Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier — Chemistry Paper 2F

Specimen 2018 (set 2) — 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.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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 Tablets to cure indigestion contain a mixture that has been designed as a useful product.

0 1 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

catalyst	**formulation**	**hydrocarbon**	**solvent**

Tablets to cure indigestion are an example of a _____ .

Table 1 shows the substances in one tablet.

Table 1

Substance	**Mass in mg**
Sodium hydrogencarbonate	64
Calcium carbonate	522
Magnesium carbonate	68

0 1 . 2 The total mass of these substances in the tablet is 654 mg

What is the approximate fraction of magnesium carbonate in the total mass of these substances?

[1 mark]

Tick **one** box.

$\frac{1}{10}$ ☐ $\frac{1}{100}$ ☐ $\frac{1}{1000}$ ☐ $\frac{1}{10\,000}$ ☐

0 1 . 3 The tablets also contain sugar.

Suggest why.

[1 mark]

0 1 . 4 Sodium hydrogencarbonate cures indigestion by reacting with acid in the stomach.

What type of reaction is this?

[1 mark]

Tick **one** box.

Combustion ☐

Displacement ☐

Neutralisation ☐

Question 1 continues on the next page

A student adds an indigestion tablet to dilute hydrochloric acid.

0 1 . 5 The gas produced is bubbled through limewater.

The gas turns the limewater milky.

Name the gas produced.

[1 mark]

_____

0 1 . 6 Water is also produced.

Which **two** statements are reasons why water is a liquid at room temperature?

[2 marks]

Tick **two** boxes.

Water has a boiling point of 100 °C ☐

Water has a gaint covalent structure ☐

Water has a melting point lower than room temperature ☐

Water has delocalised electrons ☐

Water is made of ions ☐

0 1 . 7 Calcium chloride is also produced.

- The formula for a calcium ion is Ca^{2+}
- The formula for a chloride ion is Cl^-

What is the formula of calcium chloride?

[1 mark]

Tick **one** box.

CaCl ☐ Ca_2Cl ☐ $CaCl_2$ ☐ Ca_2Cl_2 ☐

0 1 . 8 The tablets are stored in glass bottles.

Figure 1 shows part of a flowchart for recycling glass.

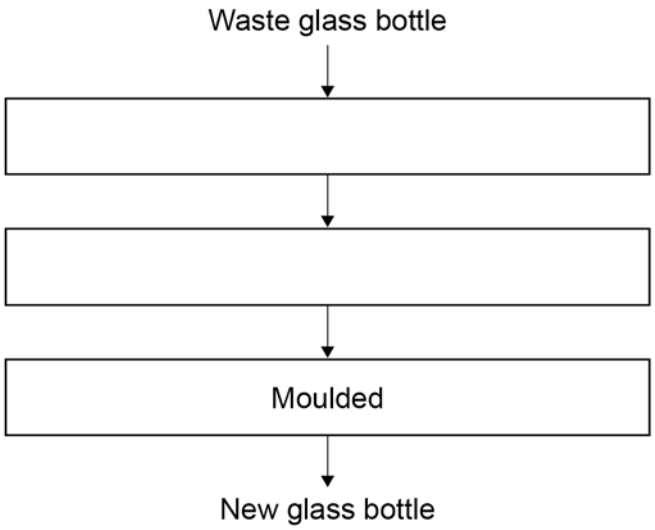
Complete **Figure 1**.

Choose the answers from the box.

[2 marks]

crushed	**electrolysed**	**frozen**	**melted**	**oxidised**

Figure 1



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DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

0 2 **Table 2** shows the gases in the Earth's atmosphere today.

Table 2

Gas	Percentage (%)
N_2	78.0
O_2	21.0
Ar	0.9
Other gases	**X**

0 2 . 1 What is the percentage of **X**?

[1 mark]

Tick **one** box.

