

Please write clearly in block capitals.

Centre number

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Candidate signature

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I declare this is my own work.

# GCSE COMBINED SCIENCE: TRILOGY

# F

Foundation Tier  
Chemistry Paper 2F

Time allowed: 1 hour 15 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.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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 70.
- 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                  |      |
| <b>TOTAL</b>       |      |



**0 1**

Fresh water contains low levels of dissolved salts.

Water reacts with anhydrous copper sulfate in a reversible reaction.

The word equation for the reaction is:

**0 1 . 1**

How does the equation show that the reaction is reversible?

**[1 mark]**

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**0 1 . 2**

Complete the sentences.

Choose answers from the box.

**[2 marks]****blue****green****orange****white****yellow**

The colour of anhydrous copper sulfate is \_\_\_\_\_ .

The colour of hydrated copper sulfate is \_\_\_\_\_ .



0 1 . 3

Figure 1 shows anhydrous copper sulfate in a sealed container.

Figure 1



Suggest **one** reason why anhydrous copper sulfate is kept in a sealed container.

[1 mark]

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Question 1 continues on the next page

Turn over ►



Sodium chloride dissolves in water to form sodium chloride solution.

**0 1 . 4** Draw **one** line from each substance to the description of the substance.

**[2 marks]**

| Substance                | Description of substance |
|--------------------------|--------------------------|
| Sodium chloride solution | Compound                 |
| Water                    | Element                  |
|                          | Hydrocarbon              |
|                          | Mixture                  |

**0 1 . 5** Name the process used to obtain solid sodium chloride from sodium chloride solution.

**[1 mark]**

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**0 1 . 6** Two processes used to obtain potable water from fresh water are:

- filtering
- sterilising.

Give **one** reason why each process is used.

**[2 marks]**

Filtering \_\_\_\_\_

\_\_\_\_\_

Sterilising \_\_\_\_\_

\_\_\_\_\_

**0 1 . 7** Which type of water is the easiest to obtain potable water from?

**[1 mark]**

Tick (✓) **one** box.

Ground water

Salt water

Waste water

**0 1 . 8** Which of the following is the first stage of waste water treatment?

**[1 mark]**

Tick (✓) **one** box.

Aerobic biological treatment of effluent

Anaerobic digestion of sewage sludge

Screening and removal of grit



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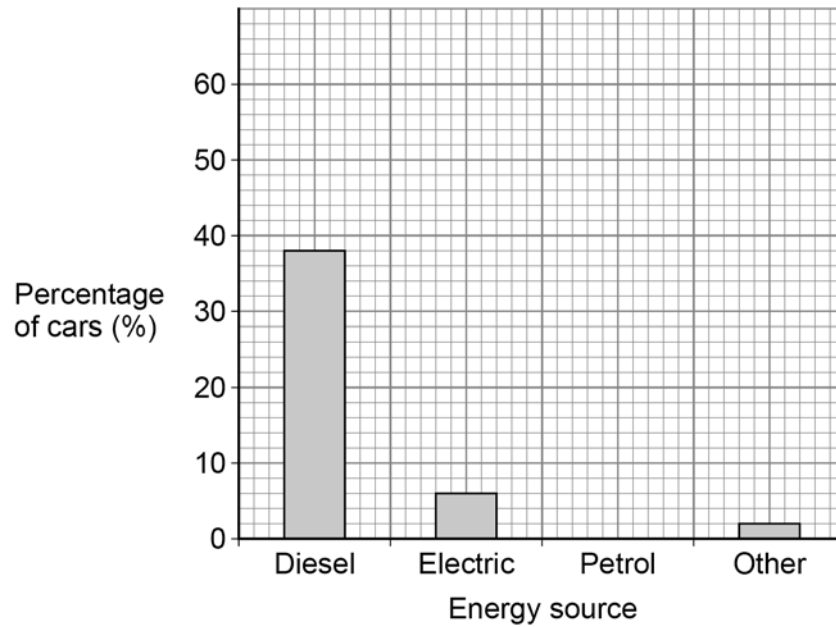
0 2

Cars cause atmospheric pollution.

0 2 . 1

Figure 2 shows the percentage of cars in the UK using different energy sources.

Figure 2



The percentage of cars using petrol is 54%.

Draw the bar for petrol on **Figure 2**.

[1 mark]

**Question 2 continues on the next page**

Turn over ►



Some car emissions contain nitrogen dioxide.

