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

Tuesday 11 June 2024 Morning 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 The Earth's atmosphere has changed during the last 4.6 billion years.

0 1 . 1 What is the approximate percentage of nitrogen and of oxygen in the Earth's atmosphere today?

Draw **one** line from each gas to the percentage of that gas.

[2 marks]

Gas	Percentage (%) of gas
Nitrogen	20
	40
Oxygen	60
	80

0 1 . 2 The approximate percentage of carbon dioxide in the Earth's early atmosphere was 95%.

Which are **two** reasons why the percentage of carbon dioxide has **decreased** since the Earth's early atmosphere?

[2 marks]

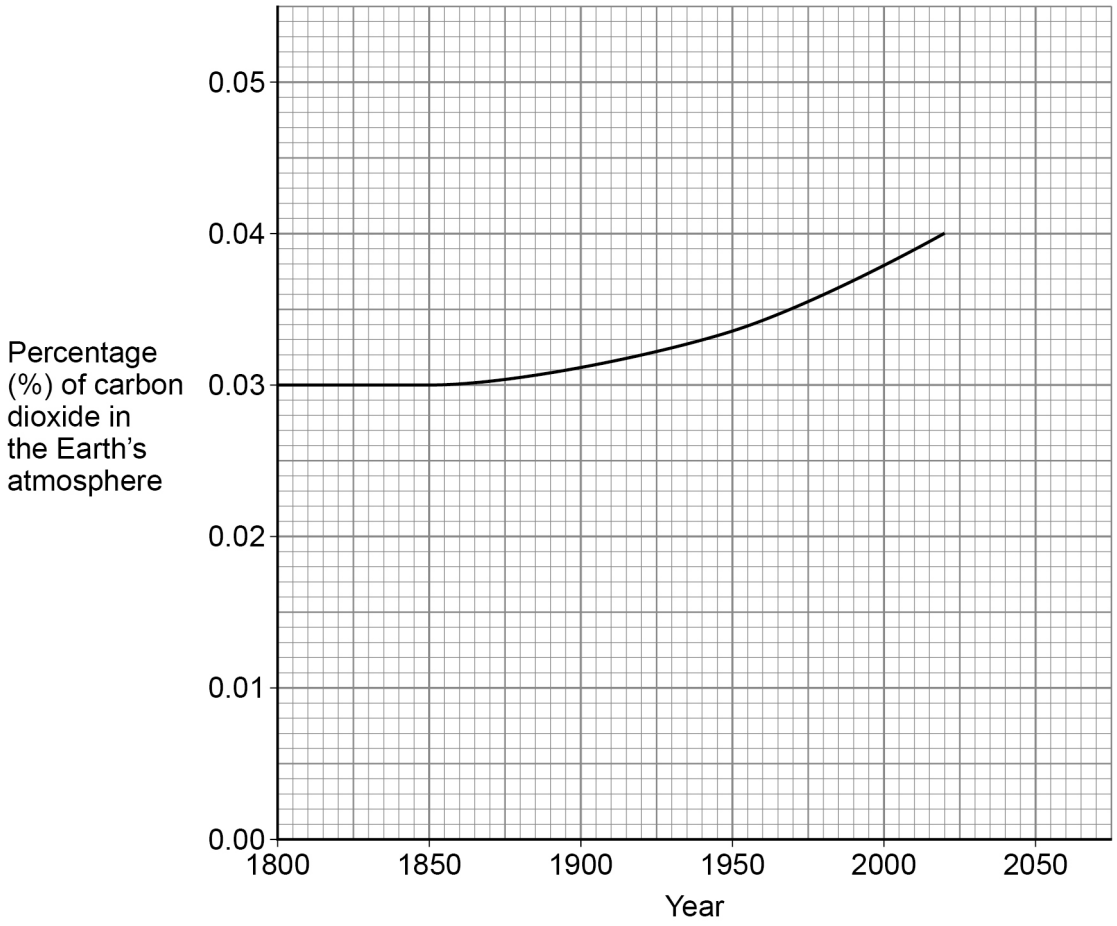
Tick (✓) **two** boxes.

- Combustion of fuels ☐
- Deforestation ☐
- Dissolving in oceans ☐
- Photosynthesis ☐
- Respiration ☐

Do not write outside the box

0 1 . 3 **Figure 1** shows the change in the percentage of carbon dioxide in the Earth's atmosphere from 1800 to 2020.

Figure 1



Describe the trend in the percentage of carbon dioxide in the Earth's atmosphere from 1800 to 2020.

Use data from **Figure 1**.

