

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

GCSE CHEMISTRY

F

Foundation Tier Paper 2

Wednesday 12 June 2019

Morning

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

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

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- 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.

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



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ANSWER IN THE SPACES PROVIDED**



Answer **all** questions in the spaces provided.

0 1

This question is about drinking water.

There are two main steps in producing drinking water from fresh water.

0 1 . 1

Draw **one** line from each step to the reason for the step.

[2 marks]

Step	Reason for step
	Desalination
Filtration	Improve taste
	Increase pH
Sterilisation	Kill bacteria
	Remove solids

0 1 . 2

Which **two** substances are used to sterilise fresh water?

[2 marks]

Tick (✓) **two** boxes.

Ammonia

☐

Chlorine

☐

Hydrogen

☐

Nitrogen

☐

Ozone

☐

Turn over ►



A large amount of aluminium sulfate was accidentally added to the drinking water supply at a water treatment works.

0 1 . 3 Scientists tested a sample of the drinking water to show that it contained dissolved solids.

Which **two** methods show the presence of dissolved solids in the sample of drinking water?

[2 marks]

Tick (✓) **two** boxes.

Add damp litmus paper to the sample.

☐

Evaporate all water from the sample.

☐

Measure the sample's boiling point.

☐

Test the sample with a glowing splint.

☐

0 1 . 4

Scientists tested two water samples from the drinking water supply.

The scientists tested one sample for aluminium ions and the other sample for sulfate ions.

Draw **one** line from each ion to the compound needed to identify the ion.

[2 marks]

Ion	Compound needed to identify ion
	Barium chloride
Aluminium ion	Copper sulfate
	Silver nitrate
Sulfate ion	Sodium hydroxide
	Sulfuric acid

0 1 . 5

How could pure water be produced from drinking water that contained dissolved solids?

[1 mark]

Tick (✓) **one** box.

Chromatography

☐

Cracking

☐

Distillation

☐

Sedimentation

☐

Turn over ►



0 2

Some central heating boilers use methane as a fuel.

Carbon monoxide detectors are placed near central heating boilers.

0 2 . 1

Which **three** properties of carbon monoxide make it necessary to use carbon monoxide detectors?

Choose answers from the box.

[3 marks]

acidic	alkaline	colourless	corrosive
insoluble	odourless	toxic	

1 _____

2 _____

3 _____

0 2 . 2

Complete the sentence.

[1 mark]

Methane produces carbon monoxide when burning in a limited supply of

_____.

0 2 . 3

8 g of methane has a volume of 12 dm^3 at room temperature and pressure.

Calculate the mass of 36 dm^3 of methane.

[2 marks]

Mass = _____ g



0 2 . 4

Most methane is obtained from natural gas, which is a fossil fuel.

Methane can also be produced renewably.

Which **two** are renewable sources of methane?

[2 marks]

Tick (✓) **two** boxes.

Animal waste

☐

Food in landfill

☐

Nitrogen in the air

☐

Non-biodegradable plastics

☐

Scrap iron

☐

8

Turn over for the next question

Turn over ►



0 3

Hydrogen is a raw material in the Haber process.

Hydrogen is produced from methane.

The word equation for the reaction is:

**0 3 . 1**

How can you tell that the reaction is reversible?

[1 mark]

0 3 . 2

The forward reaction is endothermic.

Name the type of energy change in the reverse reaction.

[1 mark]

0 3 . 3

A nickel catalyst is used in this reaction.

Why is a catalyst used in this reaction?

[2 marks]

Tick (✓) **two** boxes.