**Table 1** shows the concentration of nitrogen dioxide in the air in three different areas for 1 week.

**Table 1**

| Concentration of nitrogen dioxide in the air<br>in arbitrary units |             |             |          |
|--|-------------|-------------|----------|
| Day  | City centre | Countryside | Motorway |
| Monday   | 35          | 8           | 22       |
| Tuesday  | 37          | 8           | 23       |
| Wednesday  | 37          | 8           | 23       |
| Thursday   | 34          | 8           | 23       |
| Friday   | 37          | 8           | 23       |
| Saturday   | 29          | 7           | 20       |
| Sunday   | 22          | 6           | 17       |

**0 2 . 2** Which column of data has the greatest range?

**[1 mark]**

Tick (✓) **one** box.

City centre

Countryside

Motorway





0 2 . 3

Explain why the concentration of nitrogen dioxide in the air is lower on Sunday.

**[2 marks]**

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0 2 . 4

Calculate the mean value for the concentration of nitrogen dioxide in the air in the city centre for the days from Monday to Friday.

Use **Table 1**.**[2 marks]**

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Mean value for concentration of nitrogen dioxide = \_\_\_\_\_ arbitrary units

**Question 2 continues on the next page****Turn over ►**

Nitrogen dioxide is removed from car emissions by catalytic converters.

**0 2 . 5** Which **two** of the following are correct statements about catalysts?

**[2 marks]**

Tick (✓) **two** boxes.

Catalysts are included in the chemical equation for a reaction.

Catalysts are **not** used up in a reaction.

Catalysts decrease the surface area of the reactants.

Catalysts increase the concentration of the reactants.

Catalysts lower the activation energy of a reaction.

**0 2 . 6** The catalyst in catalytic converters contains platinum.

Platinum is an unreactive metal obtained from the Earth's crust.

Complete the sentence.

Choose the answer from the box.

**[1 mark]**

**finite resource**

**formulation**

**renewable resource**

Platinum is a \_\_\_\_\_.



0 2 . 7 Emissions from cars that burn fossil fuels contain carbon dioxide.

What is used to test for carbon dioxide?

[1 mark]

Tick (✓) **one** box.

Burning splint

Glowing splint

Limewater

10

Turn over for the next question

Turn over ►



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**0 3**

An increase in greenhouse gases in the Earth's atmosphere causes an increase in global temperature.

**0 3 . 1**

An increase in global temperature is a major cause of climate change.

Give **two** effects of global climate change.

**[2 marks]**

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

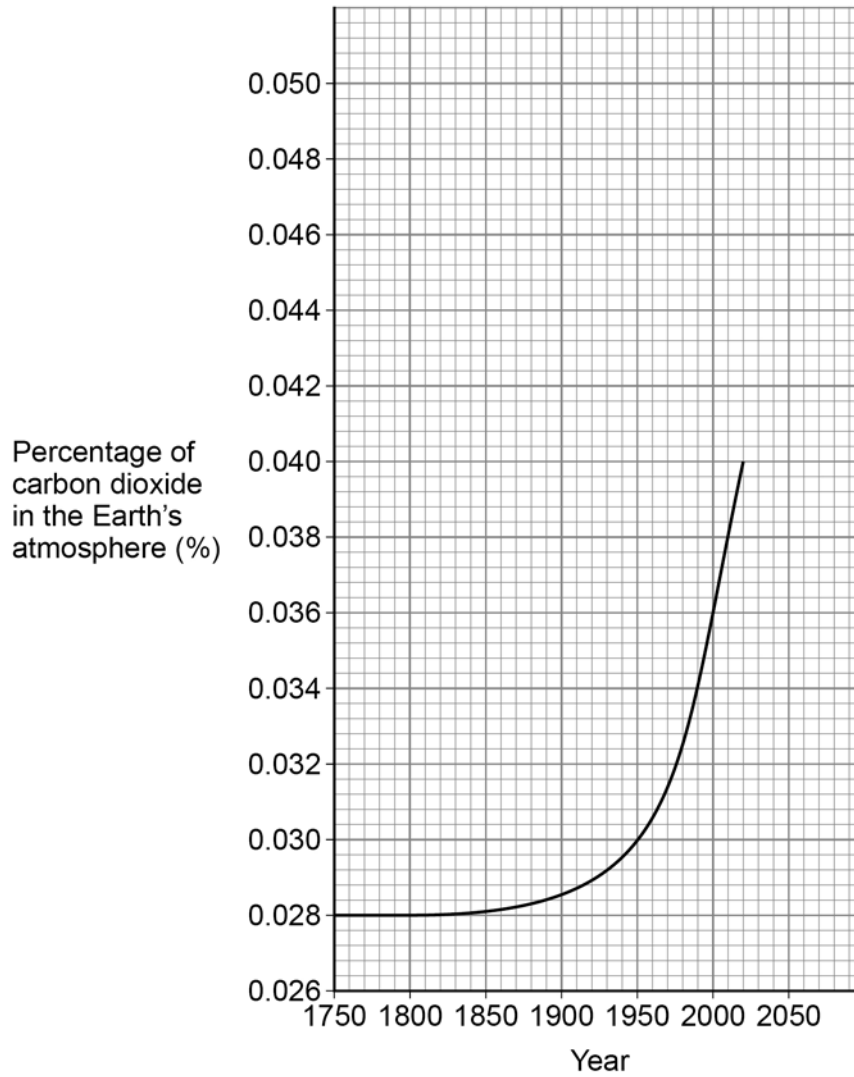
**Question 3 continues on the next page**