[3 marks]

Do not write outside the box

Carbon dioxide is a greenhouse gas.

0 1 . 4 Which of the following is also a greenhouse gas?

[1 mark]

Tick (✓) **one** box.

Argon ☐

Methane ☐

Nitrogen ☐

Oxygen ☐

0 1 . 5 Which of the following is an environmental problem caused by greenhouse gases?

[1 mark]

Tick (✓) **one** box.

Acid rain ☐

Climate change ☐

Global dimming ☐

Do not write outside the box

0 1 . 6 Calculate the relative formula mass (M_r) of carbon dioxide (CO_2).

Relative atomic masses (A_r): C = 12 O = 16

[2 marks]

Relative formula mass of carbon dioxide = _____

11

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 2 Different tests can be used to identify chemicals.

0 2 . 1 A student measured the melting points of four substances.

Table 1 shows the results.

Table 1

Substance	Melting point in °C
A	52 to 54
B	61
C	–2 to 0
D	80 to 82

Which substance was pure?

Give **one** reason for your answer.

[2 marks]

Substance _____

Reason _____

_____

Question 2 continues on the next page

Do not write outside the box

Anhydrous copper sulfate can be used to test for water.

The word equation for the reaction is:

anhydrous copper sulfate + water ⇌ hydrated copper sulfate

0 2 . 2 Complete the sentence.

Choose answers from the box.

[2 marks]

blue	**green**	**red**	**white**	**yellow**

When water is added to anhydrous copper sulfate, the colour changes

from _____ to _____.

0 2 . 3 The reaction between anhydrous copper sulfate and water is reversible.

How does the word equation show that the reaction is reversible?

[1 mark]

_____

Do not write outside the box

0 2 . 4 The formula of anhydrous copper sulfate is $CuSO_4$

What is the total number of atoms in the formula $CuSO_4$?

[1 mark]

Tick (✓) **one** box.

3 ☐ 4 ☐ 6 ☐ 7 ☐

0 2 . 5 Chlorine is a gas.

Describe the test for chlorine.

Give the result.

[2 marks]

Test _____

_____

Result _____

_____

8

Turn over for the next question

Do not write outside the box

0 3 Printer ink is a mixture of chemicals.

0 3 . 1 What is the name given to a mixture that has been designed as a useful product?

[1 mark]

Tick (✓) **one** box.

Formula ☐

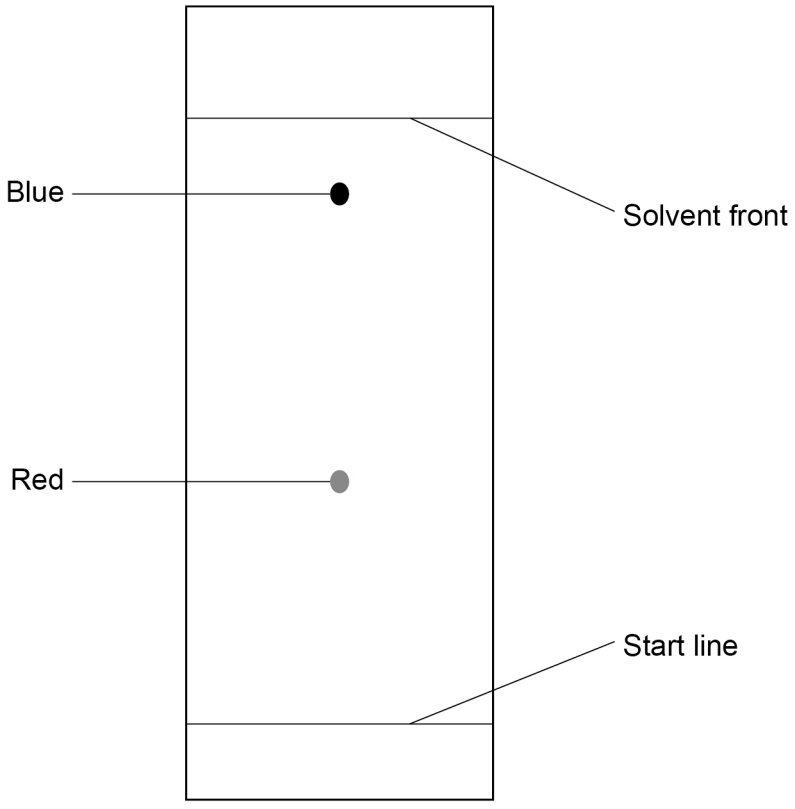
Formulation ☐

Fraction ☐

A student used chromatography to investigate the colours in a printer ink.

