturated compounds/alkenes
any two for 1 mark each 2

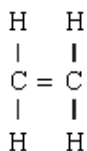
(b)



gains 1 mark

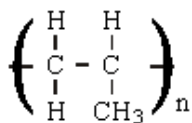
2

but



gains 2 marks

(c) (i)



for 1 mark

1

- (ii) poly(propene)
 (N.B. brackets not required; *allow* "polypropylene")
for 1 mark

1

[6]

M6. Reused

- saves raw materials / crude oil
 - *unable to reuse many times*
 - *bags easily split*
- saves energy / fuel / transport
- fewer bags needed / made
- reduces carbon / CO₂ emissions
- reduces use of landfill
- saves cost of a new bag
- no waste

1

Recycled

- saves raw materials / crude oil
 - *has to be collected / transported / washed / separated / melted*
- saves energy / use of fuel
- reduces carbon / CO₂ emissions
- reduces use of landfill
- can be used for new products
 - *ignore uses energy*

1

Burned

- heat / energy released can be used (for heating / generating electricity)
 - *has to be collected / transported*
- reduces use of landfill
 - *wastes the resource / plastic*
 - *releases harmful gases / toxic gases / CO₂*

1

Dumped

- collected / transported with household waste
 - *wastes the resource*
 - *plastic uses landfill*
- (slowly) biodegrades **or** produces methane which can be used as a fuel
 - *produces methane which is a greenhouse gas / could cause explosions*
- (not biodegradable so) does not release CO₂ / green house gas into the air
 - *not biodegradable / take years to decompose*

ignore cost / litter / waste / global warming / habitats unless mentioned above

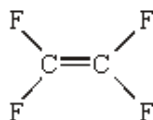
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[4]

- M7.** (a) poly(tetrafluoroethene) **or** polytetrafluoroethene
accept PTFE or Teflon

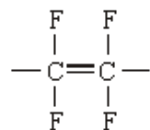
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- (b) double bond

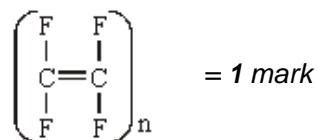


1

all other atoms and bonds correct including F for fluorine



ignore n in front



do **not** accept structures with more than 2 C atoms

1

(c) any **three** from:

- many monomers / (small) molecules / tetrafluoroethene molecules
allow many tetrafluoroethenes
many particles alone is insufficient
*do **not** accept many polymers*
- (monomers, molecules etc.) join / bond / link / combine / attach
allow many particles join
allow many atoms join
*do **not** accept collide / add ignore polymerise*
*do **not** accept many polymers join*
- to form one molecule **or**
to form a long-chain **or**
to form a large molecule
- no other substances are produced /
one substance formed (definition of addition)
- idea of double bond breaking / opening / opens / bond being
used to join to another molecule **or** the double bond becomes a single bond

3

[6]

M8. (a) C_2H_4

1

a correct other product **and** balanced eg C_4H_{10}

1

(b) bubbling / fizzing / frothing / effervescence

*ignore gas given off **or** solution goes cloudy*

1

(c) any **five** from the following bullet points:

allow converse for ethanol from crude oil

To gain full marks there should be both advantageous and disadvantageous issues and their importance

Advantageous issues using sugar cane:

ignore costs – unless specified

ignore safety

ignore simple/low technology process

ignore labour intensive as an advantage

linked importance

- sugar cane/plants absorb carbon dioxide / photosynthesise
*so is carbon neutral **or** reduce global warming*
- sugar cane / plants are renewable / sustainable
*and so save resources / oil **or** crude oil is non-renewable*
- low energy process
*and so it saves fuel **or** / making ethanol from crude oil needs fuel for fractional distillation / cracking*

Disadvantageous issues using sugar cane:

ignore fermentation releases carbon dioxide; destruction of habitats/land to build production plants; types of pollution; waste products

- large areas of land are needed
which leads to destruction of habitats / forest
- land could be used for food crops
*may cause food shortages **or** increases the price of food **or** increasing world population*
- slow process
so limits supply / production of ethanol
- ethanol is impure **or** contains 50% ethanol
so needs further separation or ethanol from crude oil is 100% pure
- batch process
so uses more labour
- the crop yield / supply of ethanol is unreliable
*because growth is seasonal / weather dependent **or** possibility of crop failure*

a justified conclusion

compensation mark, if no other mark awarded allow one mark for two or more issues

5

[9]

