AQA Style

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier Chemistry Paper 2

Time allowed: 1 hour 15 minutes

Materials

- A ruler
- A pen and pencil
- A calculator
- Periodic Table of Elements

Instructions and Information

- Answer all the questions using a black pen.
- Answer the questions in the space available and cross out any work you do not want to be marked.
- In any calculations make sure you show your working out.
- The marks for each question are shown in brackets.
- The maximum mark for the paper is 70.
- You must make your work as neat as possible and use good English in your answers.
- You should make sure you leave time to check your answers.

Question	Mark
1	
2	
3	
4	
5	
6	
7	
Total	

Name _____

Date _____

0 1 Medicines are designed to treat symptoms or cure illness.

Most medicines contain an active ingredient along with other compounds. The active ingredient is the substance that has the desired effect in the body.

Medicines are formulations.

0 1 . 1 What is a formulation?

[1 mark]

Each batch of medicine must be tested to make sure it contains the correct ingredients.

Chromatography is used to compare four new batches of a medicine.

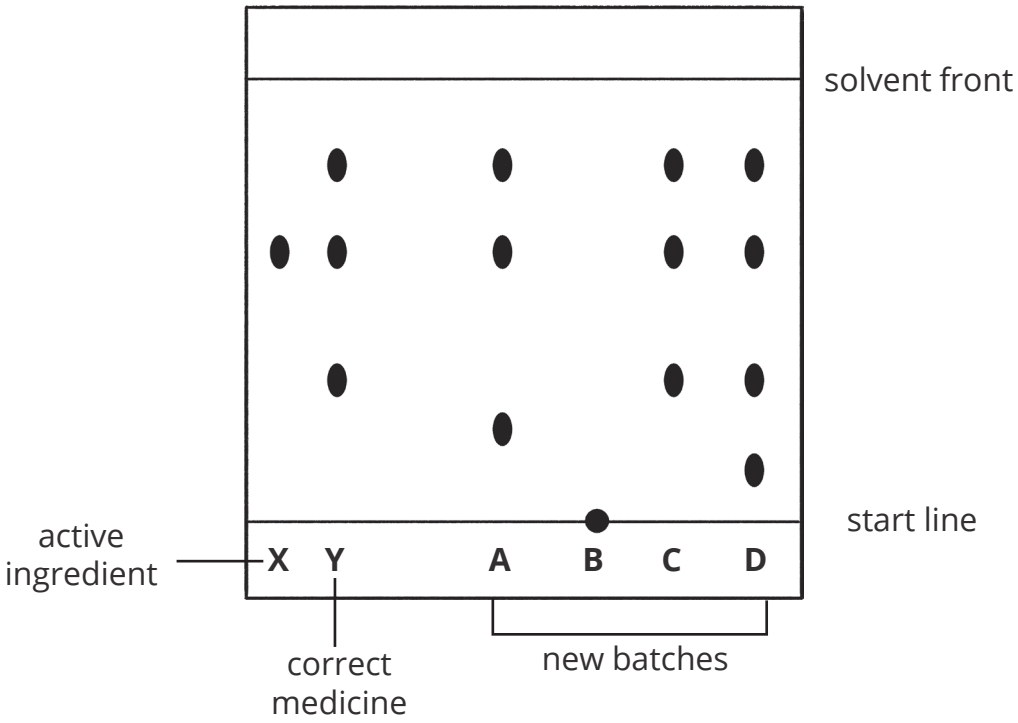
Figure 1 shows the results.

Sample **X** is the active ingredient.

Sample **Y** is the correct medicine.

Samples **A - D** are the four new batches that were tested.

Figure 1



0 1 . 2 Which of the samples in **Figure 1** is a pure substance?

Tick **one** box.

[1 mark]

C ☐

D ☐

X ☐

Y ☐

0 1 . 3 Explain whether the new batches **A, B, C** and **D** contain the correct ingredients.

