

A



Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

**GCSE
CHEMISTRY**

F

Foundation Tier Paper 2

8462/2F

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]



J U N 2 1 8 4 6 2 2 F 0 1

For this paper you must have:

- a ruler
- a scientific calculator
- the periodic table (enclosed)

INSTRUCTIONS

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Answer ALL questions in the spaces provided. Do not write on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.



INFORMATION

- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO



0	1
---	---

This question is about the Earth's atmosphere.

0	1	.	1
---	---	---	---

How long ago was the Earth formed? [1 mark]

Tick (✓) ONE box.

4.6 billion years ago

4.6 million years ago

4.6 thousand years ago

TABLE 1, on the opposite page, shows the percentages of gases in the atmospheres of Mars and Earth today.



TABLE 1

Gas	Percentage of gas in atmosphere (%)	
	Mars	Earth
Carbon dioxide	95.97	0.04
Nitrogen	1.89	78.09
Oxygen	0.15	20.95
Other gases	1.99	X

01.2

Calculate the percentage X of other gases in the Earth's atmosphere.

Use TABLE 1. [1 mark]

X = _____ %

[Turn over]



REPEAT OF TABLE 1

Gas	Percentage of gas in atmosphere (%)	
	Mars	Earth
Carbon dioxide	95.97	0.04
Nitrogen	1.89	78.09
Oxygen	0.15	20.95
Other gases	1.99	X

The atmosphere of the early Earth is thought to have been similar to the atmosphere of Mars today.

The percentages of nitrogen and of oxygen in the Earth's atmosphere today have changed from the percentages in the Earth's early atmosphere.



01.3

Draw ONE line from each gas to the change in the percentage of that gas.

Use TABLE 1. [2 marks]

Gas	Change in percentage of gas
Nitrogen	Increased by about 4 times
	Increased by about 21%
Oxygen	Increased by about 40 times
	Increased by about 96%

[Turn over]



01.4

The percentage of carbon dioxide in the Earth's early atmosphere decreased.

Which TWO processes caused this decrease?
[2 marks]

Tick (✓) TWO boxes.

Carbon dioxide dissolving in sea water

Combustion of fossil fuels

Farming of animals

Formation of sedimentary rocks

Volcanoes releasing carbon dioxide



01.5

Photosynthesis also decreased the percentage of carbon dioxide in the Earth's early atmosphere.

Photosynthesis increased the percentage of another gas.

Complete the word equation for photosynthesis.
[2 marks]

_____ + water →
glucose + _____

01.6

Complete the sentence. [1 mark]

Scientists are not certain about the percentages of gases in the Earth's early atmosphere because there is a lack of _____.

[Turn over]

9



0	2
---	---

This question is about water.

A student investigated the concentration of salt in sea water.

This is the method used.

- 1. Filter the sea water to remove sand.**
- 2. Measure the mass of an empty evaporating dish.**
- 3. Measure 50 cm³ of sea water into the evaporating dish.**
- 4. Heat the evaporating dish and sea water.**
- 5. Evaporate the sea water to dryness.**
- 6. Measure the mass of the evaporating dish and salt.**



0	2	.	1
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What equipment should the student use to measure:

- the mass of the evaporating dish
- the volume of sea water?

[2 marks]

Mass of evaporating dish _____

Volume of sea water _____

[Turn over]



02.2

TABLE 2 shows the student's results.

TABLE 2

	Mass in g
Evaporating dish	30.44
Evaporating dish and salt	30.49

The student used 50 cm^3 of sea water.

Calculate the mass of salt in 1000 cm^3 of this sea water.
[3 marks]

Mass of salt = _____ g



02.3

The salt must be completely dry.

Which TWO extra steps are needed to show that the salt is completely dry? [2 marks]

Tick (✓) TWO boxes.

Filter the sea water again.

Heat the evaporating dish and salt again.

Measure the 50 cm³ of sea water again.

Measure the mass of the empty evaporating dish again.

Measure the mass of the evaporating dish and salt again.

[Turn over]

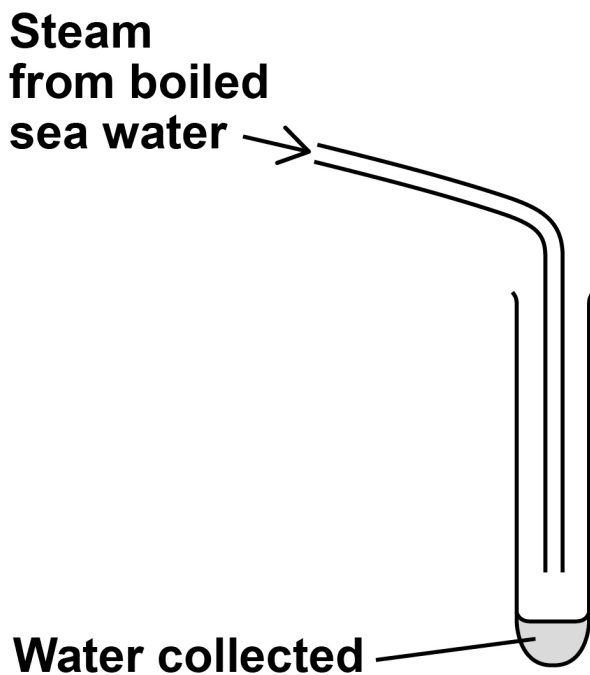


Two students, Y and Z, distil sea water to collect water.