To increase the temperature

☐

To produce less carbon monoxide

☐

To reduce costs

☐

To use less energy

☐

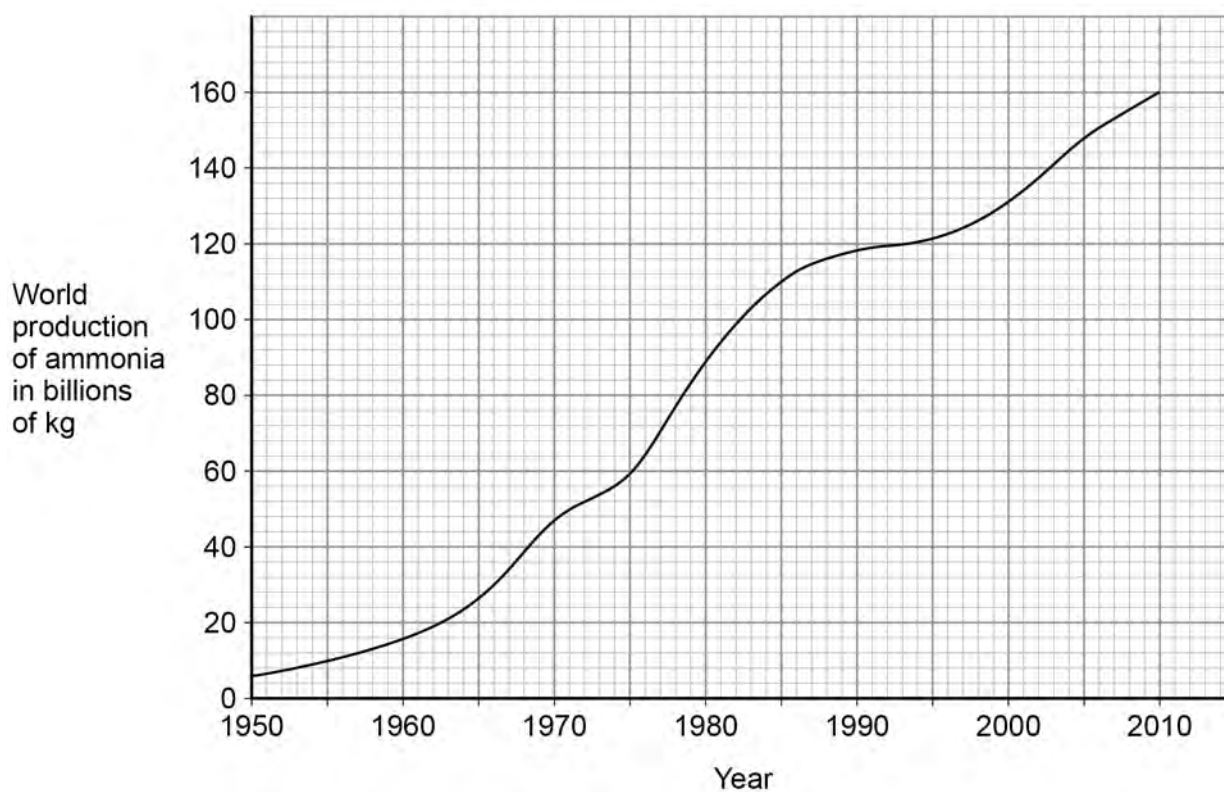
To use less methane

☐

0 3 . 4 The Haber process also uses nitrogen to produce ammonia.

Figure 1 shows how the world production of ammonia changed between 1950 and 2010.

Figure 1



Describe how the world production of ammonia changed between 1950 and 2010.

[2 marks]

Turn over ►



Most of the ammonia produced is used to make fertilisers.

0 3 . 5 Why did the world production of ammonia change between 1950 and 2010?

[2 marks]

Tick (✓) **two** boxes.

The demand for food changed.

☐

The demand for fuels changed.

☐

The nitrogen percentage in air changed.

☐

The number of cars changed.

☐

The world population changed.

☐

Table 1 shows data about four fertilisers, **A**, **B**, **C** and **D**.

Table 1

Fertiliser	Percentage by mass of nitrogen (%)	Percentage by mass of phosphorus (%)	Percentage by mass of potassium (%)
A	35.0	0.0	0.0
B	21.2	0.0	0.0
C	21.2	23.5	0.0
D	0.0	0.0	52.3



0 3 . 6

Which combination of fertilisers **A**, **B**, **C** and **D** provides **all** of the elements needed for an NPK fertiliser?