[4 marks]

0 1 . 4 Explain the result for batch **B.**

[2 marks]

0 1 . 5 A scientist takes measurements for sample **X.** The results are shown in **Table 1.**

Table 1

	Distance (mm)
Distance Moved by Sample X	8
Distance Moved by the Solvent	40

Calculate the R_f value for sample **X.**

Use the results in **Table 1.**

[2 marks]

_____

_____

_____

R_f value = _____

10

0 2 Life cycle assessments (LCAs) are carried out to assess the environmental impacts of products in each of four stages.

0 2 . 1 Give **two** of the stages that are considered in a life cycle assessment.

[2 marks]

1. _____

_____

2. _____

_____

0 2 . 2 **Table 2** shows some information collected from life cycle assessments of shopping bags made of plastic and paper.

Table 2

Indicator of Environmental Impact (per 1000 bags)	**Plastic Bag**	**Paper Bag**
Volume of Water Used (l)	230	930
Mass of CO_2 Released (kg)	1.5	4.5
Relative Risk of the Bag Becoming Litter	1	0.2

Compare the two types of shopping bag.

Use information from **Table 2.**

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

0 2 . 3 Give **one** criticism of life cycle assessments.

[1 mark]

_____

_____

_____

7

0 3 Carbon dioxide is a greenhouse gas.

0 3 . 1 Name **one** other greenhouse gas.

[1 mark]

_____

0 3 . 2 Give **two** human activities that increase the amount of greenhouse gases in the Earth's atmosphere.

[2 marks]

1. _____

_____

2. _____

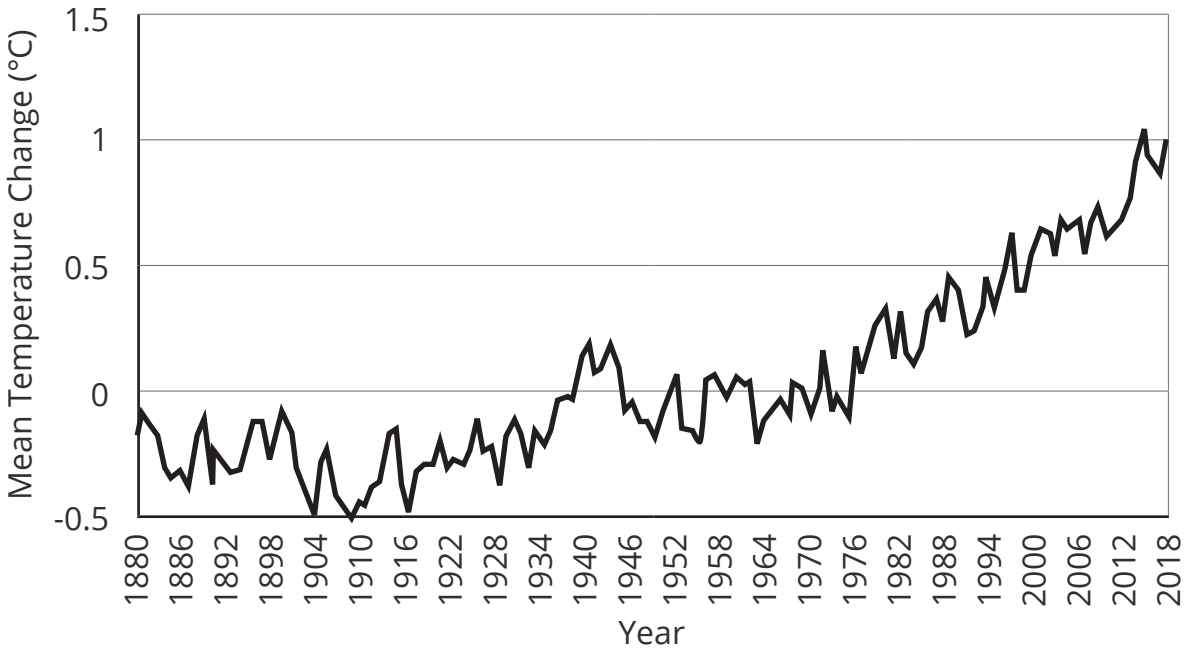
_____

Question 3 continues on the next page.