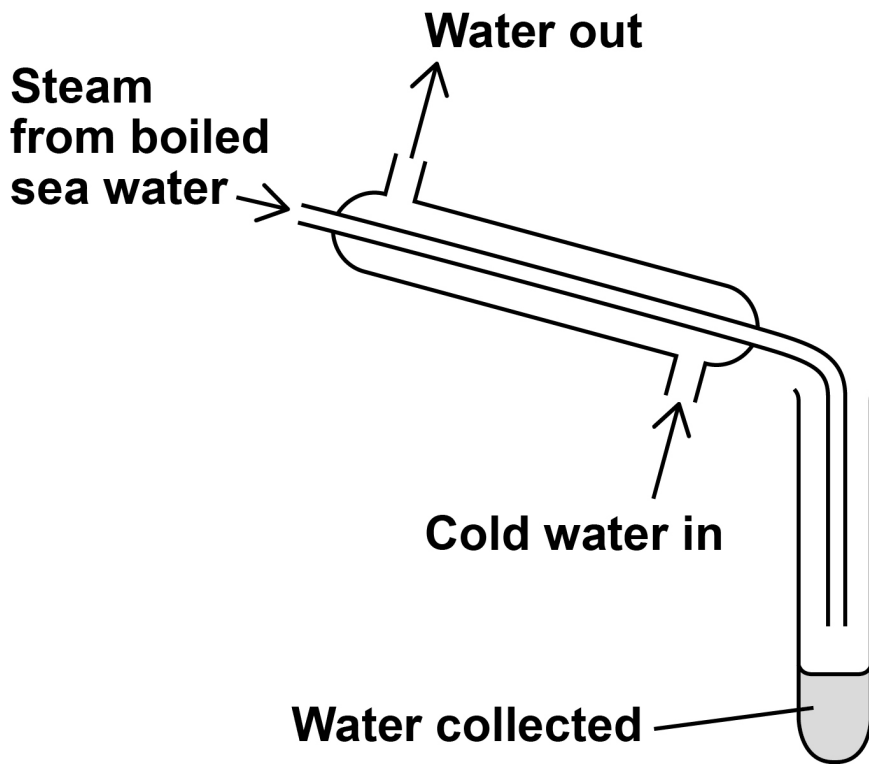
FIGURE 1, below and on the opposite page, shows the apparatus used by each student to collect the water.

FIGURE 1

Student Y



Student Z



[Turn over]



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02.4

Students Y and Z boil the same volume of sea water for the same period of time.

Explain why student Y collects a smaller volume of water than student Z. [2 marks]

02.5

Water obtained by distillation does NOT need to be sterilised and is safe to drink.

Suggest why. [1 mark]

[Turn over]



Fresh water needs to be sterilised before it is safe to drink.

0 2 . 6

How is fresh water sterilised? [2 marks]

Tick (✓) TWO boxes.

Using ammonia

Using chlorine

Using chromatography

Using filtration

Using ozone



0	2	.	7
---	---	---	---

A student tests the pH of fresh water using universal indicator solution.

When added to the fresh water, the colour of the universal indicator solution is green.

What is the pH of this fresh water? [1 mark]

pH = _____

[Turn over]

