AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

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.

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

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.

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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:

water + anhydrous copper sulfate ⇌ hydrated copper sulfate

0 1 . 1 How does the equation show that the reaction is reversible?

[1 mark]

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 _____ .

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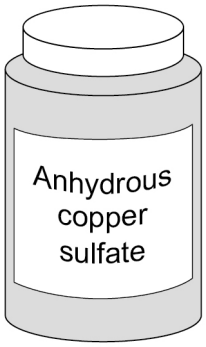
0 1 . 3 **Figure 1** shows anhydrous copper sulfate in a sealed container.

Figure 1



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

[1 mark]

Question 1 continues on the next page

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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**
	Compound
Sodium chloride solution	
	Element
Water	Hydrocarbon
	Mixture

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

[1 mark]

_____

Do not write outside the box

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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ANSWER IN THE SPACES PROVIDED

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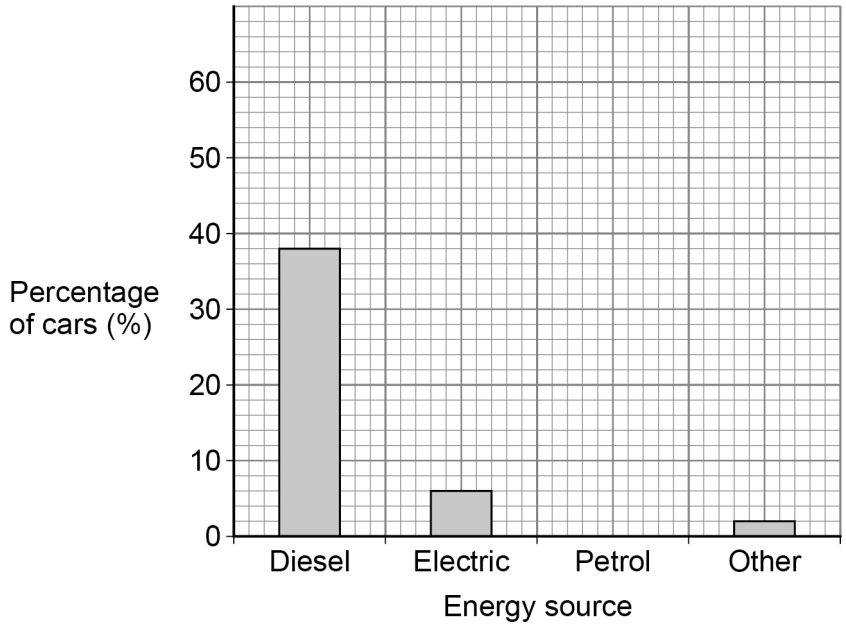
0 2 Cars cause atmospheric pollution.

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

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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 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 ☐

Do not write outside the box

0 2 . 3 Explain why the concentration of nitrogen dioxide in the air is lower on Sunday.

[2 marks]

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]

Mean value for concentration of nitrogen dioxide = _____ arbitrary units

Question 2 continues on the next page

Do not write outside the box

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 _____ .

Do not write outside the box

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

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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 _____

