AQA Style

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation 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	
8	
Total	

Name _____

Date _____

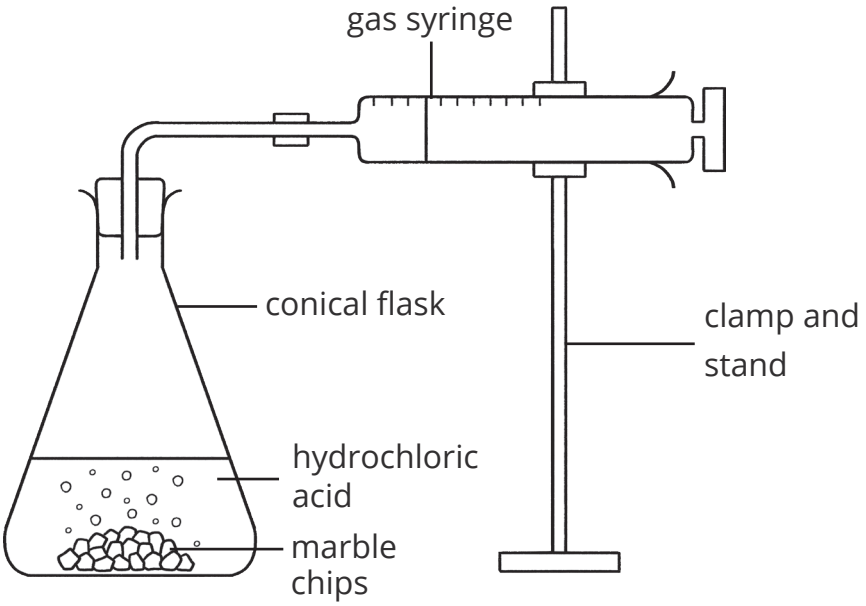
0 1 A student investigated the effect of the concentration of acid on the rate of the reaction between marble chips and hydrochloric acid.

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 30 seconds.
5. Repeat steps 1 to 4 with different concentrations of acid.

A diagram of the equipment is shown in **Figure 1**.

Figure 1



0 1 . 1 Draw **one** line from each type of variable to the correct example of the variable.

[2 marks]

Type of Variable	Example of Variable
control	The concentration of the acid.
dependent	The volume of gas produced.
	The volume of the acid.

0 1 . 2 $30cm^3$ of gas was produced in the first 40 seconds of the reaction.

Calculate the mean rate of reaction in the first 40 seconds.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{volume of gas produced in } cm^3}{\text{time in seconds}}$$

[2 marks]

mean rate of reaction = _____

0 1 . 3 What is the unit for the mean rate of the reaction calculated in **01.2**?

Tick **one** box.

[1 mark]

- cm^3 ☐
- g/s ☐
- cm^3/s ☐
- s/cm^3 ☐

Question 1 continues on the next page.

0 1 . 4 **Table 1** shows the student's results.