Use **Table 1**.

[1 mark]

Tick (✓) **one** box.

A and **C**

☐

A and **D**

☐

B and **C**

☐

C and **D**

☐

0 3 . 7

Which fertiliser is **not** made using ammonia?

Use **Table 1**.

[1 mark]

Tick (✓) **one** box.

A

☐

B

☐

C

☐

D

☐

0 4

Titan is a moon of the planet Saturn.

Table 2 shows the percentages of some gases in the atmosphere of Titan and in the atmosphere of the Earth.

Table 2

Gas	Percentage of gas in atmosphere (%)	
	Titan	Earth
Nitrogen	98	78
Oxygen	Zero	21
Methane	1.4	0.0002
Argon	0.14	0.9
Carbon dioxide	0.0001	0.04

0 4

1

Which **two** gases are present in smaller percentages on the Earth than on Titan?

[1 mark]

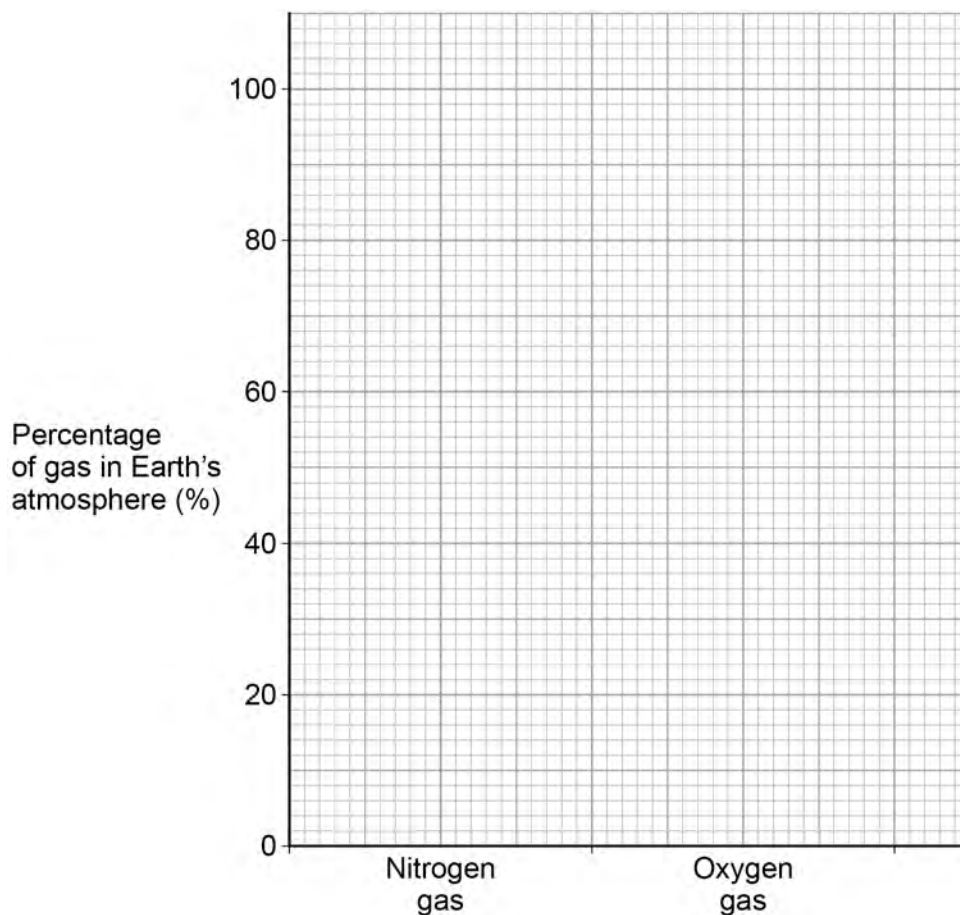
_____ and _____



0 4 . 2

Complete the bar chart in **Figure 2** to show the percentages of nitrogen gas and oxygen gas in the Earth's atmosphere.

