



Please write clearly in block capitals.

Centre number

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Candidate number

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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.

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.

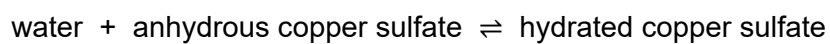
For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

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]

0 1 . 2

Complete the sentences.

Choose answers from the box.

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

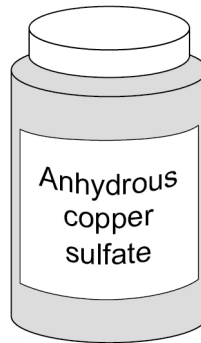
The colour of anhydrous copper sulfate is _____.

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]

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

Element

Water

Hydrocarbon

Mixture

0 1 . 5 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 . 6 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 . 7 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

10

Turn over ►



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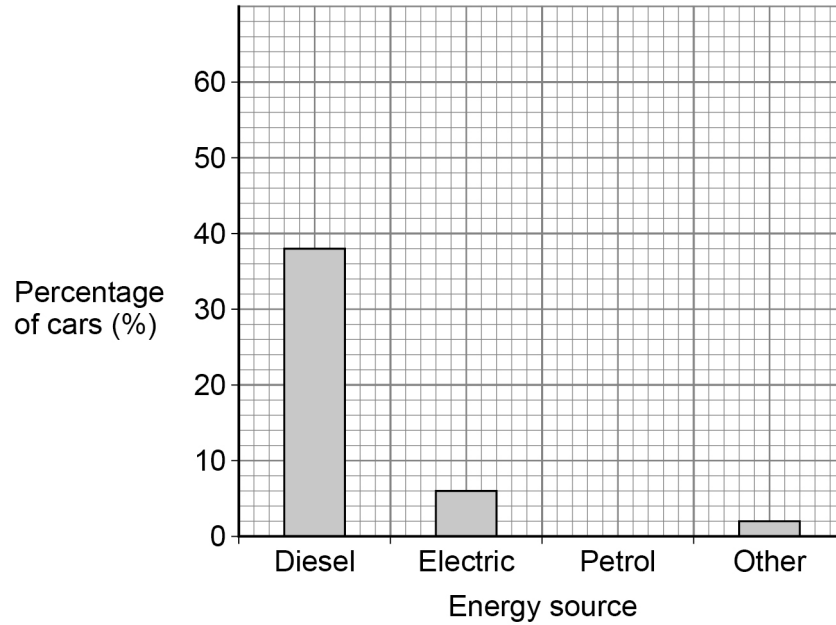
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ANSWER IN THE SPACES PROVIDED**

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 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]

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**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

Turn over for the next question

Turn over ►



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3.1 This question is about mixtures.

Which substance is a mixture?

Tick (✓) **one** box.

Air Gold Methane Nitrogen

(1)

3.2 Food colourings are often mixtures of dyes.

What name is given to mixtures that are designed as useful products?

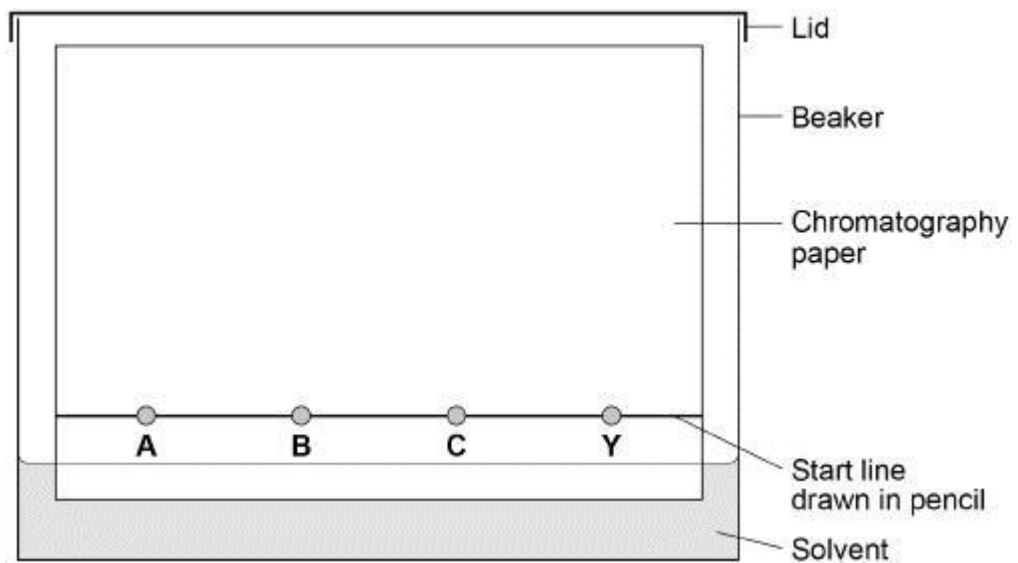
(1)

A student investigated a purple food colouring, **Y**, using chromatography.

