SPECIMEN MATERIAL

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier Paper 4: Chemistry 2F

Specimen 2018 Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a calculator
- the periodic table (enclosed)

Instructions
- 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.

Information
- There are 70 marks available on this paper.
- 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.
- When answering questions 06.4 and 07.1 you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

Advice
- In all calculations, show clearly how you work out your answer.

Please write clearly, in block capitals.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Forename(s) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Candidate signature _____

0 1 This question is about gases in the Earth's atmosphere.

0 1 . 1 The amount of carbon dioxide in the Earth's atmosphere decreased during the first billion years of the Earth's existence.

Complete the sentences. Use words from the box.

[2 marks]

carbonates	**dissolved**	**evaporated**	**melted**	**nitrates**	**sulfates**

The amount of carbon dioxide in the Earth's atmosphere decreased because

the carbon dioxide _____ in the oceans.

Sediments were formed when _____ were produced.

Algae and plants use carbon dioxide and water to produce oxygen.

0 1 . 2 What is the name of this process?

[1 mark]

Tick **one** box.

- Carbon capture ☐
- Combustion ☐
- Photosynthesis ☐
- Polymerisation ☐

0 1 . 3 Complete the word equation for this process.

[1 mark]

carbon dioxide + _____ → glucose + _____

0 1 . 4 Draw **one** line from each gas to the approximate percentage of the gas in the Earth's atmosphere today.

[3 marks]

Gas	Approximate percentage of gas in the Earth's atmosphere today
Carbon dioxide	5
Nitrogen	20
Oxygen	80

<1
10
50
>90

0 1 . 5 Carbon dioxide is a greenhouse gas.

Why does increasing the amount of carbon dioxide change the global climate?

[1 mark]

Question 1 continues on the next page

0 1 . 6 How can countries reduce carbon dioxide emissions?

[1 mark]

Tick **one** box.

- only burn methane ☐
- use renewable energy supplies ☐
- use waste plastic bags as fuel ☐

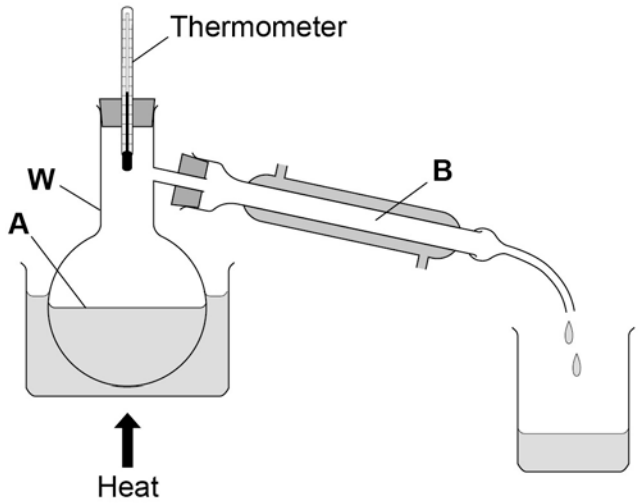
0 1 . 7 Give **one** reason why it is difficult for countries to reduce emissions of carbon dioxide.

[1 mark]

Turn over for the next question

0 2 The apparatus in **Figure 1** is used to separate a mixture of liquids in a fuel.

Figure 1



0 2 . 1 What is apparatus **W** on **Figure 1**?

[1 mark]

Tick **one** box.

- Beaker ☐
- Boiling Tube ☐
- Flask ☐
- Jug ☐

0 2 . 2 What is the name of this method of separation?

[1 mark]

Tick **one** box.

Crystallisation ☐

Electrolysis ☐

Filtration ☐

Distillation ☐

0 2 . 3 Name the changes of state taking place at **A** and **B** in **Figure 1**.

Use words from the box.

[2 marks]

boiling	**condensing**	**freezing**	**melting**

Change of state at **A**: _____

Change of state at **B**: _____

Question 2 continues on the next page

Table 1 shows the boiling points of the hydrocarbons in the fuel.

Table 1

Hydrocarbon	Boiling point in °C
Pentane	36
Hexane	69
Heptane	98
Octane	125

0 2 . 4 Which hydrocarbon will be the last to collect in the beaker?

[1 mark]

Tick **one** box.