0 3 . 3 The temperature of the Earth's atmosphere is measured in different locations around the Earth. The data from these locations is verified using multiple methods and then used to calculate the mean temperature change per year.

Figure 2 shows the mean yearly temperature change over the last 140 years.

Figure 2



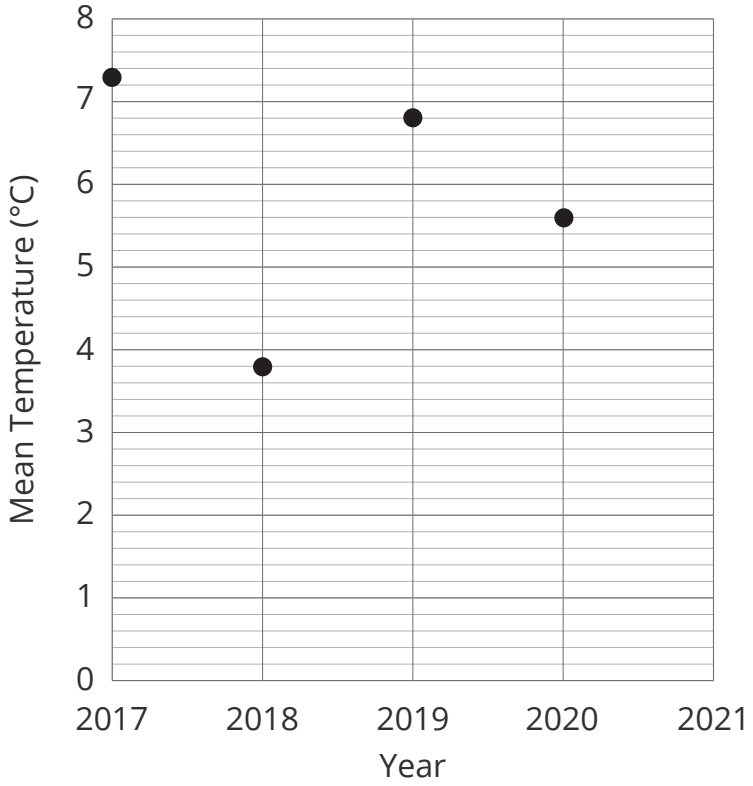
The measurements and methods used to collect the data are published in scientific journals.

Explain why it is important that the data is published in scientific journals.

[2 marks]

0 3 . 4 A person measured the temperature in their garden each day in March and calculated the mean temperature for the whole month. They did this each March for four years. Their results are shown in **Figure 3.**

Figure 3



The person compared their data with the data in **Figure 2.**

The person stated: 'The data shows that the temperature of the Earth's atmosphere is decreasing.'

Evaluate the person's statement.

You should refer to **Figure 2** and **Figure 3** in your answer.

[6 marks]

11

0 4 Propane (C_3H_8) burns in oxygen.

0 4 . 1 Describe the test for oxygen.

You should include the result you would expect to see.

[2 marks]

0 4 . 2 Balance the symbol equation for the complete combustion of propane.

[1 mark]

$$C_3H_8 + \_\_\_\_\_\ O_2 \longrightarrow 3CO_2 + \_\_\_\_\_\ H_2O$$

0 4 . 3 Calculate the percentage by mass of carbon in propane (C_3H_8).

Give your answer to 3 significant figures.

Relative atomic masses (A_r): H = 1, C = 12

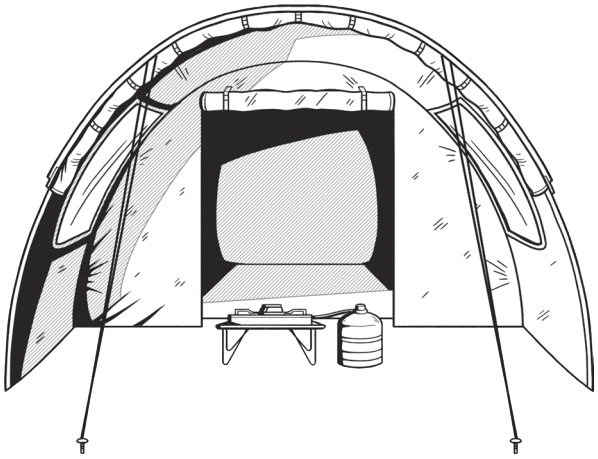
Relative formula mass (M_r): C_3H_8 = 44