Figure 2 shows the chromatogram.

Figure 2



Do not write outside the box

0 3 . 2 The student used a ruler for the start line.

What would the student have used to draw the start line?

Give **one** reason for your answer.

[2 marks]

_____

Reason _____

_____

0 3 . 3 Determine the R_f value of the **red** colour.

Use the equation:

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

[4 marks]

Distance moved by red colour _____

Distance moved by solvent _____

_____

_____

_____

R_f = _____

Question 3 continues on the next page

Do not write outside the box

0 3 . 4 **Table 2** shows the R_f values of four blue colours.

Table 2

Blue colour	**R_f**
Cerulean	0.40
Cobalt	0.15
Prussian	0.88
Ultramarine	0.68

The student determined that the R_f value of the blue colour in the printer ink was 0.86

Suggest which blue colour was used in the printer ink.

Give **one** reason for your answer.

[2 marks]

Blue colour _____

Reason _____

_____

9

Do not write outside the box

0 4 Tap water must be safe to drink.

0 4 . 1 What name is given to water that is safe to drink?

[1 mark]

Tick (✓) **one** box.

Ground water ☐

Potable water ☐

Waste water ☐

0 4 . 2 Water is sterilised to make the water safe to drink.

Which **two** of the following are used to sterilise drinking water?

[2 marks]

Tick (✓) **two** boxes.

Carbon dioxide ☐

Electrolysis ☐

Filtration ☐

Ozone ☐

Ultraviolet light ☐

Question 4 continues on the next page

Do not write outside the box

A student investigated the mass of dissolved solids in samples of river water, sea water and tap water.

This is the method used.

1. Weigh an evaporating basin.

2. Measure 100 cm^3 of river water.

3. Pour the river water into the evaporating basin.

4. Heat the evaporating basin until all the water has evaporated.

5. Weigh the evaporating basin and dissolved solids.

6. Calculate the mass of dissolved solids in the water.

7. Repeat steps 1 to 6 with sea water and then with tap water.

0 4 . 3 Which is the most suitable equipment to measure 100 cm^3 of water?

[1 mark]

Tick (✓) **one** box.

Beaker ☐

Conical flask ☐

Measuring cylinder ☐

Do not write outside the box

0 4 . 4 **Table 3** shows the results.

Table 3

Type of water	Mass in grams		
	Evaporating basin	**Evaporating basin and dissolved solids**	**Dissolved solids**
River	112.1	113.1	1.0
Sea	110.5	114.0	**X**
Tap	115.3	115.4	0.1

Calculate value **X** in **Table 3**.

[1 mark]

X = _____ g

0 4 . 5 Identify the variables used in the investigation.

Draw **one** line from each variable to the example of the variable.

[2 marks]

Variable	**Example of variable**
	Mass of dissolved solids
	Mass of evaporating basin
Control	Room temperature
Dependent	Type of water
	Volume of water

Turn over ►

Do not write outside the box

Table 4 shows the mass of different types of ions dissolved in 1 dm^3 of sea water.

Table 4

Type of ion	**Mass of type of ion dissolved in 1 dm^3 of sea water in grams**
Calcium	0.4
Magnesium	1.3
Sulfate	2.7