Pentane ☐

Hexane ☐

Heptane ☐

Octane ☐

0 2 . 5 The fuel is a mixture of liquids that has been designed as a useful product.

What name is given to this type of mixture?

[1 mark]

Tick **one** box.

Catalyst ☐

Formulation ☐

Polymer ☐

Solvent ☐

0 2 . 6 Describe how this fuel is different from crude oil.

[2 marks]

0 2 . 7 A student measured the melting point of a solid hydrocarbon four times.

The student's results are in **Table 2**.

Table 2

	Trial 1	**Trial 2**	**Trial 3**	**Trial 4**
Melting point in °C	35	48	37	37

Calculate the mean melting point of the hydrocarbon, leaving out any anomalous result.

Give your answer to two significant figures.

[2 marks]

Mean melting point = _____ °C

Turn over for the next question

0 3 This question is about drinking water.

0 3 . 1 Name **two** methods of treating water from rivers, lakes or the sea to produce drinking water.

[2 marks]

Tick **two** boxes.

- Anaerobic digestion ☐
- Cracking ☐
- Desalination ☐
- Electrolysis ☐
- Sterilising ☐

Table 3 shows the amounts of dissolved ions in a sample of drinking water.

Table 3

Dissolved ion	Mass in mg per dm^3
Cl^-	250
Na^+	200
NO_3^-	40

0 3 . 2 What is the name of the ion with the symbol Cl^-?

[1 mark]

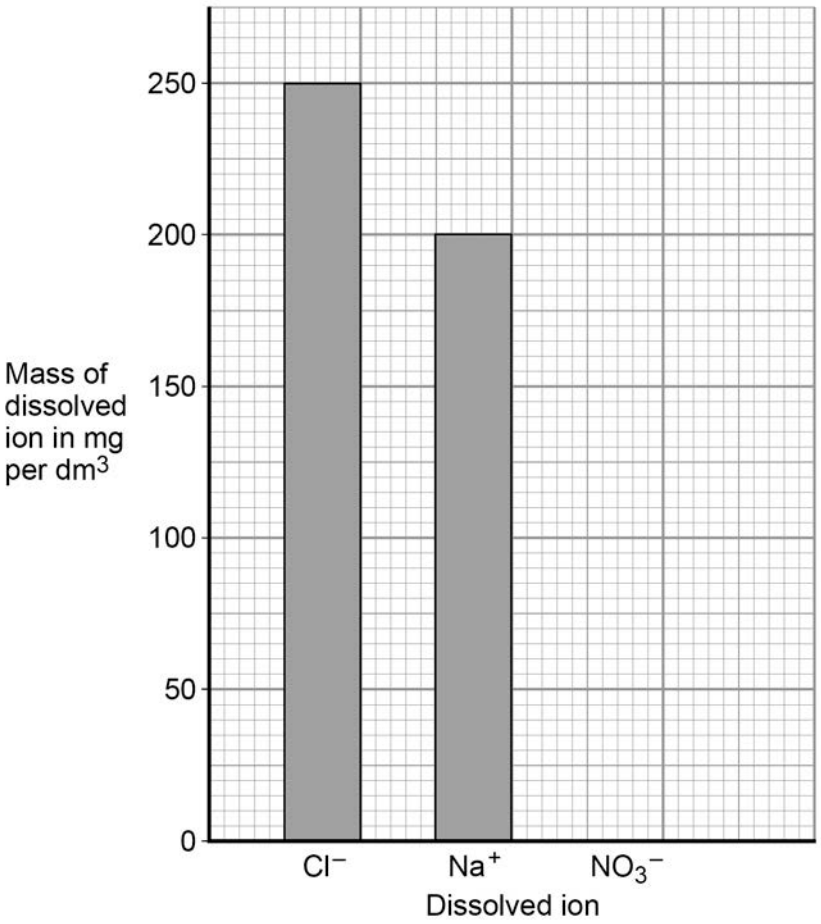
Tick **one** box.

- Calcium ion ☐
- Carbonate ion ☐
- Chloride ion ☐
- Chlorine ion ☐

0 3 . 3 Use the information in **Table 3** to complete the bar chart in **Figure 2**.

[1 mark]

Figure 2



Question 3 continues on the next page

Look at the questions labelled **A**, **B**, **C**, **D**.

A How many substances are there in drinking water?

B How much fluoride is in drinking water?