13

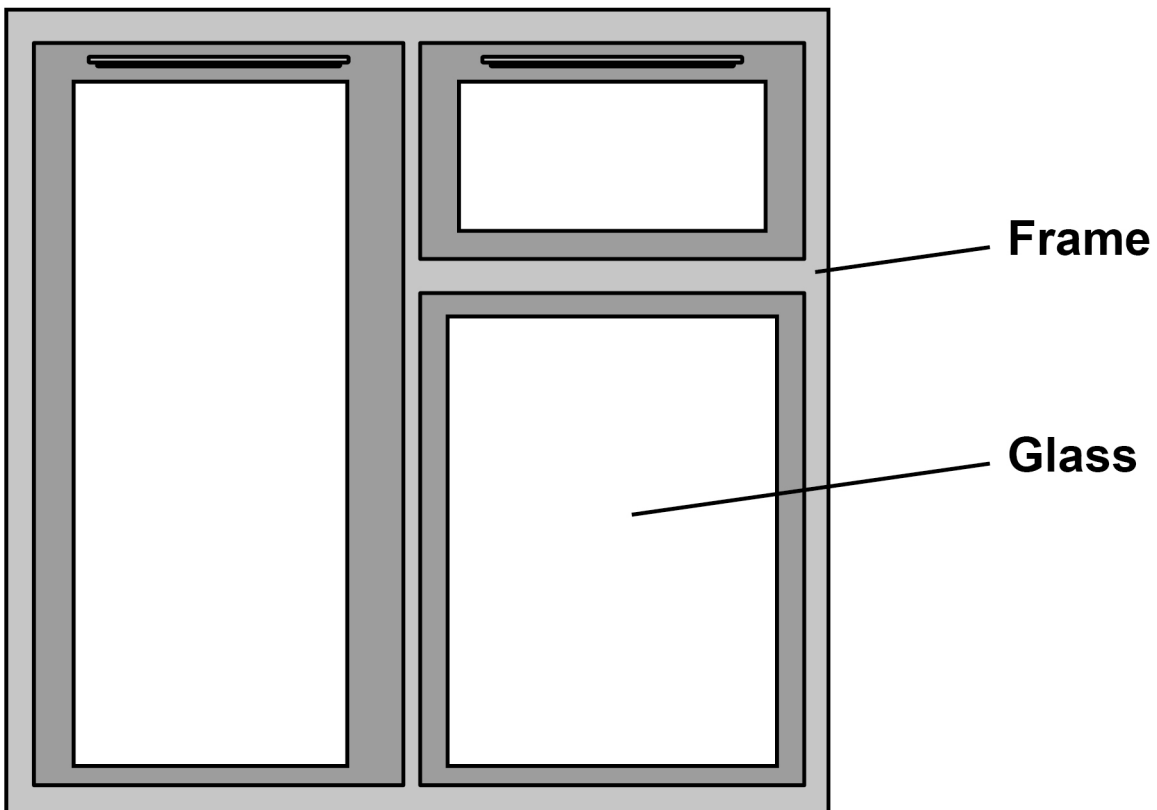


03

This question is about substances used to make windows and window frames.

FIGURE 2 shows a window.

FIGURE 2



03.1

Glass is made by heating sand with TWO other materials.

**Which TWO other materials are used to make glass?
[2 marks]**

Tick (✓) TWO boxes.

Clay

Graphite

Limestone

Sodium carbonate

Sodium hydroxide

[Turn over]



Window frames need to be:

- easy to install
- resistant to damage.

The polymers poly(chloroethene) and HDPE are used to make window frames.

TABLE 3 shows information about poly(chloroethene) and HDPE.

TABLE 3

Property	Poly(chloroethene)	HDPE
Density in g/cm ³	1.4	0.92
Relative strength	72	25

03.2

Suggest ONE advantage of using poly(chloroethene) compared with HDPE to make window frames.

Give ONE reason for your answer.

Use TABLE 3. [2 marks]

Advantage _____



Reason _____

0 3 . 3

Suggest ONE advantage of using HDPE compared with poly(chloroethene) to make window frames.

Give ONE reason for your answer.

Use TABLE 3. [2 marks]

Advantage _____

Reason _____

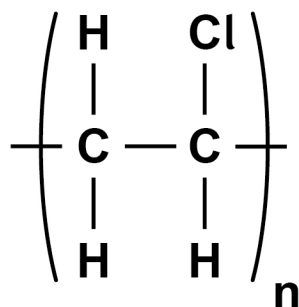
[Turn over]



03.4

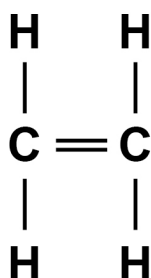
FIGURE 3 shows the displayed structural formula of poly(chloroethene).

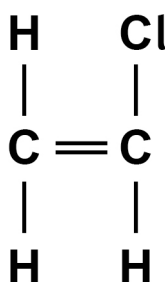
FIGURE 3

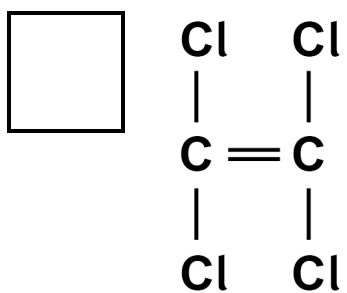
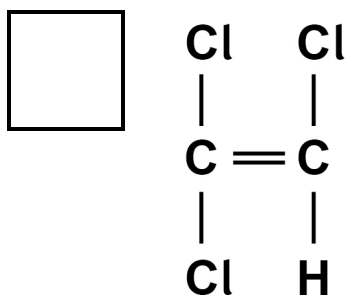


Which monomer is used to make poly(chloroethene)?
[1 mark]

Tick (✓) ONE box.