The student compares **Y** with dyes **A**, **B** and **C**.

3.3 **Figure 1** shows the apparatus used.

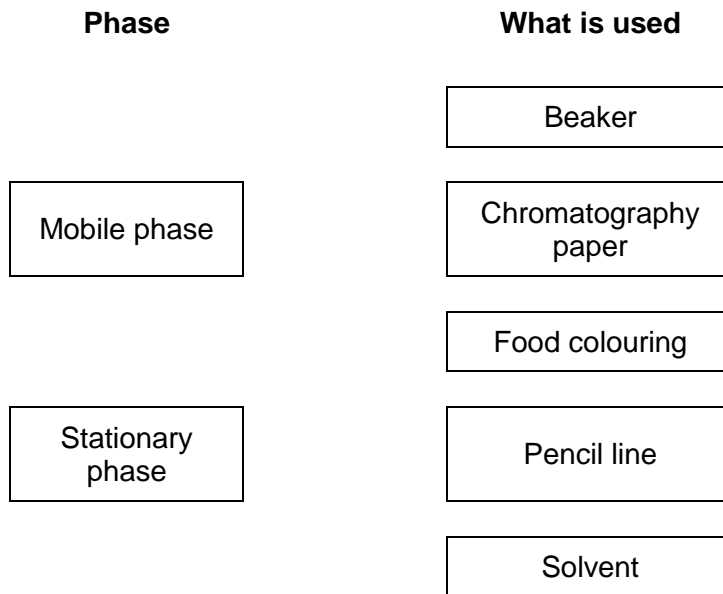
Figure 1



Chromatography involves a stationary phase and a mobile phase.

Draw **one** line from each phase to what is used for that phase.

Use **Figure 1**.



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(2)

Figure 2 shows the student's results.

Figure 2



3.4 What **three** conclusions can you make about the dyes in food colouring **Y**?

1. _____
2. _____
3. _____

(3)

3.5 In a different experiment a student recorded these results:

Distance moved by dye **G** = 60 mm

Distance moved by solvent = 8 cm

Calculate the R_f value of dye **G**.

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

$R_f =$ _____

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(3)

10

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

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]

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

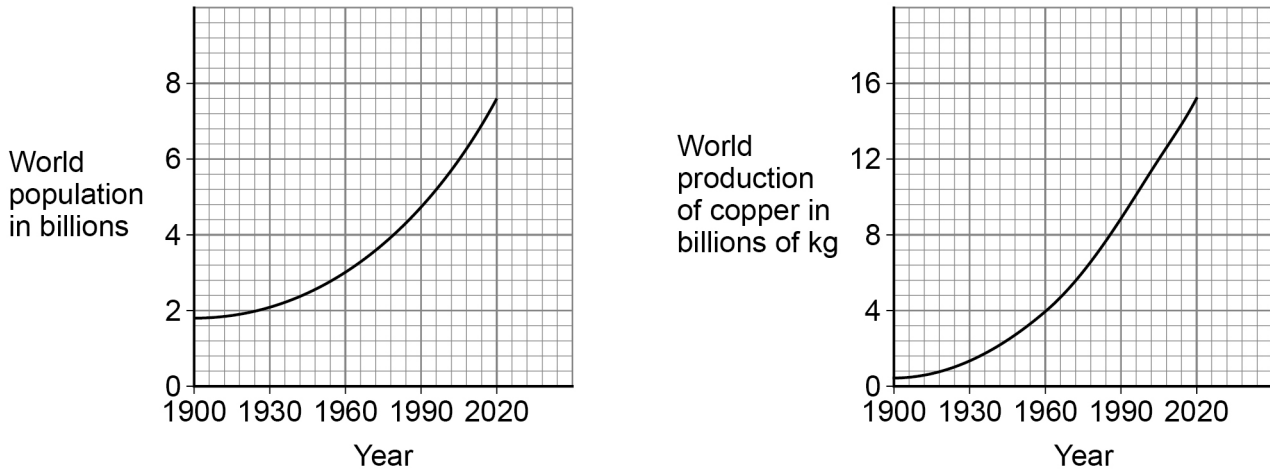
Turn over ►



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]