0.01% ☐ 0.1% ☐ 1% ☐ 10% ☐

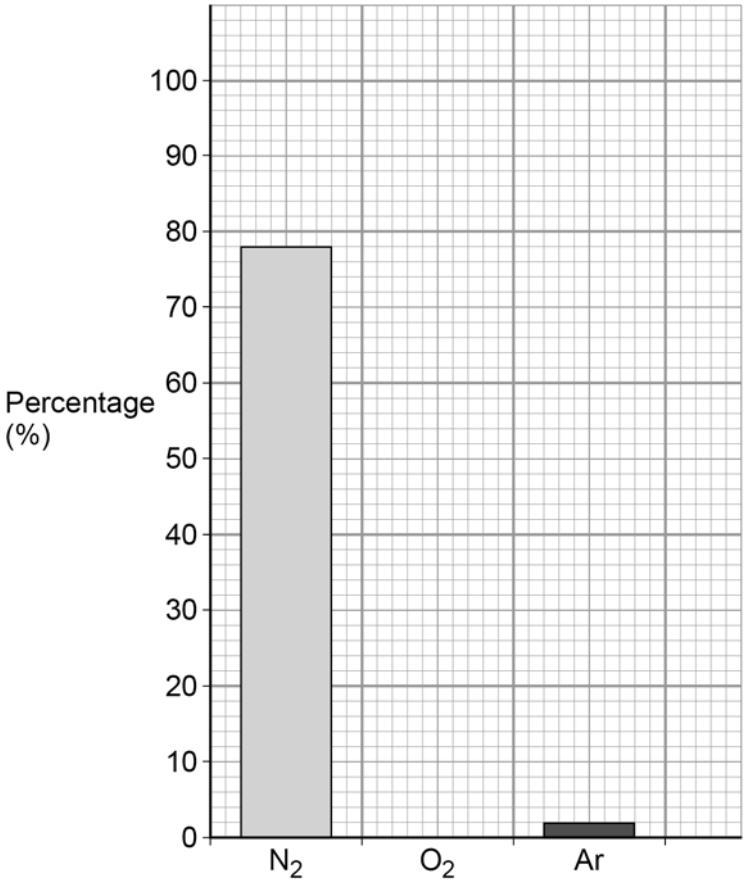
Question 2 continues on the next page

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

Plot the data from **Table 2** on **Figure 2**.

[1 mark]

Figure 2



0 2 . 3 What is the name of the gas with symbol Ar?

[1 mark]

Tick **one** box.

Aluminium ☐

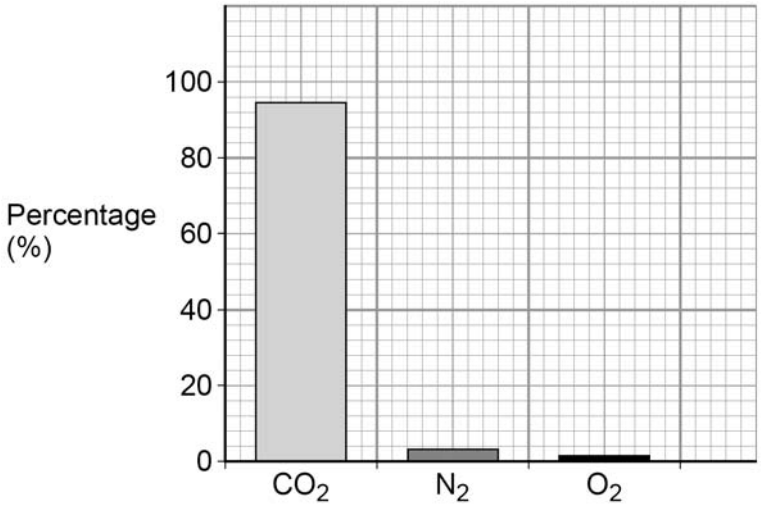
Argon ☐

Arsenic ☐

Astatine ☐

0 2 . 4 **Figure 3** shows the gases in the atmosphere of Mars today.

Figure 3



Some theories suggest that the Earth's early atmosphere was the same as the atmosphere of Mars today.

Describe the change in the percentage of oxygen from the Earth's early atmosphere to the Earth's atmosphere today.

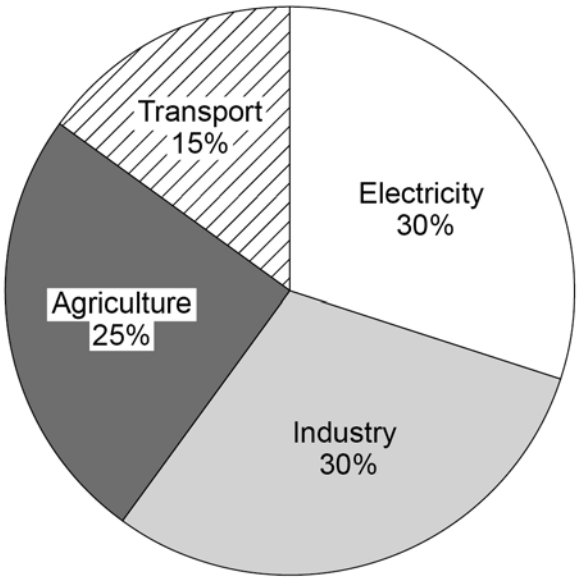
Use values from **Table 2** on page 6 and **Figure 3**.