[Turn over]



03.5

Chlorine gas is used to produce poly(chloroethene).

Describe a test to identify chlorine gas.

Give the result of the test. [2 marks]

Test _____

Result _____



0	3	.	6
---	---	---	---

Wood can be used instead of polymers to make window frames.

- **Polymers are unreactive.**
- **Polymers are produced from crude oil.**
- **Wood breaks down in wet conditions.**
- **Wood is produced from trees.**

Suggest ONE advantage of using polymers and ONE advantage of using wood to make window frames.
[2 marks]

Advantage of polymers _____

Advantage of wood _____

[Turn over]



Window frames can also be made from an alloy of aluminium.

0.37

6.00 kg of the alloy is used to make a window frame.

TABLE 4 shows the mass of each element in 6.00 kg of the alloy.

TABLE 4

Element	Mass in kg
Aluminium	5.94
Magnesium	0.04
Silicon	0.02



Calculate the percentage of aluminium in 6.00 kg of the alloy. [2 marks]

Percentage of aluminium = _____ %

03.8

Why is an alloy used instead of pure aluminium to make window frames? [1 mark]

[Turn over]

14



0	4
---	---

This question is about reactions between gases.

When hydrogen gas is heated with iodine gas, hydrogen iodide gas is produced.

The equation for this reversible reaction is:



This reversible reaction reaches equilibrium in a sealed container.

0	4	.	1
---	---	---	---

How does the equation show that the reaction is reversible? [1 mark]



04.2

Which TWO statements are correct when the reaction reaches equilibrium? [2 marks]

Tick (✓) TWO boxes.

The forward reaction and reverse reaction are both exothermic.

The gases have escaped from the container.

The hydrogen no longer reacts with iodine.

The mass of each substance does not change.

The rates of the forward reaction and reverse reaction are equal.

[Turn over]



04.3

The initial mixture of hydrogen and iodine in the sealed container is purple.

Hydrogen iodide is colourless.

How will the colour of the mixture in the sealed container have changed when equilibrium is reached?
[1 mark]

Tick (✓) ONE box.

The mixture will have become a deeper purple.

The mixture will have become a paler purple.

The mixture will have become colourless.

04.4

The rate of reaction between gases is affected by changing the pressure.

Complete the sentences on the opposite page.
[3 marks]



When the pressure of the reacting gases is increased,
the rate of reaction _____ .

This is because at higher pressures the distance
between the particles _____ .

This means that the frequency of collisions

_____ .

0 4 . 5

Give ONE other way of changing the rate of reaction
between gases.

You should NOT refer to pressure in your answer.
[1 mark]

[Turn over]

8



0 5

A student investigated the rate of the reaction between zinc and sulfuric acid.

This is the method used.

1. Pour 40 cm³ of sulfuric acid into a conical flask.
2. Add 2.0 g of zinc powder to the conical flask.
3. Put the stopper in the conical flask.
4. Measure the volume of hydrogen gas collected every 30 seconds for 5 minutes.

34

FIGURE 4, on the opposite page, shows part of the apparatus used.

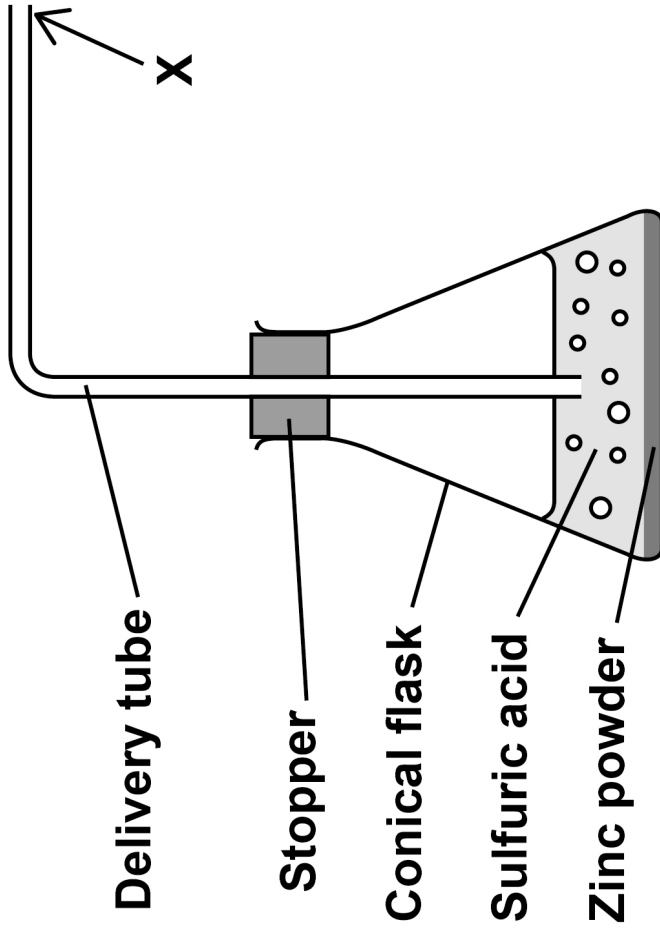
0 5 . 1

X shows where a piece of equipment is connected to measure the volume of hydrogen gas collected.