[2 marks]

Figure 2

0 4 . 3

Why are algae less likely to photosynthesise on Titan than Earth?

Use **Table 2**.

[1 mark]

Tick (✓) **one** box.

Titan's atmosphere contains too little argon.

☐

Titan's atmosphere contains too little carbon dioxide.

☐

Titan's atmosphere contains too little methane.

☐

Titan's atmosphere contains too little nitrogen.

☐

Turn over ►



0 4 . 4

Titan is warmer than the other moons of Saturn because of the greenhouse effect.

How do greenhouse gases trap energy from the sun?

[1 mark]

Tick (✓) **one** box.

All wavelengths of radiation are reflected back to the surface of Titan.

☐

Long wavelength radiation is reflected back to the surface of Titan.

☐

Short wavelength radiation is reflected back to the surface of Titan.

☐

As well as methane, the atmosphere of Titan contains small amounts of propene gas.
Methane is an alkane and propene is an alkene.

0 4 . 5

Bromine water is an orange solution used to identify alkenes.

Draw **one** line from each gas to its effect on bromine water.

[2 marks]

Gas	Effect on bromine water
	Forms a blue solution
Methane	Forms a colourless solution
	Forms a green solution
Propene	Forms a white precipitate
	No effect



0	4	.	6
---	---	---	---

Propene reacts with water (steam) to make propanol.

The ratio of the masses of propene and water that react is:

propene : water

7 : 3

Calculate the mass of propene that reacts with 21 g water.

[2 marks]

Mass = _____ g

9

Turn over for the next question

Turn over ►



0	5
---	---

Figure 3 shows a surfer on a surfboard.

Figure 3



Some surfboards are made from addition polymers.

Addition polymers are made from small alkene molecules.

0	5	.	1
---	---	---	---

Which type of bonding is present in small alkene molecules?

[1 mark]

Tick (✓) **one** box.

Covalent

☐

Ionic

☐

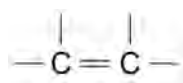
Metallic

☐

0 5 . 2 What is the functional group in these small alkene molecules?

[1 mark]

Tick (✓) **one** box.


☐

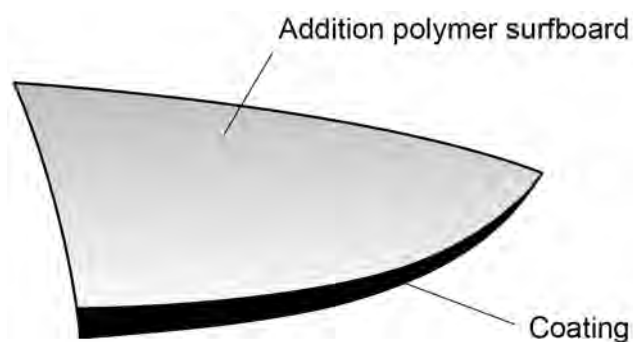
☐

☐

Figure 4 shows the structure of part of an addition polymer surfboard.

The outer surface of the surfboard is coated.

Figure 4



The coating is made from soda-lime glass fibres surrounded by a plastic.

0 5 . 3 What type of material is the coating of the surfboard?

[1 mark]

Tick (✓) **one** box.

Alloy

☐

Ceramic

☐

Composite

☐

Nanotube

☐

Turn over ►



0 5 . 4

Complete the sentence.

Choose answers from the box.

[2 marks]

air	ammonia	copper
	limestone	sand

The materials used to make the soda-lime glass fibres are sodium carbonate,

_____ and _____.

0 5 . 5

Suggest **two** reasons why surfboards are coated.

[2 marks]

1 _____

2 _____

Some surfboards are made from wood.

Table 3 contains information about the materials in an addition polymer surfboard and a wooden surfboard.**Table 3**

	Addition polymer surfboard	Wooden surfboard
Relative strength	14	38
Cost (£ per m ³)	140	390
Density (kg/m ³)	50	150
Disposal at end of life	Difficult to recycle	Can be used as fuel



0 5 . 6

Suggest **two** advantages and **two** disadvantages of using addition polymers rather than wood to make surfboards.