Table 1

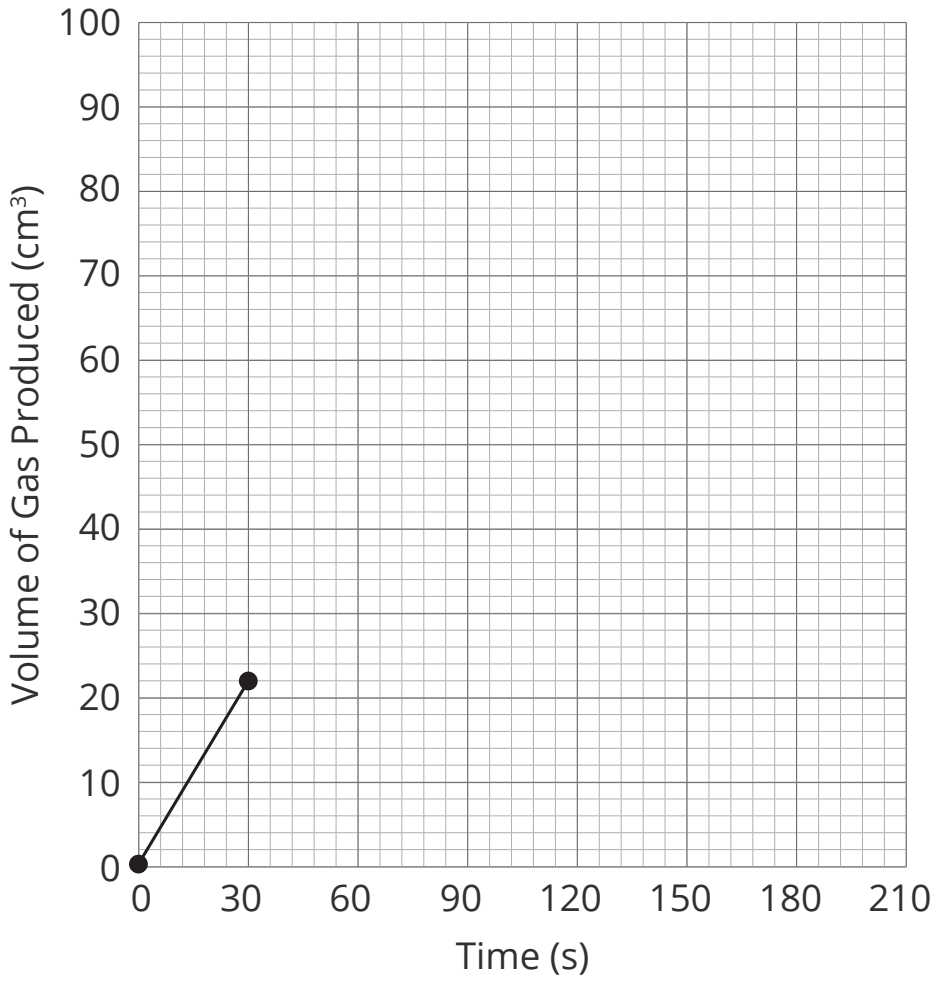
Time (s)	Volume of Gas Produced (cm^3)
0	0
30	22
60	44
90	66
120	80
150	74
180	94
210	95

The first two results have been plotted on **Figure 2**.

- Plot the rest of the data from **Table 1** on **Figure 2**.
- Draw a line of best fit, ignoring any anomalous results.

[3 marks]

Figure 2



0 1 . 5 The student repeats the investigation with a higher concentration of acid.

How does changing the concentration of acid affect the rate of the reaction?

Tick **one** box.

[1 mark]

The rate of the reaction decreases because successful collisions are less frequent. ☐

The rate of the reaction decreases because successful collisions are more frequent. ☐

The rate of the reaction increases because successful collisions are less frequent. ☐

The rate of the reaction increases because successful collisions are more frequent. ☐

9

Turn over for the next question

0 2 Most drinking water is produced from fresh water.

0 2 . 1 What do we call water that is safe to drink?

Tick **one** box.

[1 mark]

desalinated ☐

distilled ☐

filtered ☐

potable ☐

0 2 . 2 To produce water that is suitable for drinking, fresh water is filtered and then sterilised.

Draw **one** line from each step to the reason for the step.

[2 marks]

Step	Reason
	To kill microbes.
filtration	To purify the water.
sterilisation	To remove dissolved substances from the water.
	To remove solids from the water.

0 2 . 3 In the UK, chlorine is used to sterilise the water.

Draw **one** line from each substance to the correct description of the substance.

[3 marks]

Substance	Description of Substance
	atom
	compound
chlorine gas	element
pure water	hydrocarbon
salty water	lattice
	mixture

0 2 . 4 What is used in the test for chlorine?

Tick **one** box.

[1 mark]