[3 marks]

percentage by mass of carbon = _____ %

0 4 . 4 Propane canisters are used to fuel camping stoves. Camping stoves are often set up in a tent porch as shown in **Figure 4**.

Figure 4



If the camping stove was set up inside the tent there would be less air available to the stove.

Explain why the stove should **not** be set up inside the tent.

[4 marks]

10

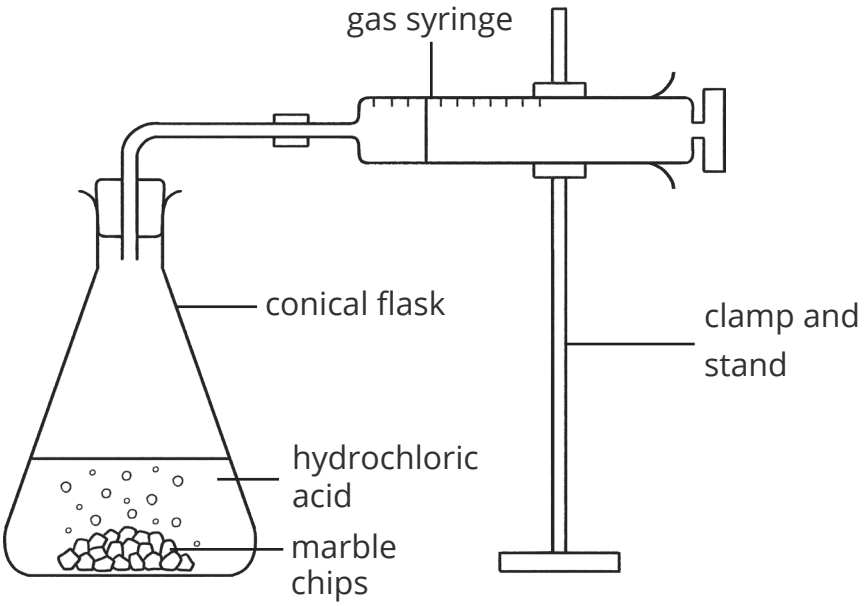
0 5 A student investigated the effect of the concentration of acid on the rate of the reaction between marble chips and hydrochloric acid.

They used the following method:

1. Pour 50cm^3 of hydrochloric acid into a conical flask.
2. Add 10g of marble chips to the conical flask.
3. Connect a gas syringe to the conical flask.
4. Record the volume of gas produced every 20 seconds.
5. Repeat steps 1 to 4 with different concentrations of acid.

A diagram of the equipment is shown in **Figure 5**.

Figure 5



0 5 . 1 Give **two** control variables in this investigation.

[2 marks]

1. _____

_____

2. _____

_____

0 5 . 2 Give **one** source of error in this investigation.

[1 mark]

_____

_____

0 5 . 3 **Table 3** shows the student's results for 1mol/dm^3 hydrochloric acid.