Complete FIGURE 4, on the opposite page, to show the equipment used. [1 mark]



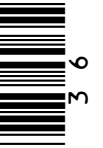
FIGURE 4



[Turn over]



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05.2

The student made an error setting up the delivery tube shown in FIGURE 4 on page 35.

Describe the error AND the problem this error would cause. [2 marks]

Error made _____

Problem caused _____

[Turn over]

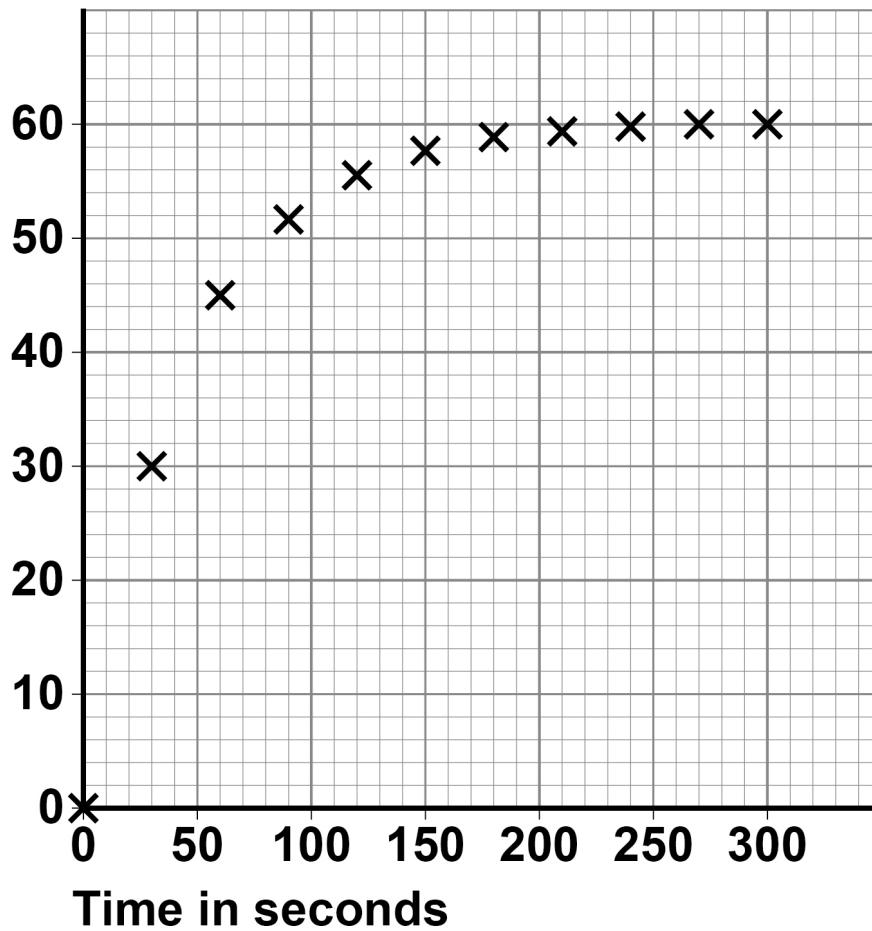


The student then set up the apparatus correctly.

FIGURE 5 shows the student's results.

FIGURE 5

Volume of
gas in cm^3



0 5 . 3

Complete FIGURE 5 by drawing a line of best fit.
[1 mark]



0	5	.	4
---	---	---	---

Determine the mean rate of reaction between 0 seconds and 60 seconds.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{volume of gas formed}}{\text{time taken}}$$

Use data from FIGURE 5, on the opposite page.

Give the unit.

Choose the answer from the list. [4 marks]

- cm^3 / s
- g / s
- s / cm^3
- s / g

Mean rate of reaction = _____

Unit _____

[Turn over]



0 5 . 5

The student repeated the investigation using sulfuric acid of a higher concentration.

The student plotted the results and drew a line of best fit.

How would the line of best fit for higher concentration compare with the line of best fit for lower concentration? [1 mark]

Tick (✓) ONE box.

The line of best fit for higher concentration would have a less steep slope.

The line of best fit for higher concentration would have a steeper slope.

The lines of best fit would have slopes with the same steepness.