Do not write outside the box

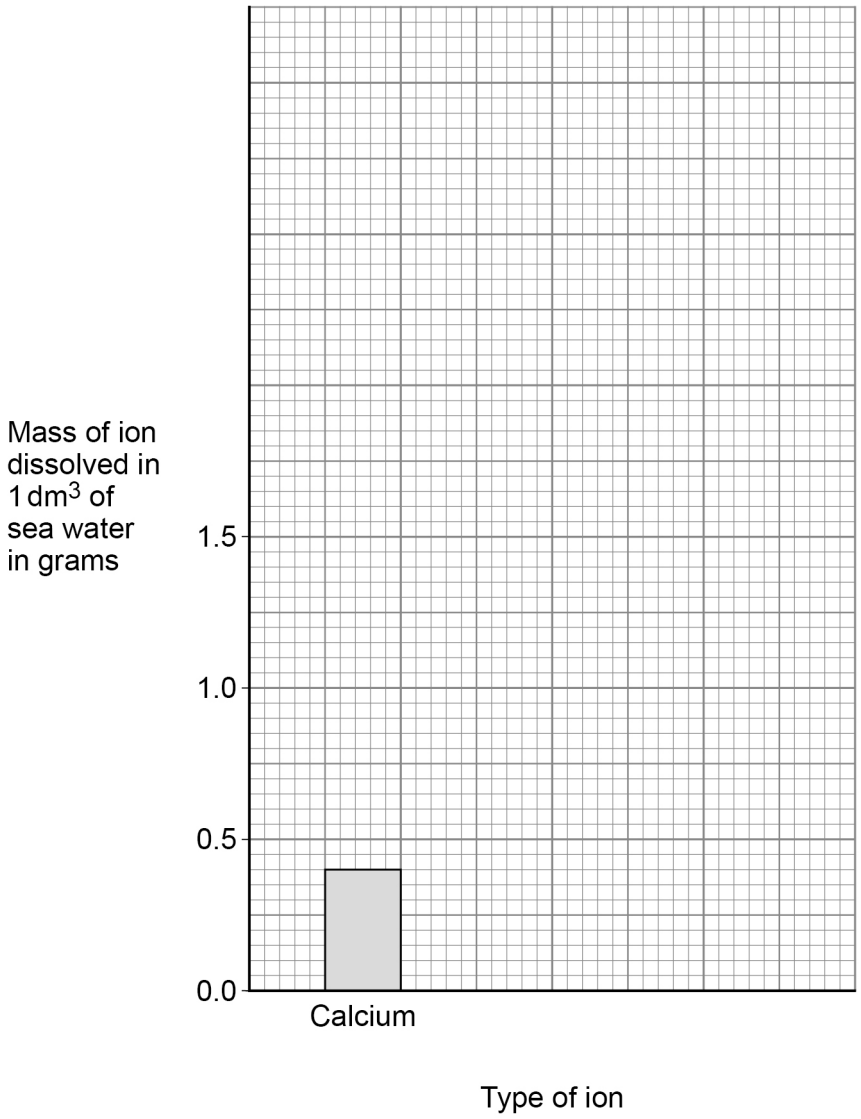
0 4 . 6 Complete **Figure 3**.

You should:

- complete the scale for the *y*-axis
- plot the data from **Table 4** as a bar chart.

[3 marks]

Figure 3



10

Turn over for the next question

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0 5 Life cycle assessments (LCAs) are used to assess the environmental impact of different products.

0 5 . 1 212 million kilograms of aluminium is used for packaging in the UK each year.

68.0% of aluminium packaging is recycled.

Calculate the mass of aluminium packaging that is recycled in the UK each year.

[2 marks]

Mass of aluminium recycled = _____ million kg

Do not write outside the box

0 5 . 2 Drinks cans are made from aluminium.

An aluminium can has a mass of 15.8 g.

1000 g = 1 kg

Calculate the **whole number** of aluminium cans that can be made from 4.00 kg of aluminium.

[4 marks]

Whole number of cans = _____

Question 5 continues on the next page

Do not write outside the box

0 5 . 3 **Table 5** shows three methods used to dispose of wood and steel after use.

Table 5

	Percentage (%) of material disposed of by each method		
	As waste	**Recycled**	**Burnt**
Wood	58	36	6
Steel	15	85	0

Evaluate the sustainability of the disposal of wood and steel.

[4 marks]

10

Do not write outside the box

0 6 Alkanes and alkenes are hydrocarbons.

0 6 . 1 Define the term 'hydrocarbon'.

[1 mark]

0 6 . 2 The general formula for alkanes is C_nH_{2n+2}

Determine the formula of the alkane with 10 carbon atoms.

[1 mark]