Table 3

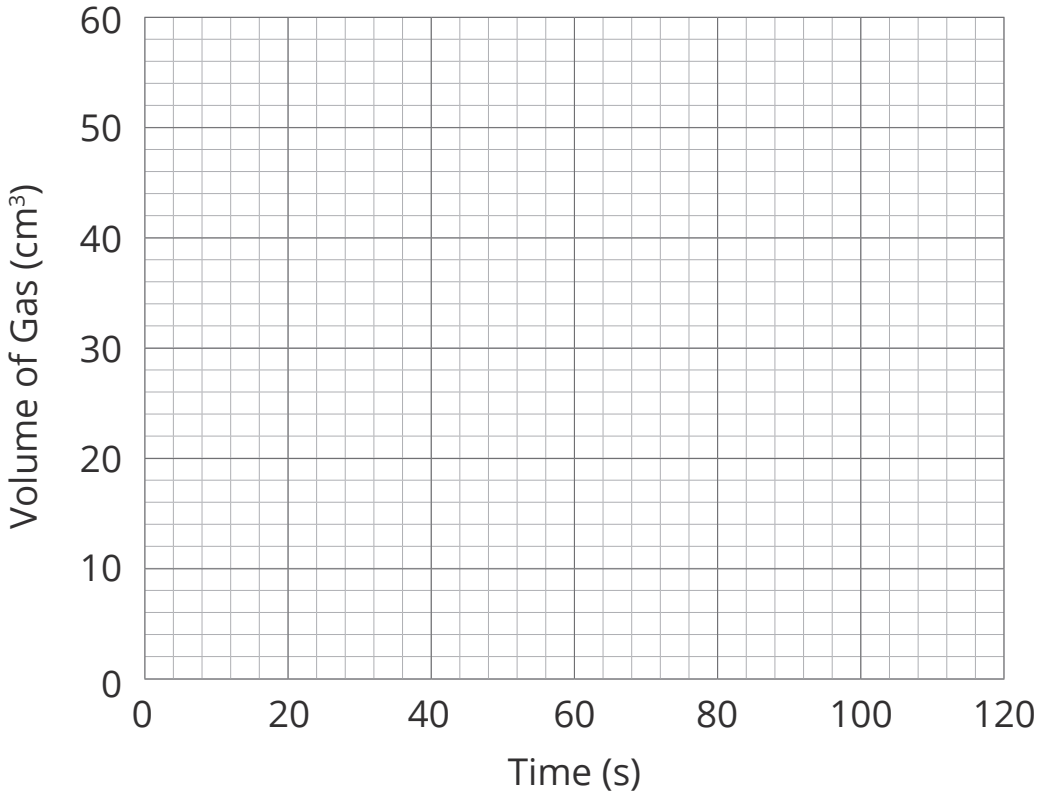
Time (s)	Volume of Gas Produced (cm^3)
0	0
20	15
40	30
60	35
80	50
100	52
120	52

Plot the data from **Table 3** on **Figure 6**.

Draw a line of best fit, ignoring any anomalous results.

[3 marks]