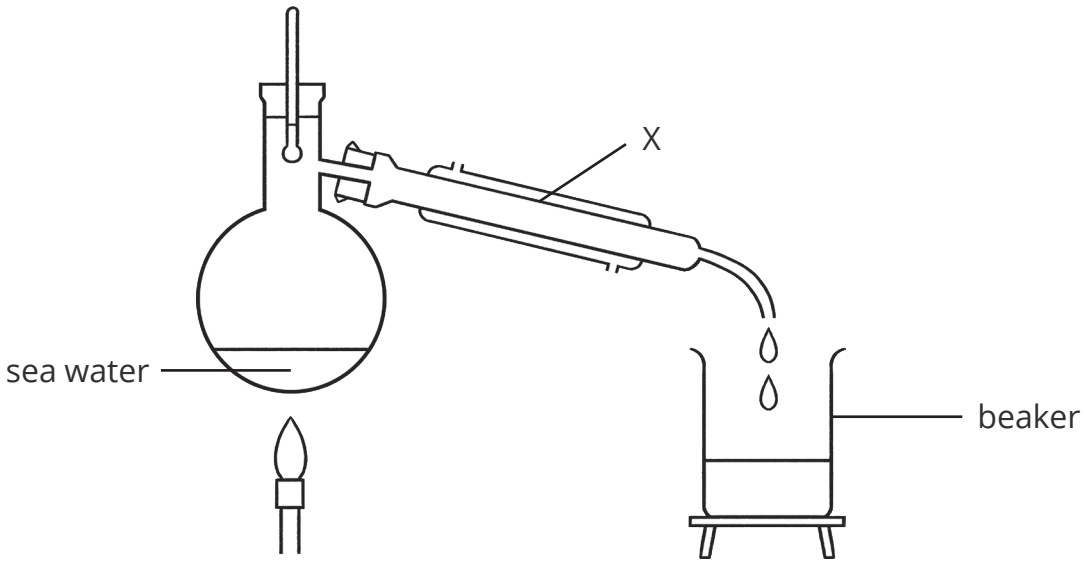
- a burning splint ☐
- a glowing splint ☐
- damp litmus paper ☐
- limewater ☐

0 2 . 5 Some countries produce drinking water from sea water instead of fresh water. Sea water is too salty to drink.

Sea water can be treated by distillation.

Figure 3 shows some equipment that can be used for the distillation of sea water.

Figure 3

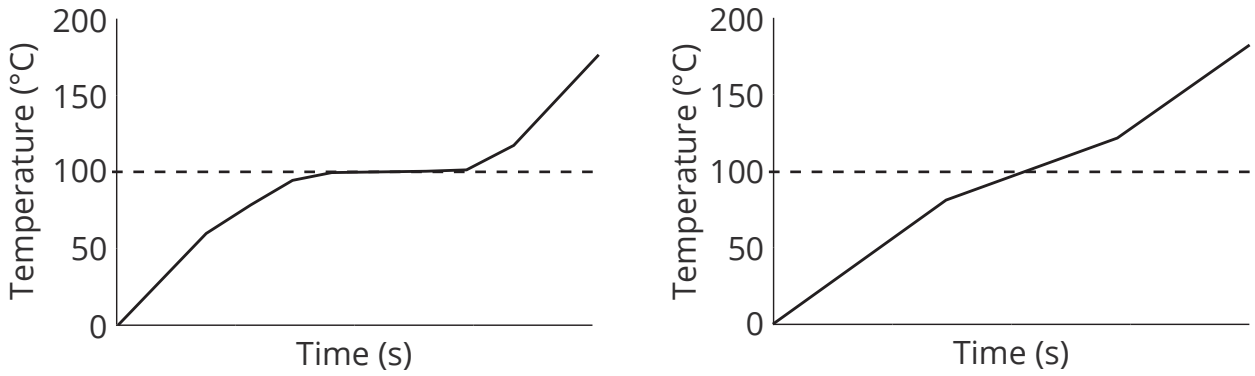


Name the change of state that takes place in part **X**.

[1 mark]

0 2 . 6 **Figure 4** shows two graphs.

Figure 4



Which graph shows the boiling point data of the water collected in the beaker in **Figure 3**?

Tick **one** box.

[1 mark]

graph A ☐

graph B ☐

9

Turn over for the next question

0 3 Carbon dioxide dissolves in water to produce carbonic acid.

The symbol equation for the reaction is:

$$CO_2 + H_2O \rightleftharpoons H_2CO_3$$

0 3 . 1 What does the symbol $\rightleftharpoons$ represent?

Tick **one** box.

[1 mark]

- decomposition reaction ☐
- displacement reaction ☐
- neutralisation reaction ☐
- reversible reaction ☐

0 3 . 2 Carbon dioxide from the Earth's atmosphere can dissolve in oceans.