[2 marks]

Question 2 continues on the next page

0 2 . 5 **Figure 4** shows the percentage of greenhouse gases from human activities.

Figure 4



Compare the contribution of each activity to the total amount of greenhouse gases.

Use data from **Figure 4**.

[4 marks]

0 2 . 6 Suggest **one** way greenhouse gas emissions could be reduced.

[1 mark]

0 2 . 7 Give **one** reason why it is difficult for some countries to reduce emissions of greenhouse gases.

[1 mark]

11

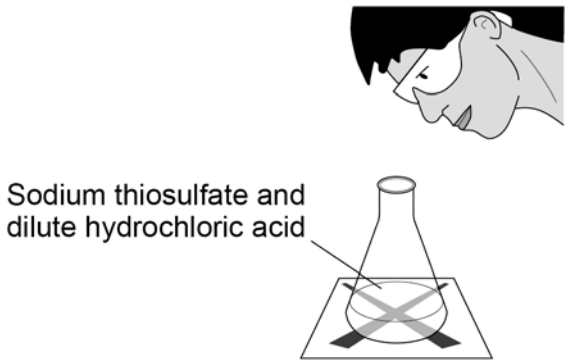
There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

0 3 A student investigated the effect of concentration on the rate of the reaction between sodium thiosulfate and dilute hydrochloric acid.

Figure 5 shows the apparatus the student used.

Figure 5



0 3 . 1 The symbol equation for the reaction is:

$$Na_2S_2O_3 + 2HCl \rightarrow 2NaCl + SO_2 + H_2O + S$$

Complete the word equation for the reaction.

[1 mark]

sodium thiosulphate + hydrochloric acid → _____ + sulfur dioxide + water + sulfur

Question 3 continues on the next page

0 3 . 2 **Table 3** shows the results.

Table 3

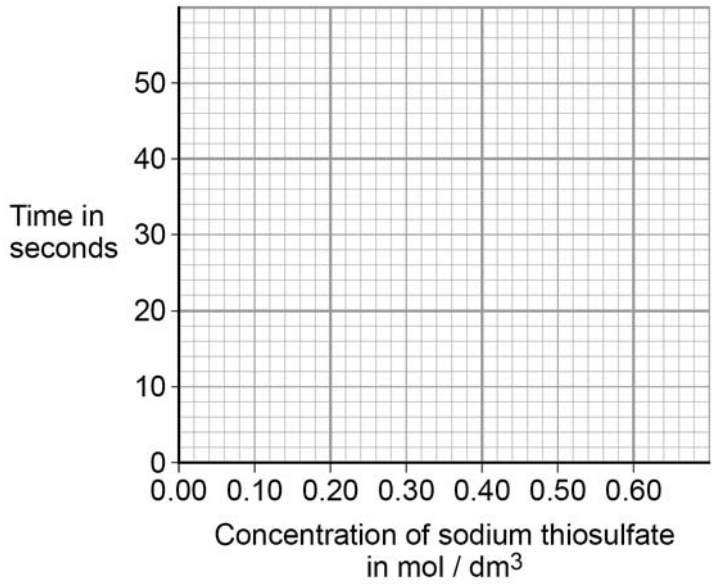
Concentration of sodium thiosulfate in mol/dm^3	Time for student to no longer see the cross in seconds
0.10	41
0.20	21
0.30	20
0.40	10
0.50	8

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

Draw a line of best fit.

[3 marks]

Figure 6



0 3 . 3 The student determined the time for a concentration of 0.15 mol/dm^3

What is the concentration when the reaction is 20 seconds faster?

You should show your working on **Figure 6**.

[2 marks]

Concentration = _____ mol/dm^3

0 3 . 4 Estimate the time taken for the reaction when the concentration of sodium thiosulfate is 0.60 mol/dm^3

[1 mark]

Time taken = _____ s

7

Turn over for the next question

0 4 Crude oil and natural gas are natural resources in many countries.

Table 4 shows percentages of hydrocarbons in natural gas from three different countries.