9



0	6
---	---

Potash alum is a chemical compound.

Potash alum contains potassium ions, aluminium ions and sulfate ions.

0	6	.	1
---	---	---	---

**Which TWO methods can be used to identify the presence of potassium ions in potash alum solution?
[2 marks]**

Tick (✓) TWO boxes.

Flame emission spectroscopy

Flame test

Measuring boiling point of solution

Paper chromatography

Using litmus paper

[Turn over]



0	6	.	2
---	---	---	---

Sodium hydroxide solution is used to test for some metal ions.

Sodium hydroxide solution is added to a solution of potash alum until a precipitate forms.

Complete the sentence.

Choose the answer from the list. [1 mark]

- blue
- brown
- green
- white

The colour of the precipitate formed is

_____.



06.3

Complete the sentence.

Choose the answer from the list. [1 mark]

- barium chloride solution
- limewater
- red litmus paper
- silver nitrate solution

Sulfate ions can be identified using dilute hydrochloric acid and _____.

[Turn over]



0	7
---	---

This question is about organic compounds.

0	7	.	1
---	---	---	---

Butane is an alkane with small molecules.

Complete the sentence.

Choose the answer from the list. [1 mark]

- fertiliser
- formulation
- fuel

Butane can be used as a _____.

[Turn over]



07.2

Poly(propene) is a polymer.

What is the name of the monomer used to produce poly(propene)? [1 mark]

Tick (✓) ONE box.

Propane

Propanoic acid

Propanol

Propene



BLANK PAGE

[Turn over]



Ethene and steam react to produce ethanol.

The equation for the reversible reaction is:

ethene + steam \rightleftharpoons ethanol

0 7 . 3

The reaction produces a maximum theoretical mass of 400 kg of ethanol from 243 kg of ethene and 157 kg of steam.

A company produces 380 kg of ethanol from 243 kg of ethene and 157 kg of steam.

The percentage yield of ethanol is less than 100%



Calculate the percentage yield of ethanol.

Use the equation:

$$\text{percentage yield of ethanol} = \frac{\text{mass of ethanol actually made}}{\text{maximum theoretical mass of ethanol}} \times 100$$

[2 marks]

49

Percentage yield = _____ %

[Turn over]



07.4

What are TWO possible reasons why the percentage yield of ethanol is less than 100%? [2 marks]

Tick (✓) TWO boxes.

Ethanol is the only product of the reaction.

Ethanol is very unreactive.

Some ethanol changes back into ethene and steam.

Some ethanol escapes from the apparatus.

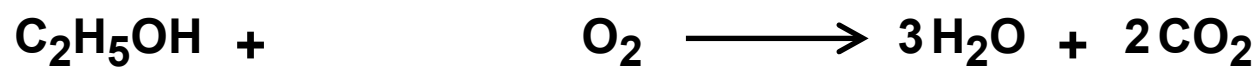
Some ethanol reacts with steam.



0	7	.	5
---	---	---	---

Ethanol burns in oxygen.

Balance the equation for the reaction. [1 mark]



[Turn over]



07.6

Two processes for producing ethanol are:

- fermentation
- hydration (reacting ethene with steam).

TABLE 5 shows information about the processes.

TABLE 5

Feature	Process	
	Fermentation	Hydration
Raw material	sugar	crude oil
Energy usage	low	high
Rate of reaction	slow	fast
Purity of ethanol	15%	98%



Give TWO advantages and TWO disadvantages of using fermentation to produce ethanol. [4 marks]

Advantage of fermentation 1 _____

Advantage of fermentation 2 _____

Disadvantage of fermentation 1 _____

Disadvantage of fermentation 2 _____

[Turn over]