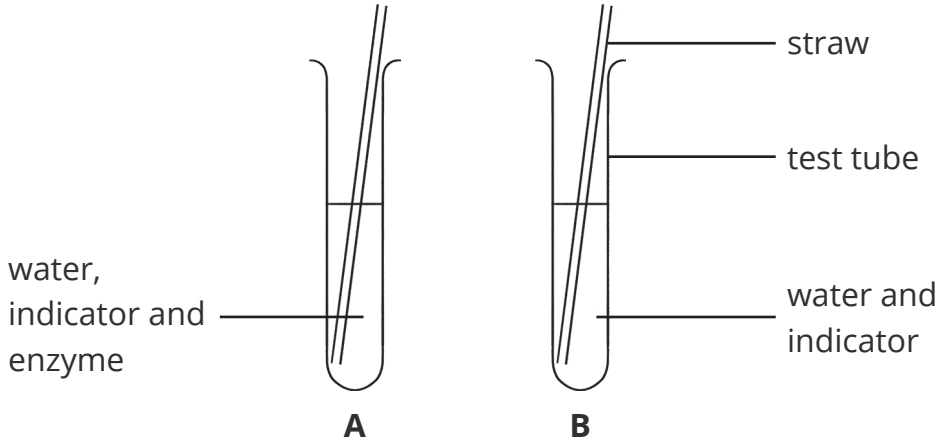
Describe how the formation of oceans affected the amount of carbon dioxide in Earth's early atmosphere.

[1 mark]

0 3 . 3 The reaction between carbon dioxide and water also occurs in the body.

A scientist set up two test tubes as shown in **Figure 5** to investigate the rate of the reaction.

Figure 5



The scientist blew down the straws to add carbon dioxide to the water.

The reaction was faster in test tube **A.**

Which of the substances used in the investigation is the catalyst for the reaction?

[1 mark]

0 3 . 4 A catalyst affects the activation energy of the reaction.

What is activation energy?

Tick **one** box.

[1 mark]

the minimum amount of energy that particles must have to activate ☐

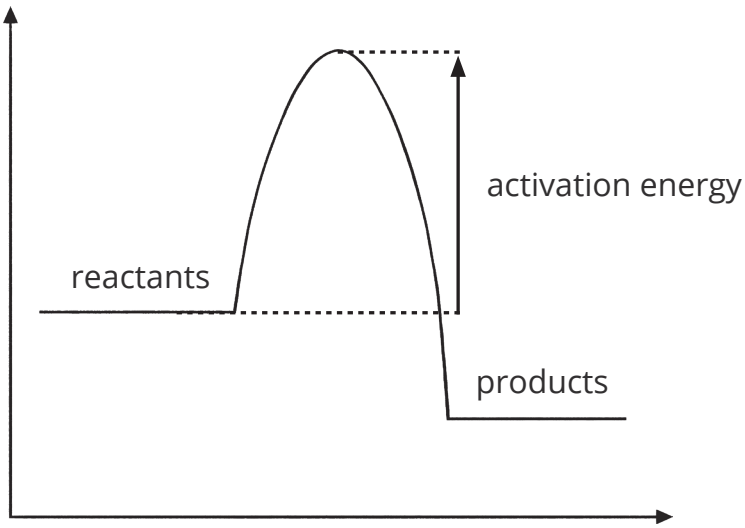
the maximum amount of energy that particles must have to activate ☐

the minimum amount of energy that particles must have to react ☐

the maximum amount of energy that particles must have to react ☐

0 3 . 5 **Figure 6** shows a reaction profile for a reaction without a catalyst.

Figure 6



Draw a line on **Figure 6** to show the reaction profile for the reaction when a catalyst is present.

[1 mark]

0 3 . 6 The scientist repeats the reaction in a sealed container so that none of the reactants or products can escape.

They measure the rate of the forward reaction and the rate of the backward reaction.

Explain how the scientist will know when the reaction has reached equilibrium.