Use **Table 3**.

[4 marks]

Advantages of addition polymers _____

Disadvantages of addition polymers _____

0 5 . 7

Calculate the volume of wood in a wooden surfboard of mass 5.25 kg

Use **Table 3** and the equation:

$$\text{Density in kg/m}^3 = \frac{\text{Mass in kg}}{\text{Volume in m}^3}$$

[3 marks]

Volume = _____ m³

14

Turn over ►



The corrosion of iron is called rusting.

You should include the results you expect to obtain.

Use apparatus and materials from the list:

- test tubes
- stoppers
- iron nails
- tap water
- boiled water
- drying agent
- oil.

[6 marks]

[illegible]

A student investigated how the mass of three iron nails, **A**, **B** and **C**, increased after rusting.

Table 4 shows the student's results.

Table 4

Nail	Mass of nail before rusting in g	Mass of nail after rusting in g	Increase in mass of nail in g
A	1.22	1.30	0.08
B	1.25	1.36	X
C	1.24	1.33	0.09

06.2 Calculate **X** in **Table 4**.

[1 mark]

X = _____ g

06.3 Calculate the mean increase in mass of the three iron nails, **A**, **B** and **C**.

Use **Table 4** and your answer to Question **06.2**

[1 mark]

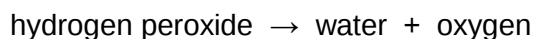
Mean increase in mass = _____ g



0 7

Some students investigated the rate of decomposition of hydrogen peroxide.

The equation for the reaction is:

**0 7 . 1**

Complete the sentence.

Choose an answer from the box.

[1 mark]**a burning splint****a glowing splint****damp litmus paper****limewater**

The students tested the gas produced to show that it was oxygen.

The students used _____.

Student **A** investigated the effect of the particle size of a manganese dioxide catalyst on the rate of the reaction.

This is the method used.

1. Measure 25 cm³ hydrogen peroxide solution into a conical flask.
2. Add some fine manganese dioxide powder to the conical flask.
3. Measure the volume of oxygen produced every 30 seconds for 10 minutes.
4. Repeat steps 1 to 3 two more times.
5. Repeat steps 1 to 4 with coarse manganese dioxide lumps.



0 7 . 2

The method student **A** used did **not** give repeatable results.

How could student **A** make the results repeatable?

[1 mark]

Tick (✓) **one** box.

Student **A** should make measurements every 2 minutes.

☐

Student **A** should measure the mass of manganese dioxide.

☐

Student **A** should use 50 cm³ hydrogen peroxide.

☐

Student **A** should use a beaker instead of a conical flask.

☐

Student **B** used a method which gave repeatable results.

0 7 . 3

How could student **B** improve the accuracy of these results?

[1 mark]

Tick (✓) **one** box.

Calculate a mean but do not include any anomalous results.

☐

Calculate a mean but do not include the first set of results.

☐

Record the results in a table and plot the results on a bar chart.