**Turn over ►**

Carbon dioxide is a greenhouse gas.

**Figure 3** shows the percentage of carbon dioxide in the Earth's atmosphere from 1750.

**Figure 3**



**0 3 . 2** Describe the trend in the percentage of carbon dioxide in the Earth's atmosphere from 1750 to 2000.

Use **Figure 3**.

**[2 marks]**

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**0 3 . 3** Determine the change in the percentage of carbon dioxide in the Earth's atmosphere from 1950 to 2000.

Use **Figure 3**.

**[2 marks]**

Percentage of carbon dioxide in 1950 \_\_\_\_\_

Percentage of carbon dioxide in 2000 \_\_\_\_\_

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Change in percentage of carbon dioxide = \_\_\_\_\_ %

**0 3 . 4** Give **one** reason why the percentage of carbon dioxide in the atmosphere is changing.

**[1 mark]**

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**0 3 . 5** Predict the percentage of carbon dioxide in the Earth's atmosphere in 2050.

You should extend the graph line on **Figure 3**.

**[2 marks]**

Percentage of carbon dioxide in 2050 = \_\_\_\_\_ %

9

Turn over ►



0 4

This question is about the atmospheres of Earth and Mars.

0 4 . 1

Earth's early atmosphere may have been like the atmosphere of Mars today.

Why are scientists **not** certain about the percentage of gases in the Earth's early atmosphere?

[1 mark]

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0 4 . 2

What was formed from the water vapour in the Earth's early atmosphere?

[1 mark]

Tick (✓) **one** box.

Crude oil

Limestone

Natural gas

Oceans





0 4 . 3 The Earth's atmosphere today consists mainly of nitrogen and oxygen.

Draw **one** line from each gas to what produced the gas.

[2 marks]

| Gas      | What produced the gas |
|----------|-----------------------|
| Nitrogen | Algae                 |
| Oxygen   | Animals               |
|          | Fossils               |
|          | Oceans                |
|          | Volcanoes             |

Question 4 continues on the next page

Turn over ►



**Table 2** shows the percentage of some gases in the atmospheres of Earth and Mars.

**Table 2**

| Gas            | Percentage of gas in atmosphere (%) |      |
|----------------|-------------------------------------|------|
|                | Earth                               | Mars |
| Argon          | 0.9                                 | 1.9  |
| Carbon dioxide | 0.04                                | 95   |
| Nitrogen       | 78                                  | 2.6  |
| Oxygen         | 21                                  | 0.2  |

**0 4 . 4** Why are animals **not** able to live on Mars?

[1 mark]

Tick (✓) **one** box.

The atmosphere of Mars does not contain enough argon.

The atmosphere of Mars does not contain enough nitrogen.

The atmosphere of Mars does not contain enough oxygen.

**0 4 . 5** There is more carbon dioxide on Mars than on Earth.

Which **other** gas is found in larger quantities on Mars than on Earth?

[1 mark]

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0 4 . 6

Calculate how many times more nitrogen than oxygen there is in the atmosphere of Earth.

Use **Table 2**.

Give your answer to 2 significant figures.