Table 4

Hydrocarbon	Percentage (%) of hydrocarbon in natural gas		
	Country X	**Country Y**	**Country Z**
Methane	78.03	88.10	94.36
Ethane	9.70	5.30	2.37
Propane	4.82	2.16	0.15
Butane	1.33	0.72	0.02
Pentane	0.30	0.18	0.00

0 4 . 1 Calculate the mean percentage of propane from countries **X**, **Y** and **Z**.

Give your answer to 2 decimal places.

[2 marks]

Mean percentage of propane = _____ %

0 4 . 2 Suggest why natural gas from different countries has different percentages of hydrocarbons.

[1 mark]

0 4 . 3 Complete the sentence.

Choose the answer from the box.

[1 mark]

an atom	**an electron**	**an ion**	**a molecule**

The formula CH_4 represents _____ of methane.

0 4 . 4 Complete the sentence.

[1 mark]

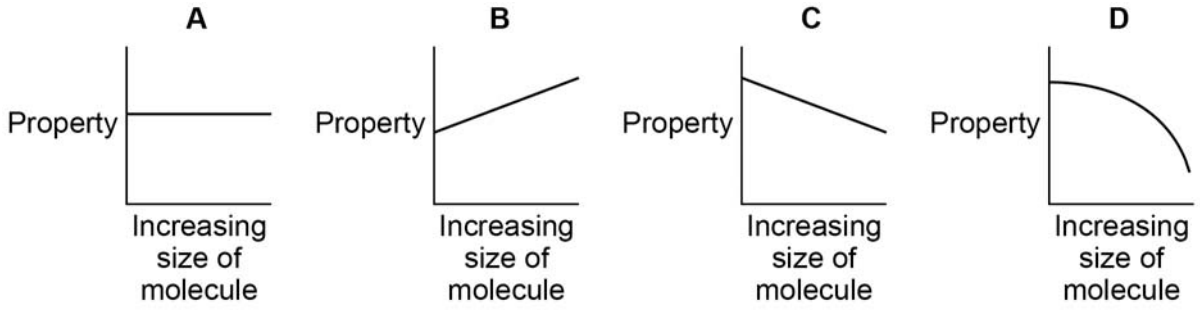
The hydrocarbons in **Table 4** belong to the homologous series of

_____ .

Question 4 continues on the next page

Figure 7 shows how properties vary with the increasing size of molecule in this homologous series.

Figure 7



0 4 . 5 Which graph shows how boiling points vary?

[1 mark]

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 4 . 6 Which graph shows how viscosity varies?

[1 mark]

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 4 . 7 Crude oil is fractionally distilled.

Fractions with larger molecules are cracked.

Describe **two** differences between fractional distillation and cracking.

[2 marks]

1 _____

_____

2 _____

_____

0 4 . 8 Ethene is a product of crude oil.

Complete the sentence.

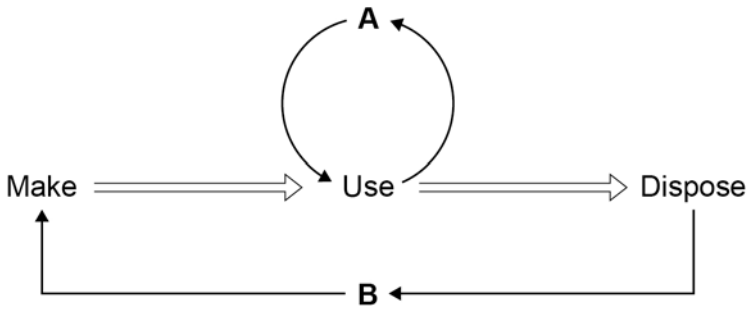
[1 mark]

Ethene polymerises to produce _____ .

0 4 . 9 The production of plastic bags uses limited resources.

Figure 8 shows two ways (**A** and **B**) of saving limited resources.

Figure 8



Name **A** and **B**.

Choose the answers from the box.

[2 marks]

recycle	**reduce**	**release**	**reuse**	**reverse**

A _____

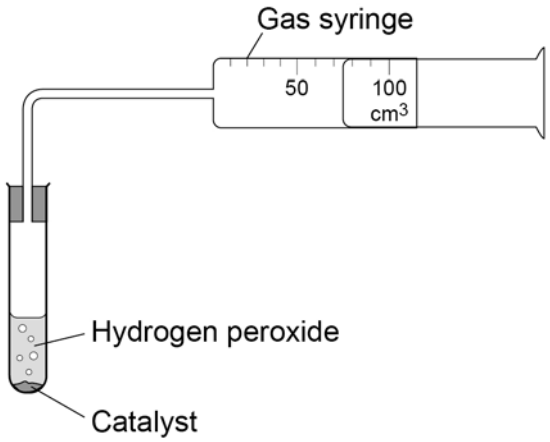
B _____

12

0 5 A student investigated the effect of different catalysts on the decomposition of hydrogen peroxide.