[1 mark]

_____

_____

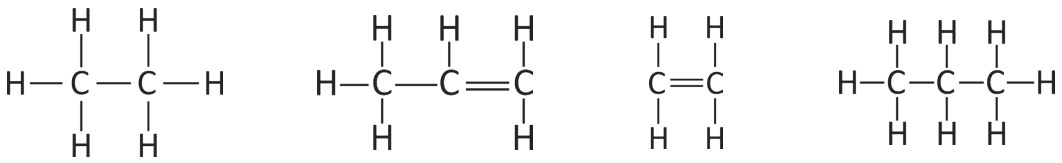
_____

6

0 4 Crude oil is a mixture of hydrocarbons. Most of the hydrocarbons in crude oil are alkanes.

Figure 7 shows the structure of some hydrocarbon molecules.

Figure 7



A **B** **C** **D**

0 4 . 1 Which of the molecules in **Figure 7** is ethane?

Tick **one** box.

[1 mark]

A ☐

B ☐

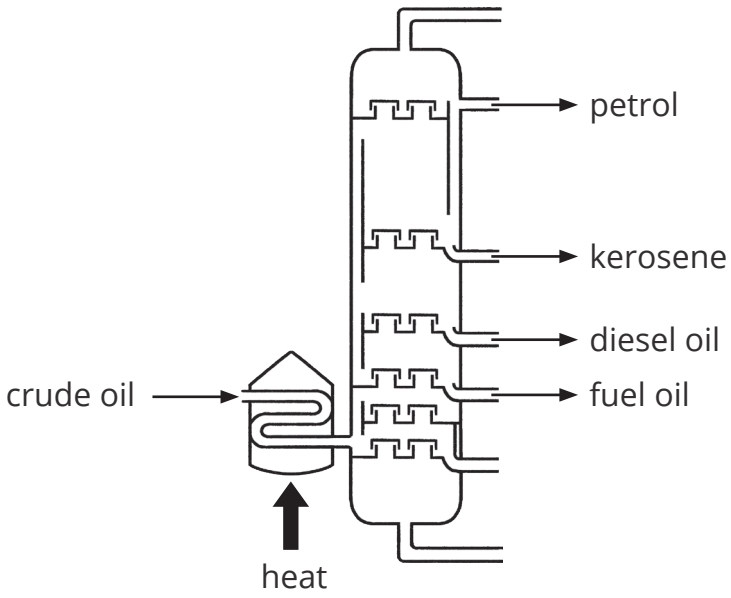
C ☐

D ☐

Question 4 continues on the next page.

0 4 . 2 **Figure 8** shows a fractional distillation column. Some fractions of crude oil are labelled.

Figure 8



Give the name of the labelled fraction with the lowest viscosity.

[1 mark]

0 4 . 3 The crude oil is heated so that it enters the fractionating column as vapours.

The fractionating column is hot at the bottom and cooler at the top.

Explain why there is a temperature gradient in the fractionating column.

[3 marks]

0 4 . 4 Fractions that contain larger molecules often undergo a process called cracking.

The statements in **Table 2** describe either cracking **or** fractional distillation.

Place **one** tick in each row to show which process the statement describes.

[3 marks]

Table 2

Statement	**Cracking**	**Fractional Distillation**
It is a chemical process.		
It separates molecules.		
It uses a catalyst.		

0 4 . 5 Alkenes are one of the products of cracking.

Describe how you would test for an alkene.

You should include the result you would expect to see.

[2 marks]

_____

_____

_____

10

Turn over for the next question

0 5 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 5 . 1 What is a formulation?

Tick **one** box.

[1 mark]

- a compound designed as a useful product ☐
- a fraction designed as a useful product ☐
- a mixture designed as a useful product ☐
- a solute designed as a useful product ☐

0 5 . 2 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.