**[3 marks]**

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Number of times more nitrogen than oxygen (2 significant figures) = \_\_\_\_\_

9

**Turn over for the next question**

**Turn over ►**



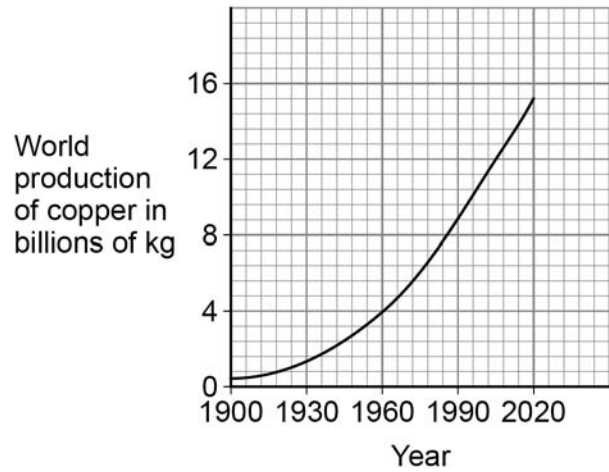
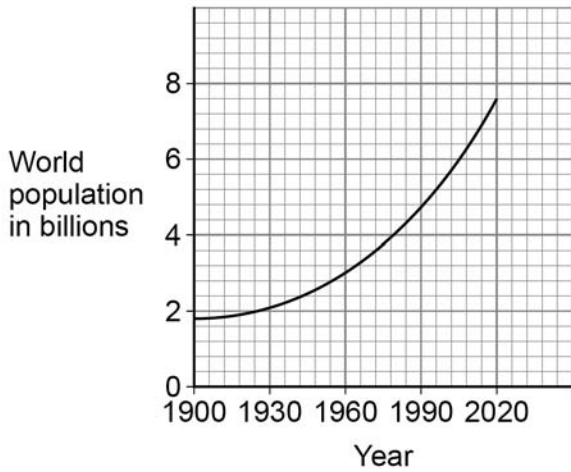
0 5

Industries use the Earth's resources to produce useful products.

0 5 . 1

**Figure 4** shows the world population and the world production of copper between 1900 and 2020.

**Figure 4**



How does the change in the world population compare with the world production of copper?

**[1 mark]**

Tick (✓) **one** box.

As population decreased, copper production increased.

As population increased, copper production decreased.

As population increased, copper production increased.



Copper is produced from copper ore and from recycling waste copper.

**0 5 . 2** The energy needed to produce 1 kg of copper from copper ore is 70 MJ.

The energy needed to produce 1 kg of recycled copper is 27 MJ.

Calculate the energy saved if 100 kg of copper is produced from recycled copper and **not** from copper ore.

**[3 marks]**

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Energy saved = \_\_\_\_\_ MJ

**0 5 . 3** Producing copper from recycling waste copper reduces emissions of sulfur dioxide.

Why is reducing emissions of sulfur dioxide important?

**[1 mark]**

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**0 5 . 4** Copper is used to make coins.

A coin of mass 8 g contains 75% copper.

Calculate the mass of copper in the coin.

**[2 marks]**

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Mass of copper = \_\_\_\_\_ g

**Turn over ►**



0 5 . 5 Iron and glass are both produced from the Earth's resources.

Some processes can reduce the use of limited resources.

Draw **one** line from the description of the process to the name of the process.

[2 marks]

**Description of process**

**Name of process**

Scrap steel is added to  
iron from a blast furnace

A glass bottle is refilled

Extraction

Quarrying

Reacting

Recycling

Reusing



0 5 . 6

Life cycle assessments are used to assess the environmental impact of producing iron nails and glass bottles.

There are four stages, **A**, **B**, **C** and **D**, in a life cycle assessment.

The stages are **not** in the correct order.

Stage **A** Disposal

Stage **B** Extracting and processing raw materials

Stage **C** Manufacturing and packaging

Stage **D** Use and operation

What is the correct order of stages **A**, **B**, **C**, and **D**?

[1 mark]

Tick (✓) **one** box.