Figure 9 shows the apparatus the student used.

Figure 9



0 5 . 1 Oxygen gas is produced.

Table 5 shows the student's observations.

Table 5

Catalyst	**Observation**
Manganese dioxide	A lot of gas and hydrogen peroxide bubbles up into gas syringe
Potato	Steady bubbles of gas
Copper oxide	Few bubbles of gas
Sodium chloride	Very few bubbles of gas

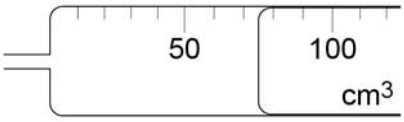
Which is the most useful catalyst?

Explain your answer.

[2 marks]

0 5 . 2 **Figure 10** shows the gas syringe during the investigation.

Figure 10



What is the volume of gas?

[1 mark]

Tick **one** box.

52 cm^3 ☐ 55 cm^3 ☐ 70 cm^3 ☐ 75 cm^3 ☐

Question 5 continues on the next page

0 5 . 3 For one of the catalysts the student measures the volume of gas given off every 20 seconds for 2 minutes.

The volume of gas was zero at the start of the experiment.

The measured volumes of gas are:

23 cm^3 42 cm^3 59 cm^3 72 cm^3 80 cm^3 88 cm^3

Complete **Table 6** to show these results.

[4 marks]

Table 6

0 5 . 4 Suggest why the readings might be lower than expected.

[1 mark]

0 5 . 5 The student did the experiment with four different catalysts.

Give **two** variables the student should keep constant.

[2 marks]

1 _____

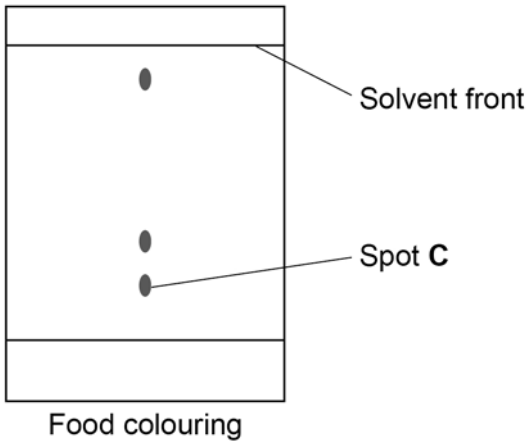
2 _____

10

Turn over for the next question

0 6 **Figure 11** shows a chromatogram for a food colouring.

Figure 11



0 6 . 1 How does the chromatogram show that the food colouring is a mixture?

[1 mark]

0 6 . 2 A student makes measurements for spot **C**.

Table 7 shows the results.

Table 7

	Distance in mm
Distance moved by spot **C**	7
Distance moved by solvent	39

Calculate the R_f value for spot **C**.

Give your answer to 2 significant figures.

Use the results in **Table 7**.

[3 marks]

R_f value = _____

Question 6 continues on the next page

0 6 . 3 Plan a chromatography experiment to investigate the colours in an ink.

[6 marks]

10

0 7 . 1 Methane is burned in a plentiful supply of oxygen.

Which is the correct balanced chemical equation?

Tick **one** box.

[1 mark]

$CH_4 + O_2 \rightarrow CO_2 + H_2O$ ☐

$CH_4 + 2O_2 \rightarrow CO_2 + H_2O$ ☐

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ ☐

$CH_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$ ☐

0 7 . 2 Burning fuels causes atmospheric pollution.

Write **one** effect for each pollutant in **Table 8**.

[3 marks]

Table 8

Pollutant	Effect
Carbon monoxide	
Sulfur dioxide	
Particulates	

Question 7 continues on the next page

0 7 . 3 Methane, petrol and coal are fuels.

Table 9 shows information about these fuels.

Table 9

Fuel	State	Energy content in kJ per g	Mass in mg of CO_2 produced for one kJ of energy released
Methane	Gas	52	53
Petrol	Liquid	43	71
Coal	Solid	24	93

Evaluate the use of the fuels.

Use in the information in **Table 9** and your knowledge.

[6 marks]

END OF QUESTIONS

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