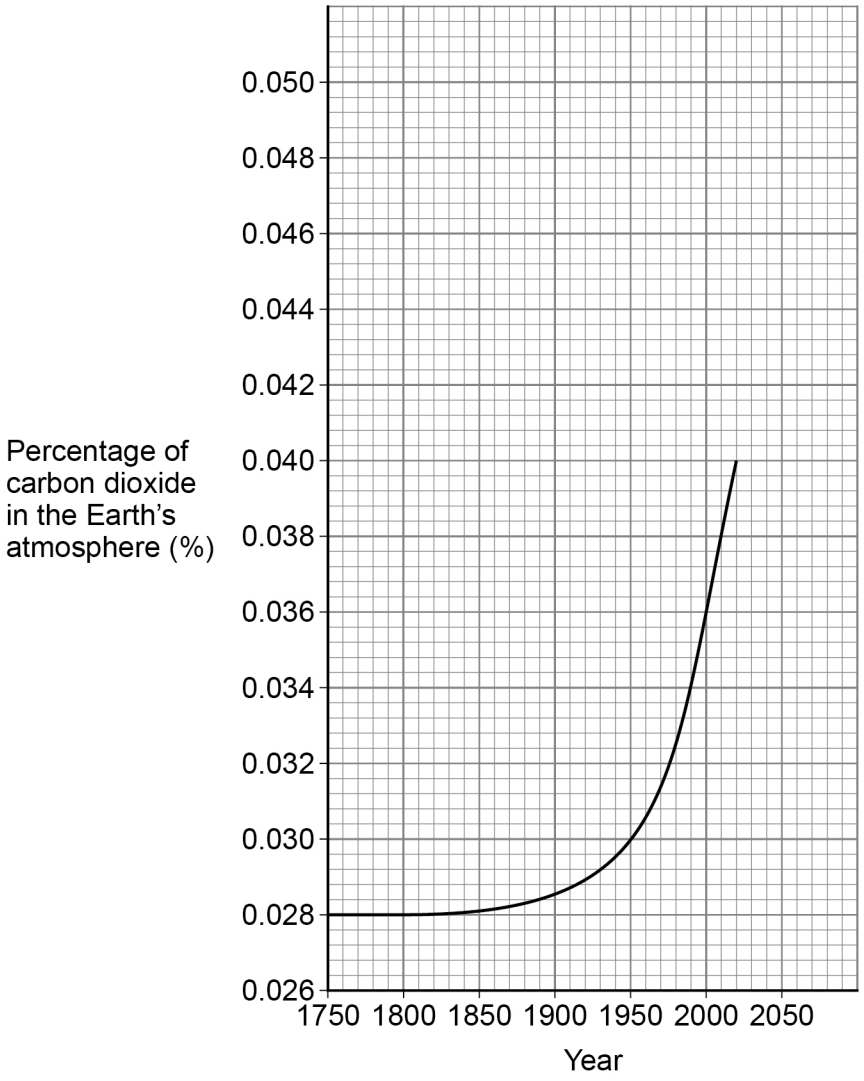
_____

Question 3 continues on the next page

Carbon dioxide is a greenhouse gas.

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

Figure 3



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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]

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 _____

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]

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

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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]

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 ☐

Do not write outside the box

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**
	Algae
Nitrogen	Animals
	Fossils
Oxygen	Oceans
	Volcanoes

Question 4 continues on the next page

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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]

Do not write outside the box

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]

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

9

Turn over for the next question

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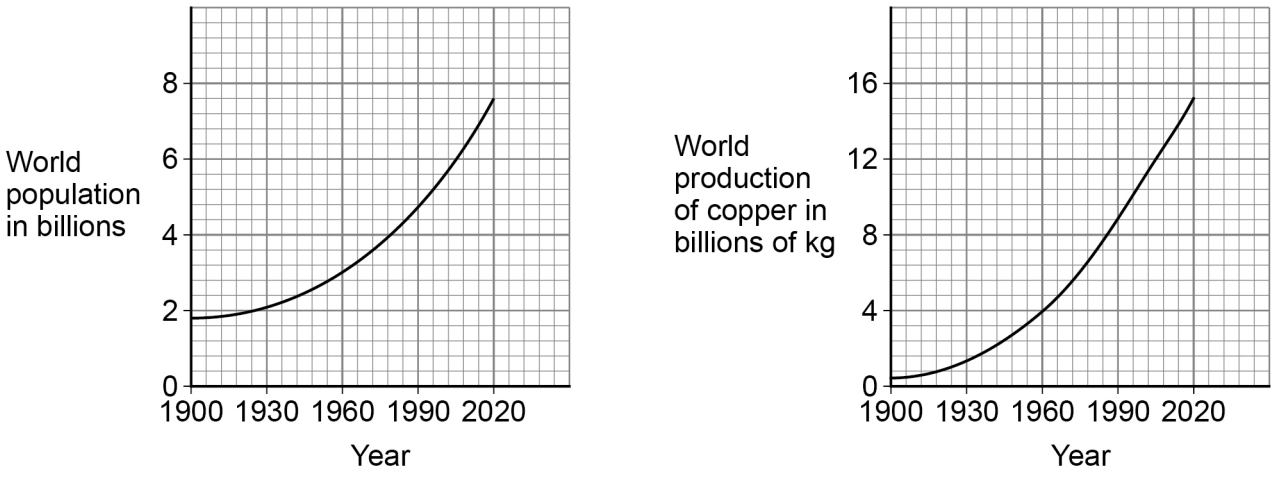
0 5 Industries use the Earth's resources to produce useful products.

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. ☐

Do not write outside the box

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]

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]

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]

Mass of copper = _____ g

Turn over ►

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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**
	Extraction
Scrap steel is added to iron from a blast furnace	Quarrying
	Reacting
A glass bottle is refilled	Recycling
	Reusing

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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** ☐

10

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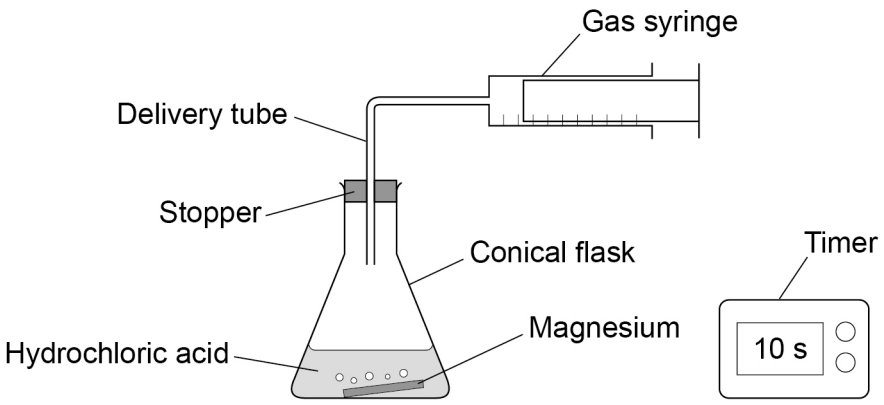
0 6 A student investigated the reaction between magnesium and excess hydrochloric acid.