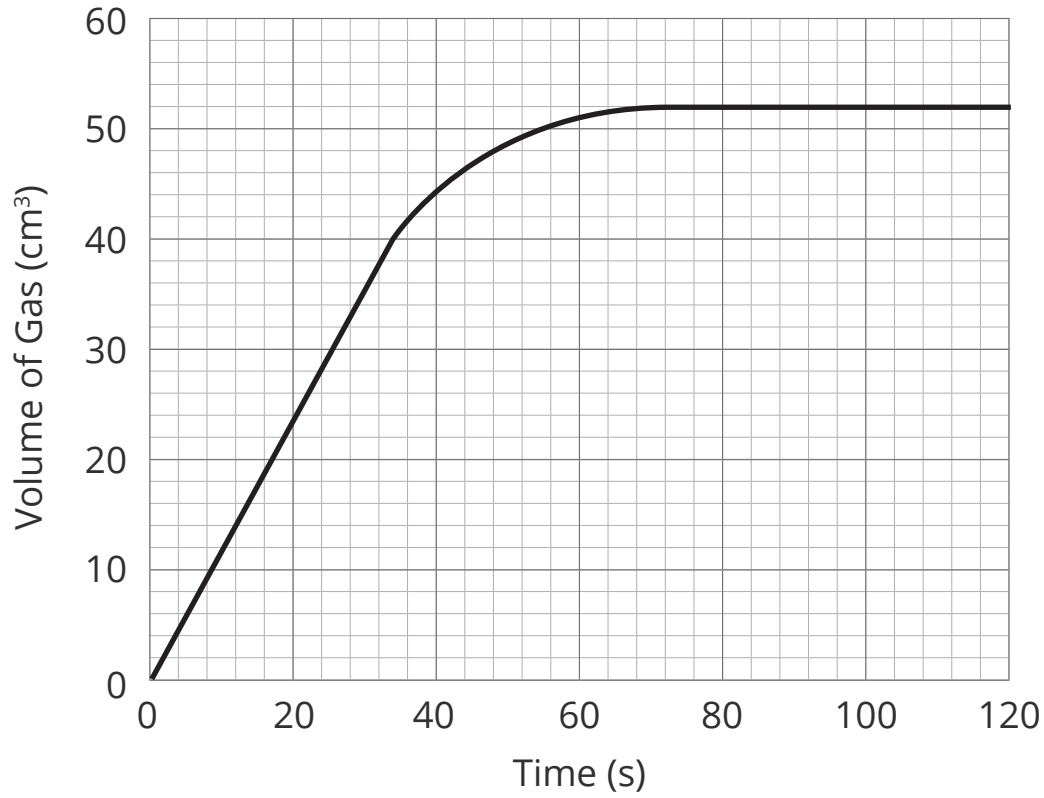
Figure 6



0 5 . 4 The student repeated the investigation using 1.5mol/dm^3 hydrochloric acid.

Figure 7 shows a graph of their results.

Figure 7



Describe how the rate of the reaction changes over time.

[3 marks]

0 5 . 5 Calculate the rate of the reaction at 40 seconds.

Give the unit.

[4 marks]

rate of reaction = _____ unit _____

13

0 6 Biological methods are being introduced for extracting copper.

0 6 . 1 Give **two** reasons why biological methods are used for copper extraction.

[2 marks]

1. _____

_____

2. _____

_____

0 6 . 2 Biological methods of copper extraction produce compounds such as copper sulfate.

Explain why copper can be extracted from copper sulfate solution by adding iron.

[2 marks]

_____

_____

_____

_____

0 6 . 3 A solution of copper sulfate ($CuSO_4$) has a concentration of 0.957g/dm^3.

Relative atomic masses (A_r): Cu = 63.5, O = 16, S = 32

Calculate the number of moles of copper than can be produced from 1dm^3 of the solution.

[3 marks]

_____

_____

_____

_____

_____

number of moles = _____ mol

0 6 . 4 When anhydrous copper sulfate (white) reacts with water it forms hydrated copper sulfate (blue).

The equation for the reaction is:

anhydrous copper sulfate + water $\rightleftharpoons$ hydrated copper sulfate

The forward reaction is exothermic.

Predict the effect of increasing the temperature on the amount of hydrated copper sulfate produced at equilibrium.

Explain your answer using Le Chatelier's principle.

[2 marks]

9

0 7 Banded iron formations are sedimentary rocks that contain layers of iron oxide, Fe_3O_4 or Fe_2O_3.

The equations for the reactions that form these sediments are:

$$4Fe_3 + 2O_2 \longrightarrow 2Fe_2O_3$$

$$6Fe_2 + 4O_2 \longrightarrow 2Fe_3O_4$$

0 7 . 1 Explain why there are no banded iron formations older than 2.7 billion years old.

[2 marks]

0 7 . 2 Limestone is another type of sedimentary rock.

A source rock is a rock with a high concentration of organic material that can be transformed into crude oil at high temperatures.

Explain why limestone is a good source rock for crude oil.

[1 mark]

0 7 . 3 Most of the hydrocarbons in crude oil are alkanes.

Write down the general formula for an alkane.

[1 mark]

0 7 . 4 Hydrocarbon fuels such as petrol and kerosene are produced from crude oil.

Crude oil is separated into fractions by fractional distillation.

Explain why petrol is collected at a higher level of the fractionating column than kerosene.

[4 marks]

0 7 . 5 **Table 4** shows some information about petrol and kerosene.

Table 4

	Percentage in Crude Oil (%)	**Percentage Demand (%)**
Petrol	9	23
Kerosene	14	8

Suggest how the demand for petrol can be met.

[2 marks]

10

END OF QUESTIONS