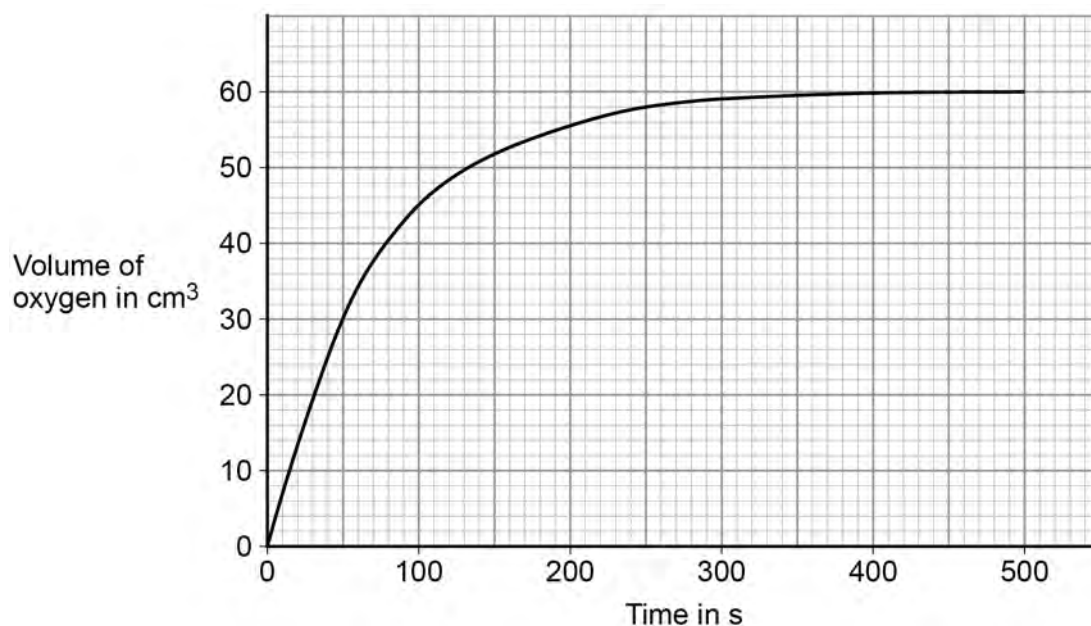
☐

Record the results in a table and plot the results on a line graph.

☐**Turn over ►**

Figure 5 shows student B's results for coarse manganese dioxide lumps.

Figure 5



0 7 . 4

Calculate the mean rate of reaction between 30 and 250 seconds for coarse manganese dioxide lumps.

Use **Figure 5** and the equation:

$$\text{Mean rate of reaction} = \frac{\text{Volume of oxygen formed}}{\text{Time taken}}$$

Give your answer to 3 significant figures.

[4 marks]

Volume of oxygen formed _____

Time taken _____

Mean rate of reaction = _____ cm³/s



0 7 . 5

Fine manganese dioxide powder produces a higher rate of reaction than coarse manganese dioxide lumps.

Sketch on **Figure 5** the results you would expect for student **B**'s experiment with fine manganese dioxide powder.

[2 marks]

0 7 . 6

Hydrogen peroxide molecules collide with manganese dioxide particles during the reaction.

Why does fine manganese dioxide powder produce a higher rate of reaction than coarse manganese dioxide lumps?

[1 mark]

Tick (✓) **one** box.

Fine manganese dioxide powder has a larger surface area.

☐

Fine manganese dioxide powder has larger particles.

☐

Fine manganese dioxide powder produces less frequent collisions.

☐

Turn over for the next question

10

Turn over ►



0 8

This question is about crude oil and hydrocarbons.

Figure 6 shows a fractionating column used to separate crude oil into fractions.