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 ►



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

10

Turn over for the next question

Turn over ►



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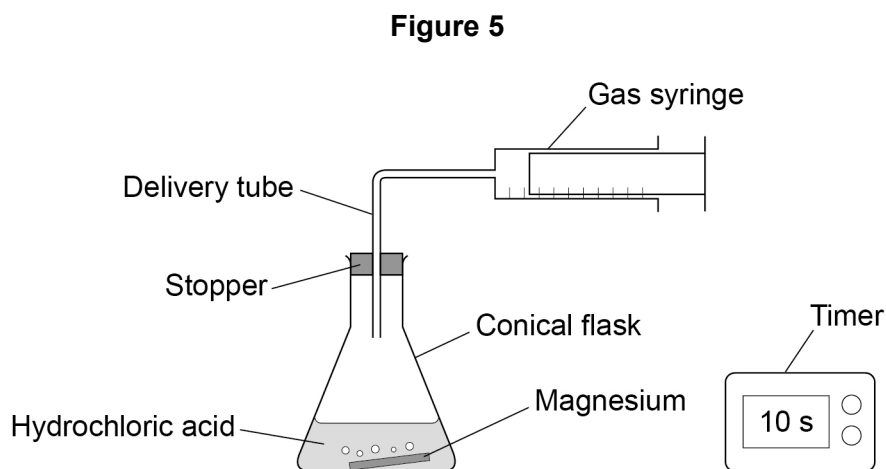
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0 6

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

Figure 5 shows the apparatus.



This is the method used.

1. Pour 50 cm³ 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

Time in seconds	0	20	40	60	80	100	120
Volume of gas in cm³	0	48	72	90	97	98	98

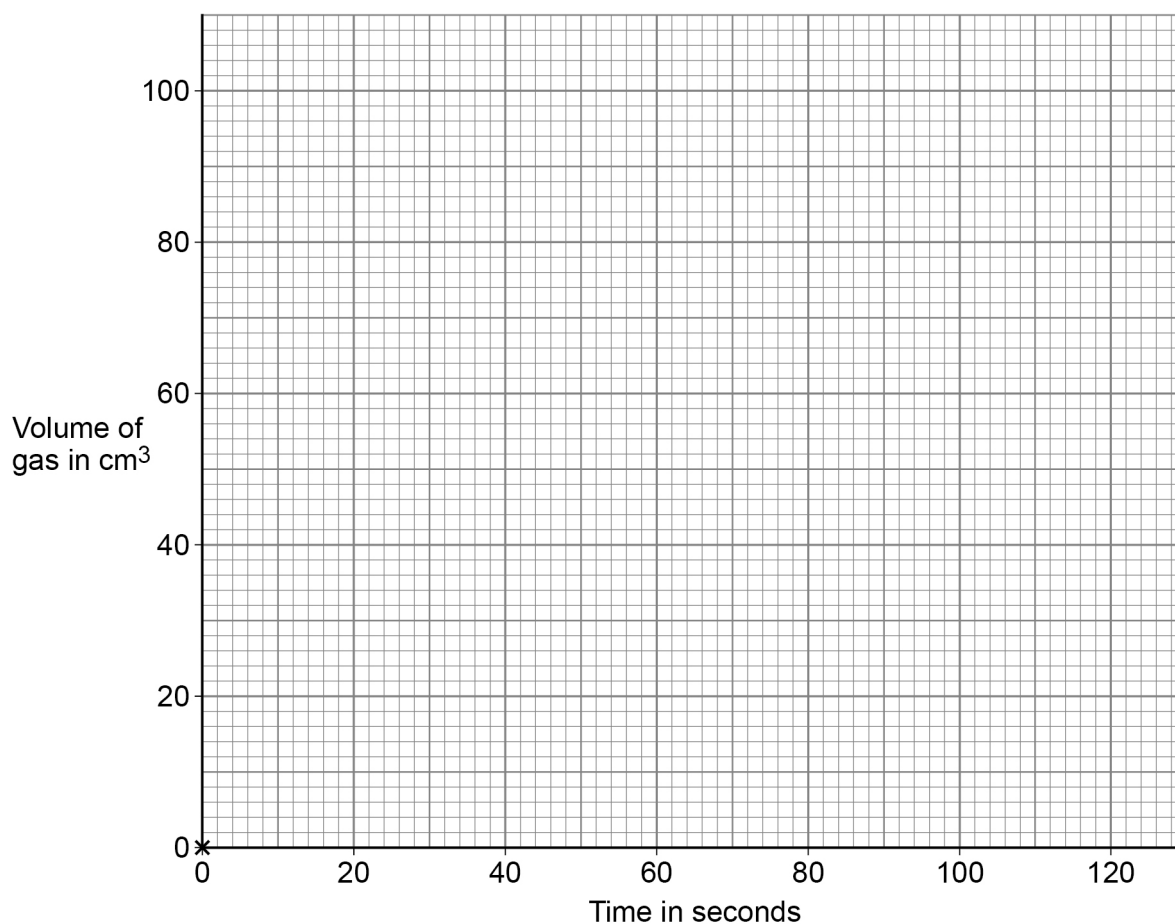
0 6 . 2 Complete **Figure 6**.

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]

10

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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