**C, D, B, A**

**D, B, C, A**

**B, C, D, A**

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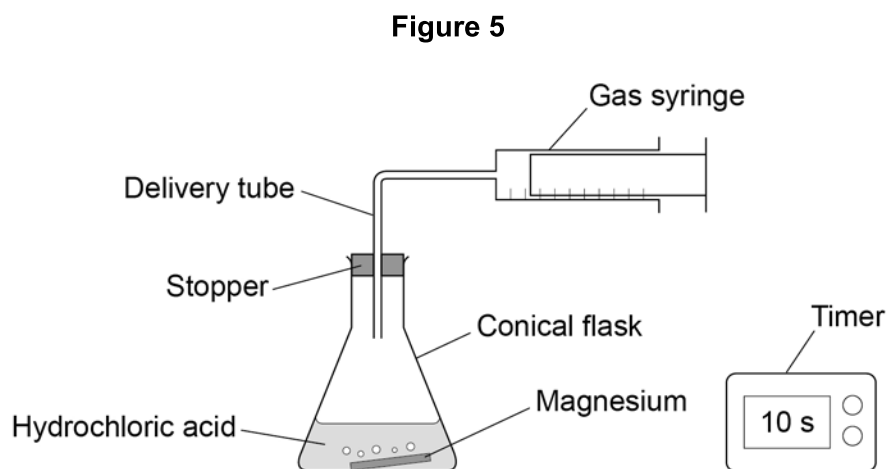




0 6

A student investigated the reaction between magnesium and excess hydrochloric acid.

Figure 5 shows the apparatus.



This is the method used.

1. Pour 50 cm<sup>3</sup> of hydrochloric acid into a conical flask.
2. Add a piece of magnesium.
3. Insert stopper and delivery tube and start a timer.
4. Collect the gas produced in a gas syringe.
5. Record the volume of gas produced every 20 seconds for 2 minutes.
6. Repeat steps 1 to 5 with higher concentrations of hydrochloric acid.

0 6 . 1

Give the independent variable and **one** control variable in this investigation.

[2 marks]

Independent variable \_\_\_\_\_

Control variable \_\_\_\_\_

Question 6 continues on the next page

Turn over ►



**Table 3** shows the results from the first experiment using hydrochloric acid with a low concentration.

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**Table 3**

|  |   |    |    |    |    |     |     |
|--|---|----|----|----|----|-----|-----|
| <b>Time in seconds</b>                 | 0 | 20 | 40 | 60 | 80 | 100 | 120 |
| <b>Volume of gas in cm<sup>3</sup></b> | 0 | 48 | 72 | 90 | 97 | 98  | 98  |

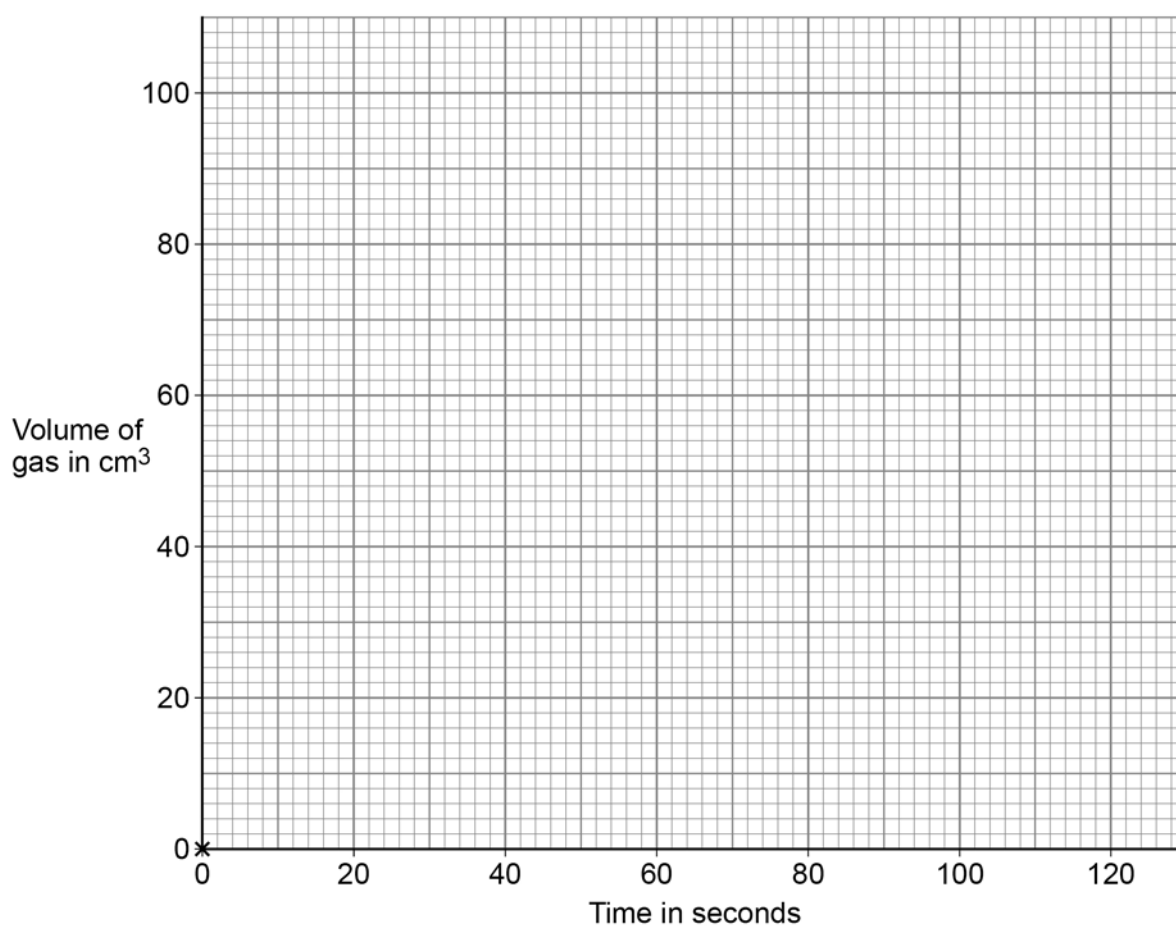
**0 6 . 2** Complete **Figure 6**.