11



08

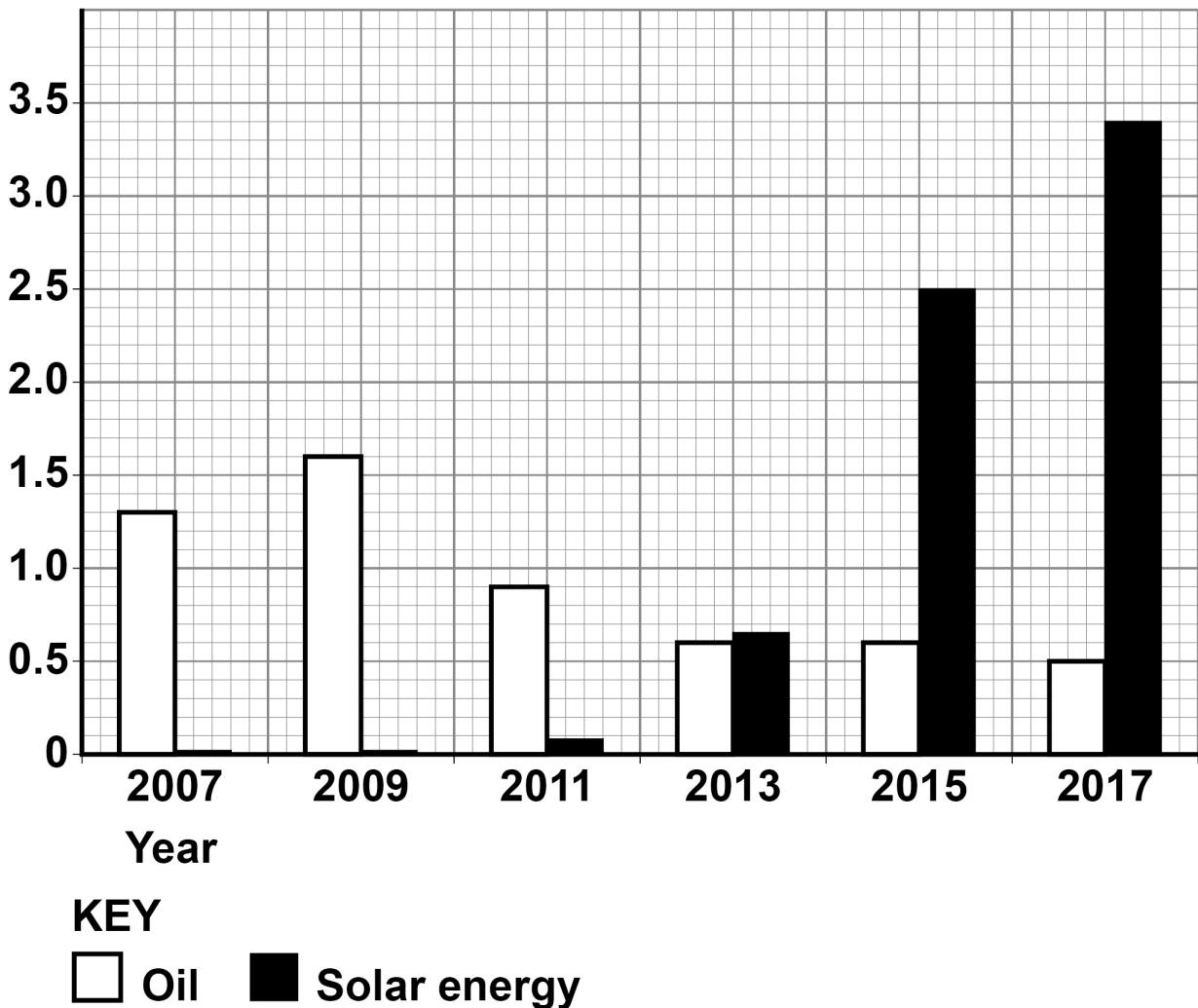
This question is about fuels and energy.

FIGURE 6 shows the percentage of electricity generated in the UK between 2007 and 2017 using:

- oil
- solar energy.

FIGURE 6

Percentage
of electricity
generated (%)



08.3

Suggest ONE reason why using solar energy is a more sustainable way of generating electricity than burning oil. [1 mark]

08.4

Solar energy may NOT be able to replace the generation of electricity from fossil fuels completely.

Suggest TWO reasons why. [2 marks]

1 _____

2 _____

12



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[Turn over]



09

This question is about alkanes.

TABLE 6 shows information about some alkanes.

TABLE 6

Number of carbon atoms in alkane molecule	Boiling point of alkane in °C
4	0
5	36
6	69
7	X
8	126
9	151

09.1

Plot the data from TABLE 6 on FIGURE 7, on the opposite page. [2 marks]

09.2

Predict the boiling point X of the alkane with seven carbon atoms in a molecule.