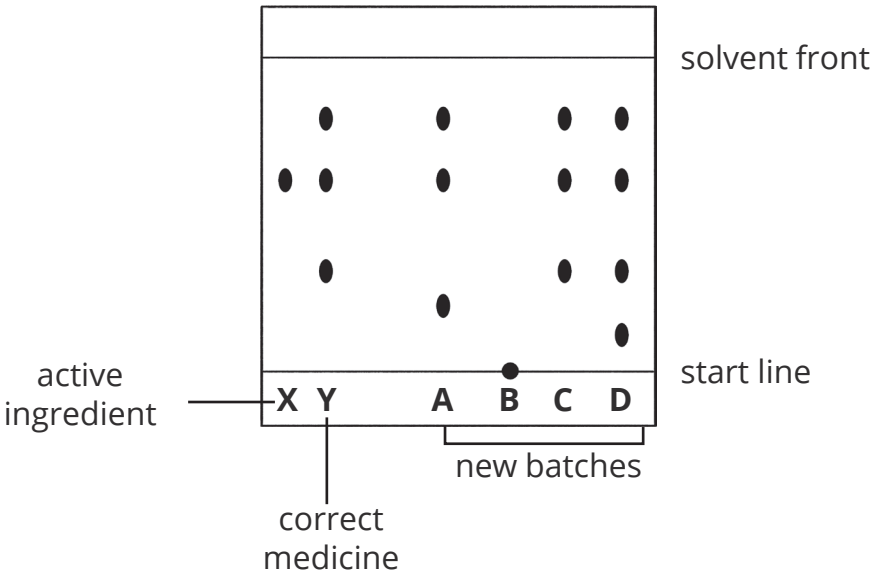
Figure 9 shows the results.

Sample **X** is the active ingredient.

Sample **Y** is the correct medicine.

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

Figure 9



Which of the samples in **Figure 9** is a pure substance?

Tick **one** box.

[1 mark]

C ☐

D ☐

X ☐

Y ☐

0 5 . 3 Explain whether the new batches **A, B, C** and **D** contain the correct ingredients.

[4 marks]

0 5 . 4 Explain the result for batch **B.**

[2 marks]

0 5 . 5 A scientist takes measurements for sample **X. Table 3** shows the results.

Table 3

	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 the table.

[2 marks]

R_f value = _____

10

0 6 Life cycle assessments (LCAs) are carried out to assess the environmental impacts of products in each of four stages.

0 6 . 1 Give **two** of the stages that are considered in a life cycle assessment.

[2 marks]

1. _____

_____

2. _____

_____

0 6 . 2 **Table 4** shows some information collected from life cycle assessments of shopping bags made of plastic and paper.

Table 4

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 4.**

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

0 6 . 3 Give **one** criticism of life cycle assessments.

[1 mark]

_____

_____

_____

7

0 7 Carbon dioxide is a greenhouse gas.

0 7 . 1 Name **one** other greenhouse gas.

[1 mark]

_____

0 7 . 2 Give **two** human activities that increase the amount of greenhouse gases in the Earth's atmosphere.

[2 marks]