Figure 5 shows the apparatus.

Figure 5



This is the method used.

1. Pour 50 cm^3 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

Do not write outside the box

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

Table 3

Time in seconds	0	20	40	60	80	100	120
Volume of gas in cm^3	0	48	72	90	97	98	98

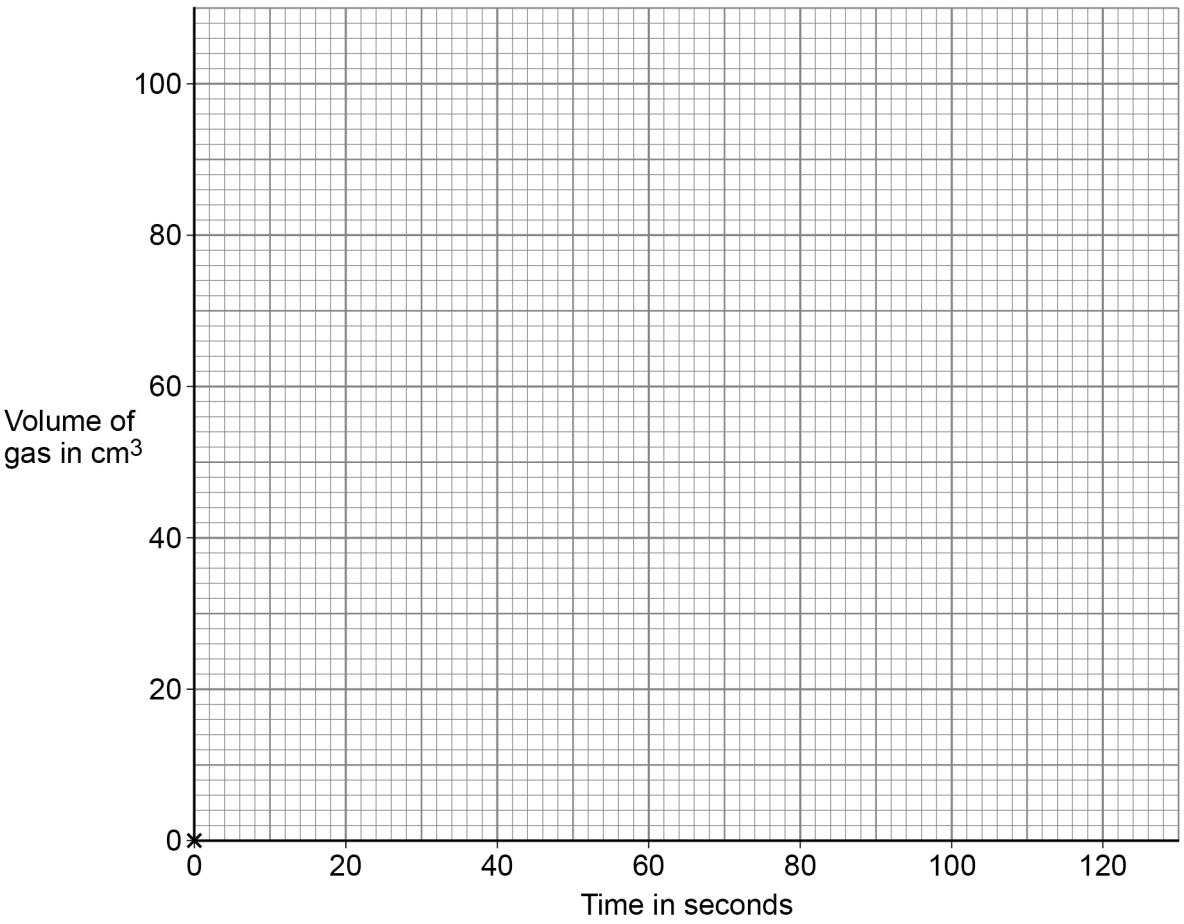
0 6 . 2 Complete **Figure 6**.

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



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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

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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]

10

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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]

_____

Question 7 continues on the next page

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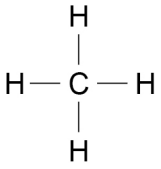
0 7 . 3 **Figure 7** shows two alkane molecules.

Figure 7

Methane



Hexane

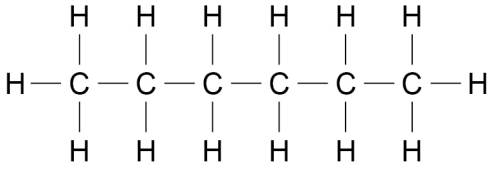


Table 4 shows the melting points and boiling points of methane and hexane.

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]

$$C_{10}H_{22} \rightarrow \_\_\_\_\_ + C_2H_4$$

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 _____

_____

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END OF QUESTIONS

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