Formula = _____

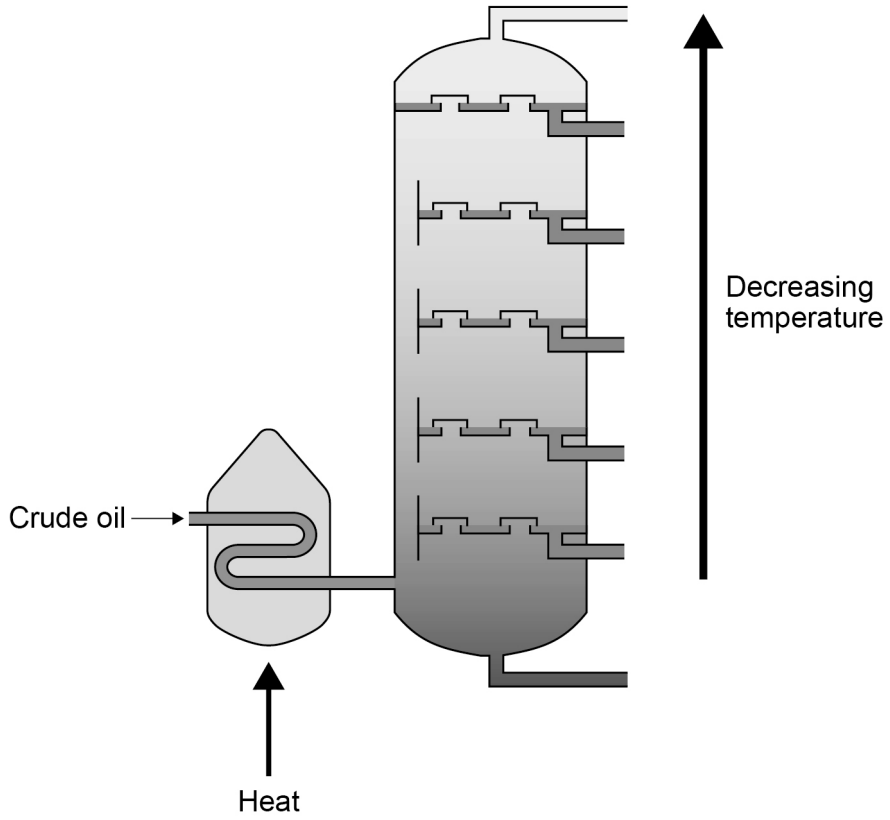
Question 6 continues on the next page

Do not write outside the box

0 6 . 3 Crude oil is a mixture of hydrocarbons.

Figure 4 represents industrial equipment used to separate crude oil into fractions.

Figure 4



Explain how crude oil is separated into fractions.

Use **Figure 4**.

[4 marks]

Do not write outside the box

0 6 . 4 The alkane molecule $C_{14}H_{30}$ can be cracked to produce smaller molecules.

Balance the equation for the reaction.

[1 mark]

$$C_{14}H_{30} \rightarrow C_8H_{18} + ____ C_3H_6$$

Question 6 continues on the next page

Do not write outside the box

Propene (C_3H_6) is an alkene.

0 6 . 5 Describe the test for alkenes.

Give the result.

[2 marks]

Test _____

_____

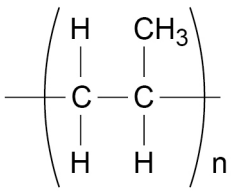
Result _____

_____

0 6 . 6 Poly(propene) is made from propene.

Figure 5 represents the repeating unit of poly(propene).

Figure 5



What type of substance is poly(propene)?

[1 mark]

_____

10

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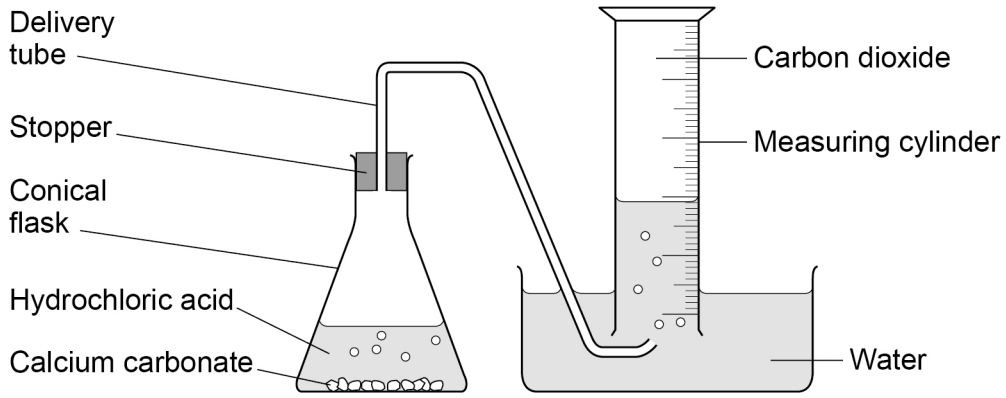
0 7 Some factors affect the rates of chemical reactions.

0 7 . 1 A student investigated the effect of changing the particle size of calcium carbonate on the rate of reaction with hydrochloric acid.

Figure 6 shows the apparatus.

Figure 6



Describe a method the student could use to produce valid results.

[6 marks]

Do not write outside the box

0 7 . 2 The student investigated the effect of increasing the temperature on the rate of a reaction.

Explain the effect of increasing the temperature on the rate of a reaction.

Refer to particles and collisions in your answer.

[3 marks]

Do not write outside the box

Catalysts affect the rate of reactions.

0 7 . 3 What is meant by a 'catalyst'?

[2 marks]

0 7 . 4 What are catalysts in biological systems called?

[1 mark]

12

END OF QUESTIONS

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