Figure 6

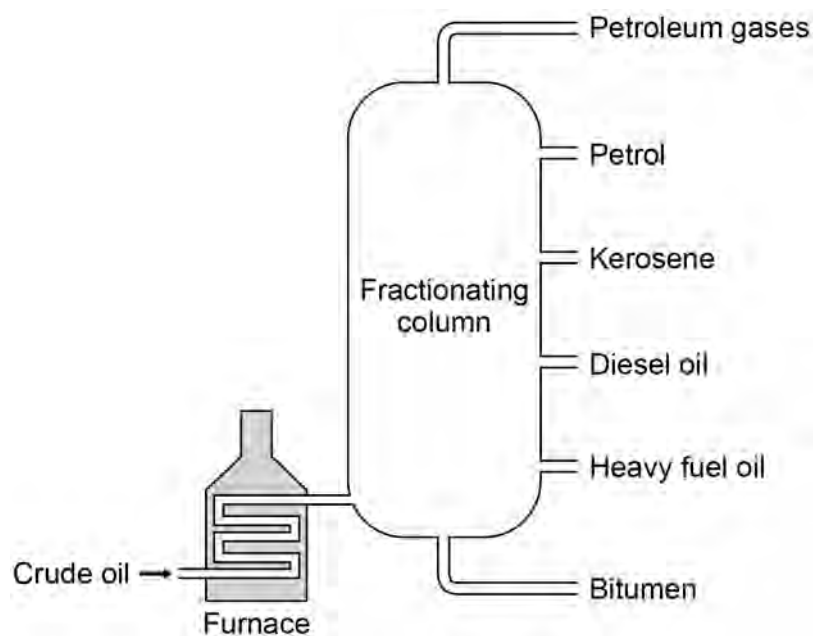


Table 5 gives information about some of the fractions.

Table 5

Fraction	Boiling point range in °C
Petroleum gases	Below 30
Petrol	40–110
Kerosene	180–260
Diesel oil	260–320
Heavy fuel oil	320–400
Bitumen	400–450



0	8	.	1
---	---	---	---

Suggest a suitable temperature for the furnace in **Figure 6**.

[1 mark]

_____ °C

0	8	.	2
---	---	---	---

Explain why diesel oil collects above heavy fuel oil but below kerosene in the fractionating column.

Use **Table 5**.

[2 marks]

0	8	.	3
---	---	---	---

Suggest **two** reasons why bitumen is **not** used as a fuel.

[2 marks]

1 _____

2 _____

Question 8 continues on the next page

Turn over ►



0 8 . 4

Petrol contains mainly alkanes.

Which of the following compounds is an alkane?

[1 mark]

Tick (✓) **one** box.☐☐☐☐

Large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

0 8 . 5

Describe the conditions needed to crack hydrocarbon molecules from the diesel oil fraction.

[2 marks]



0 8 . 6

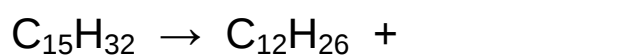
Explain why large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

[2 marks]

0 8 . 7

Complete the equation for the cracking of $C_{15}H_{32}$

[1 mark]



Turn over for the next question

11

Turn over ►



0	9
---	---

This question is about lithium carbonate.

Lithium carbonate is used in medicines.

Figure 7 shows a tablet containing lithium carbonate.

Figure 7



0	9	.	1
---	---	---	---

Lithium carbonate contains lithium ions and carbonate ions.

A student tested the tablet for lithium ions and for carbonate ions.

The student used:

- a metal wire
- dilute hydrochloric acid
- limewater.

Plan an investigation to show the presence of lithium ions **and** of carbonate ions in the tablet.

You should include the results of the tests for the ions.

[6 marks]



0	9	.	2
---	---	---	---

The tablet also contains other substances.

The substances in tablets are present in fixed amounts.

What name is given to mixtures like tablets?

[1 mark]

0	9	.	3
---	---	---	---

The tablet has a mass of 1.20 g and contains 700 mg of lithium carbonate.

Calculate the percentage by mass of lithium carbonate in this tablet.

[3 marks]

Percentage by mass of lithium carbonate = _____ %

10

Turn over ►



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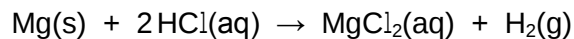


1	0
---	---

This question is about rate of reaction.

A student investigated the rate of the reaction between magnesium and dilute hydrochloric acid.

The equation for the reaction is:



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

Which state symbol in the equation for the reaction does **not** represent one of the three states of matter?

[1 mark]

The student determined the rate of production of hydrogen gas.

1	0	.	2
---	---	---	---

What **two** pieces of measuring apparatus could the student use to find the rate of production of hydrogen gas?

[2 marks]

1

2

Question 10 continues on the next page

Turn over ►



Table 6 shows the results of the investigation.