You should:

- plot the data from **Table 3** (the point 0,0 has been plotted for you)
- draw a line of best fit.

**[3 marks]**

**Figure 6**



0 6 . 3 How does the **rate** of this reaction change with time?

Use **Table 3**.

[1 mark]

Tick (✓) **one** box.

The rate decreases.

The rate stays the same.

The rate increases.

0 6 . 4 The student repeated the experiment using hydrochloric acid with a higher concentration.

Which statement is correct?

[1 mark]

Tick (✓) **one** box.

The activation energy for the reaction was higher.

The magnesium reacted more quickly.

The reaction finished at the same time.

The total volume of gas collected was smaller.

**Question 6 continues on the next page**

**Turn over ►**



0 6 . 5 Temperature also affects the rate of the reaction.

Explain how increasing the temperature affects the **rate** of the reaction.

You should refer to particles and collisions.

[3 marks]

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|---|---|
| 0 | 7 |
|---|---|

Crude oil is a resource found in rocks.

Most of the compounds in crude oil are hydrocarbons.

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

Complete the sentence.

[1 mark]

Crude oil is formed by the decomposition of \_\_\_\_\_.

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

Alkanes are hydrocarbons.

Give the name of the alkane molecule that has three carbon atoms.

[1 mark]

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**Question 7 continues on the next page**

**Turn over ►**



0 7 . 3 Figure 7 shows two alkane molecules.

Figure 7

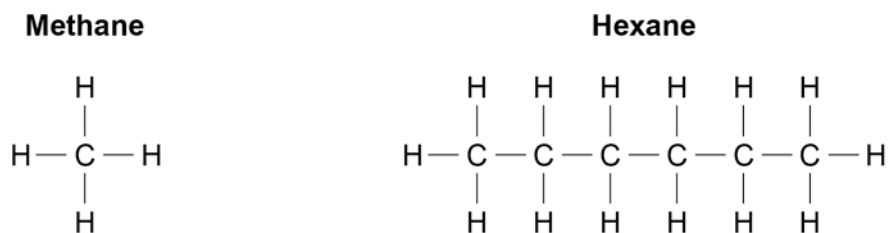


Table 4 shows the melting points and boiling points of methane and hexane.

Table 4

|         | Melting point in °C | Boiling point in °C |
|---------|---------------------|---------------------|
| Methane | -183                | -162                |
| Hexane  | -95                 | 69                  |

Compare the structure and properties of methane and hexane.

[6 marks]

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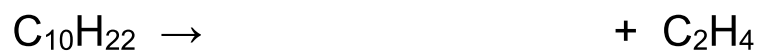


Hydrocarbons are cracked to produce more useful alkanes and alkenes.

**0 7 . 4** Decane ( $C_{10}H_{22}$ ) is cracked to produce **two** products.

Complete the equation for the reaction.

**[1 mark]**



**0 7 . 5**  $C_2H_4$  is an alkene.

What is the test for alkenes?

Give the result of the test if an alkene is present.

**[2 marks]**

Test \_\_\_\_\_

\_\_\_\_\_

Result \_\_\_\_\_

\_\_\_\_\_

11

**END OF QUESTIONS**



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