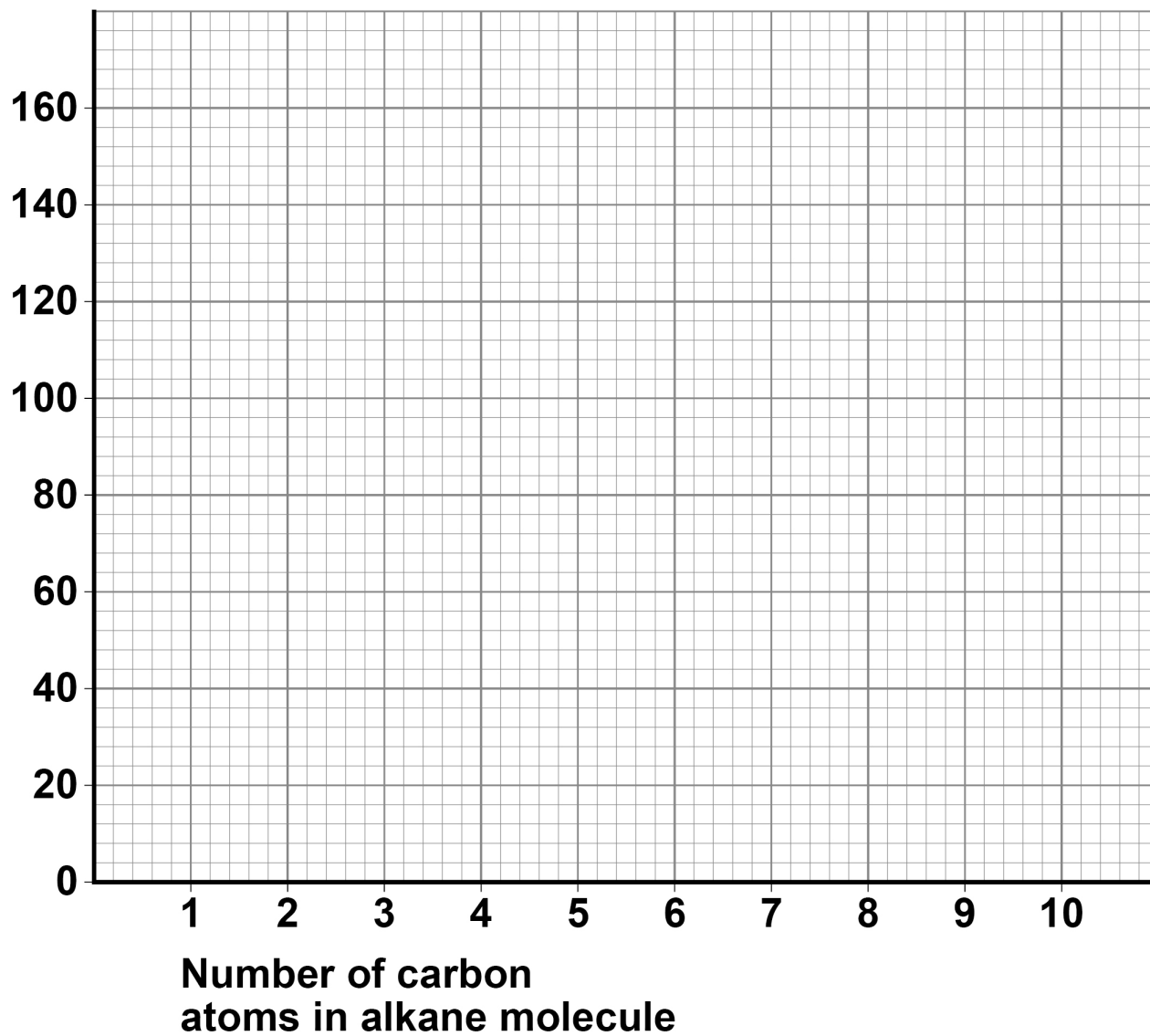
Use TABLE 6 and FIGURE 7. [1 mark]

X = _____ °C



FIGURE 7

Boiling
point of
alkane
in °C



[Turn over]



BLANK PAGE



09.3

FIGURE 7, on page 61, is NOT suitable to show the boiling point of the alkane with three carbon atoms in a molecule.

Suggest ONE reason why. [1 mark]

09.4

What is the state at 20 °C of the alkane with four carbon atoms in a molecule?

Use TABLE 6, on page 60. [1 mark]

[Turn over]



TABLE 6 is repeated below.

TABLE 6

Number of carbon atoms in alkane molecule	Boiling point of alkane in °C
4	0
5	36
6	69
7	X
8	126
9	151

The alkane with nine carbon atoms in a molecule is called nonane.

0 9 . 5

Complete the formula of nonane. [1 mark]

C₉H _____



09.6

Nonane will condense lower in a fractionating column during fractional distillation than the other alkanes in TABLE 6.

Explain why.

You should refer to the temperature gradient in the fractionating column. [2 marks]

[Turn over]

—
8



1	0
---	---

This question is about paper chromatography.

A food colouring contains a dye.

1	0	.	1
---	---	---	---

Plan an investigation to determine the R_f value for the dye in this food colouring.

$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

Your plan should include the use of:

- a beaker
- a solvent
- chromatography paper.

[6 marks]



10.2

Two students investigated a dye in a food colouring using paper chromatography.

Each student did the investigation differently.

The R_f values they determined for the **SAME** dye were different.

How did the students' investigations differ? [1 mark]

Tick (✓) **ONE** box.

Different length of paper used

Different period of time used

Different size of beaker used

Different solvent used



10.3

Paper chromatography involves a stationary phase.

What is the stationary phase in paper chromatography?
[1 mark]

Tick (✓) ONE box.

Beaker

Dye

Paper

Solvent

END OF QUESTIONS

8



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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

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