Table 6

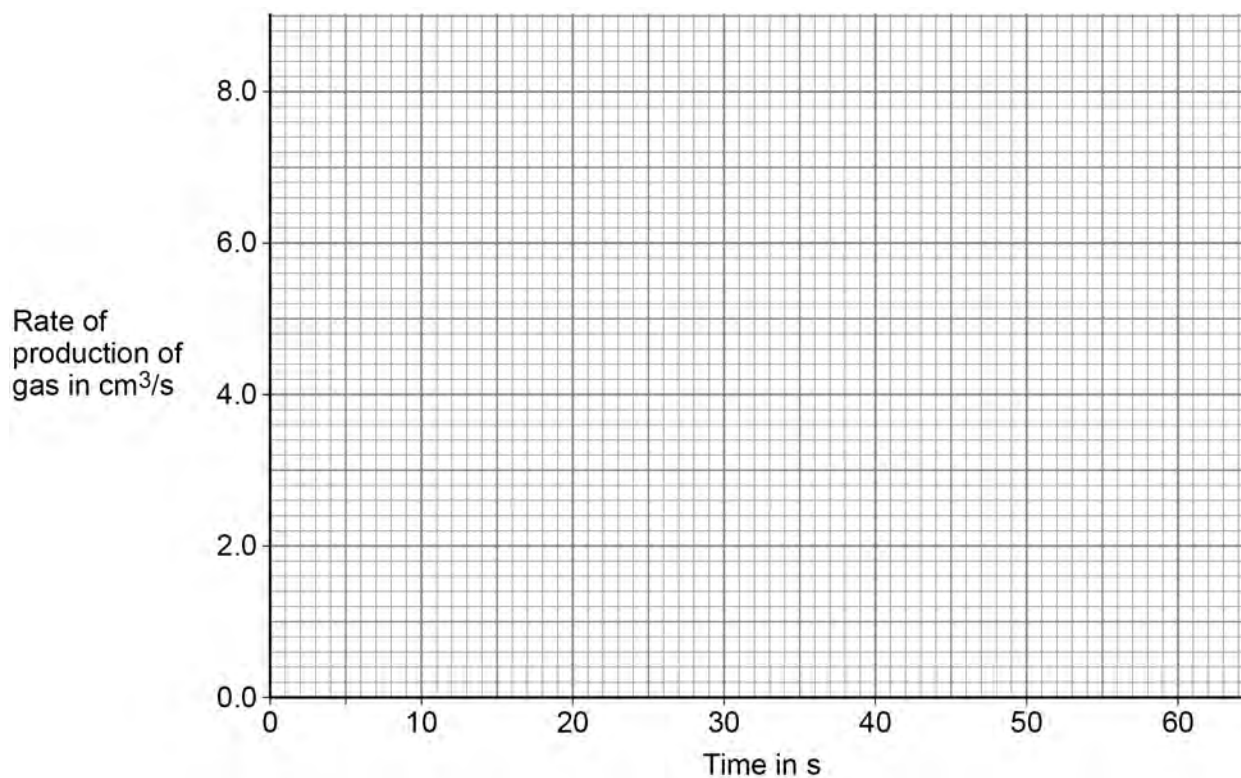
Time in s	Rate of production of gas in cm ³ /s
10	6.9
20	3.9
30	2.0
40	0.9
50	0.3
60	0.0

1 0 . 3 Plot the data from **Table 6** on **Figure 8**.

You should draw a line of best fit.

[3 marks]

Figure 8



1 0 . 4

Give **three** conclusions that can be drawn about the rate of reaction between magnesium and dilute hydrochloric acid in this investigation.

Use data from **Figure 8** and **Table 6**.

[3 marks]

1 _____

2 _____

3 _____

1 0 . 5

The student repeated the investigation using dilute hydrochloric acid at a higher temperature.

All the other variables were kept the same.

Which **two** statements are correct?

[2 marks]

Tick (✓) **two** boxes.

More bubbles were produced in the first 10 seconds.

☐

The activation energy for the reaction was higher.

☐

The magnesium was used up more quickly.

☐

The reaction finished at the same time.

☐

The total volume of gas collected was greater.

☐**END OF QUESTIONS**

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