1. _____

_____

2. _____

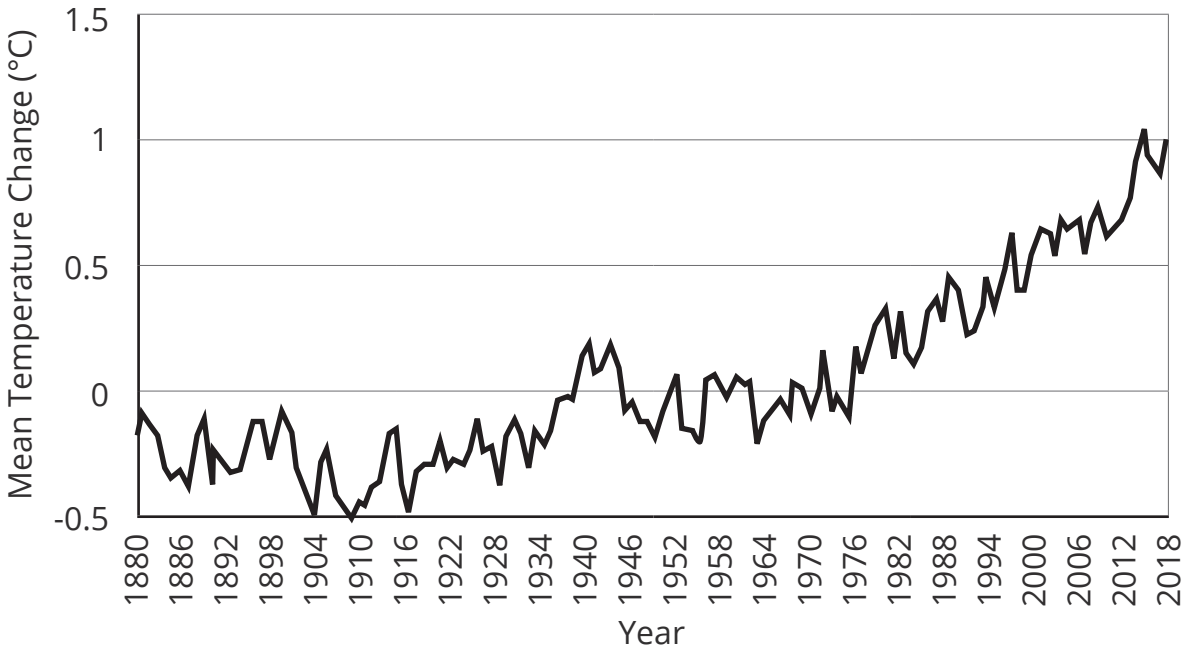
_____

Question 7 continues on the next page.

0 7 . 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 10 shows the mean yearly temperature change over the last 140 years.

Figure 10



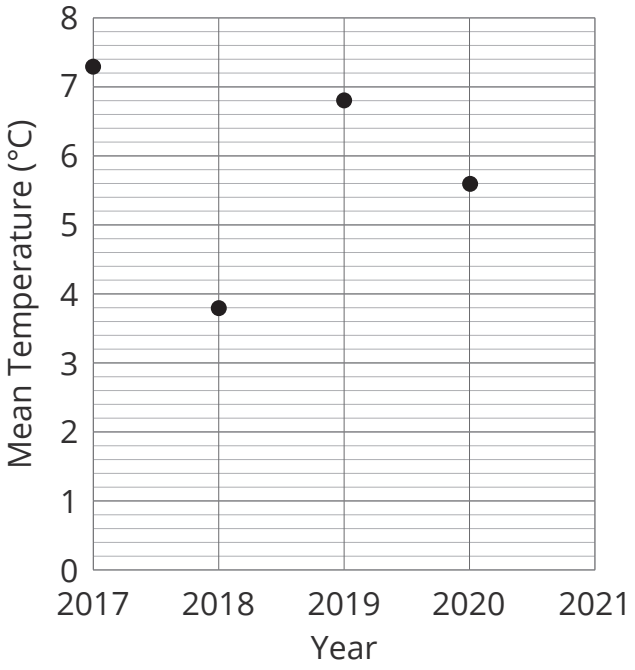
The measurements and methods used to collect the data are published in scientific journals.

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

[2 marks]

0 7 . 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 11.**

Figure 11



The person compared their data with the data in **Figure 10.**

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 10** and **Figure 11** in your answer.

[6 marks]

11

0 8 Propane (C_3H_8) is burnt as a fuel.

0 8 . 1 Balance the symbol equation for the complete combustion of propane.

[1 mark]

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

0 8 . 2 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

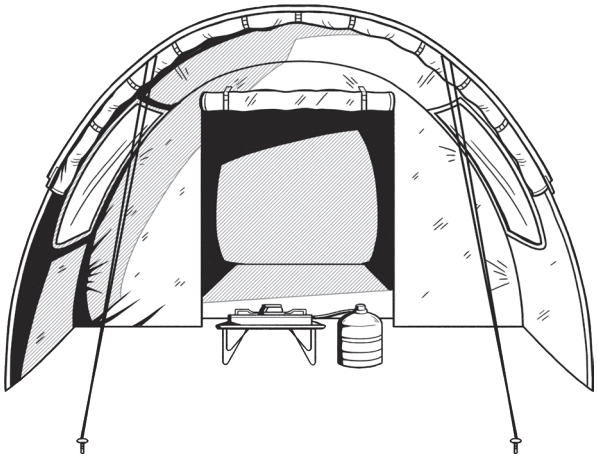
Relative formula mass (M_r): C_3H_8 = 44

[3 marks]

percentage by mass of carbon = _____ %

0 8 . 3 Propane canisters are used to fuel camping stoves. Camping stoves are often set up in a tent porch as shown in **Figure 12**.

Figure 12



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]

8

END OF QUESTIONS