C Is fluoride soluble in drinking water?

D Should fluoride be added to drinking water?

0 3 . 4 Which **one** of the questions cannot be answered by science alone?

[1 mark]

Tick **one** box.

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

0 3 . 5 Give **two** reasons why the answer you have chosen cannot be answered by science alone.

[2 marks]

1 _____

_____

2 _____

_____

0 3 . 6 A sample of drinking water contains 1.5 mg of fluoride per dm^3 of water.
A person drinks 1 dm^3 of this water.

The recommended daily amount of fluoride is 4.0 mg.

Which calculation gives the percentage of the recommended daily amount of fluoride in 1 dm^3 of this water?

[1 mark]

Tick **one** box.

$\frac{1.5}{4.0} \times 100$ ☐

$\frac{1.5}{100} \times 4.0$ ☐

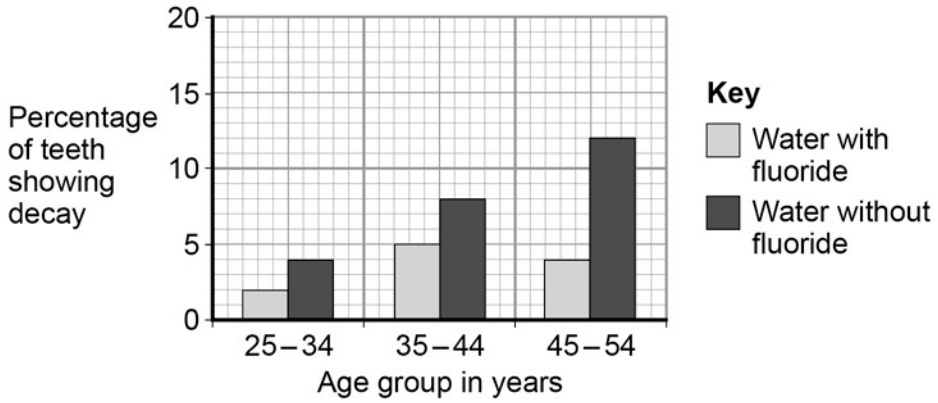
$\frac{4.0}{1.5} \times 100$ ☐

$\frac{100}{1.5 \times 4.0}$ ☐

Question 3 continues on the next page

Figure 3 shows the effect of fluoride in drinking water on tooth decay in different age groups.

Figure 3



0 3 . 7 Describe the pattern of tooth decay in **Figure 3** for water without fluoride.

Use data to justify your answer.

[2 marks]

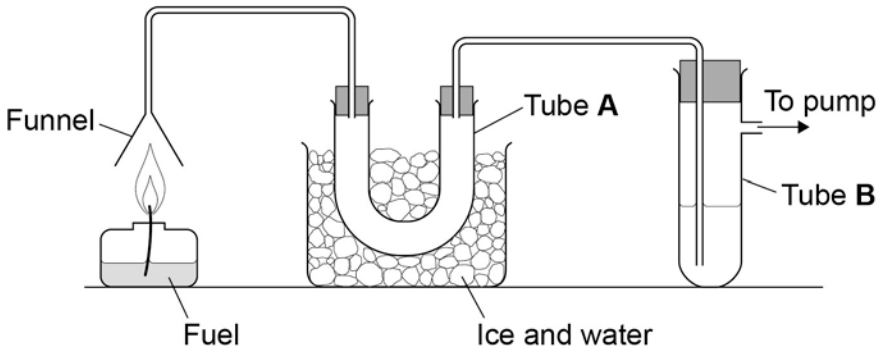
0 3 . 8 Describe the effect of adding fluoride to drinking water for the age groups in **Figure 3**.

[2 marks]

0 4 A student investigated the substances produced when fuels burn.

Figure 4 shows the apparatus the student used.

Figure 4



0 4 . 1 The complete combustion of a hydrocarbon produces carbon dioxide and **one** other substance.

Look at **Figure 4**. What would the student see in tube **A**?

[1 mark]

0 4 . 2 When the student burned the fuel she saw soot in the funnel.

Explain why soot forms.

[2 marks]

Question 4 continues on the next page

The student burned another fuel which contained impurities.

The substance in tube **B** is water containing universal indicator.

The indicator turned red.

0 4 . 3 Which gas made the indicator turn red?

[1 mark]

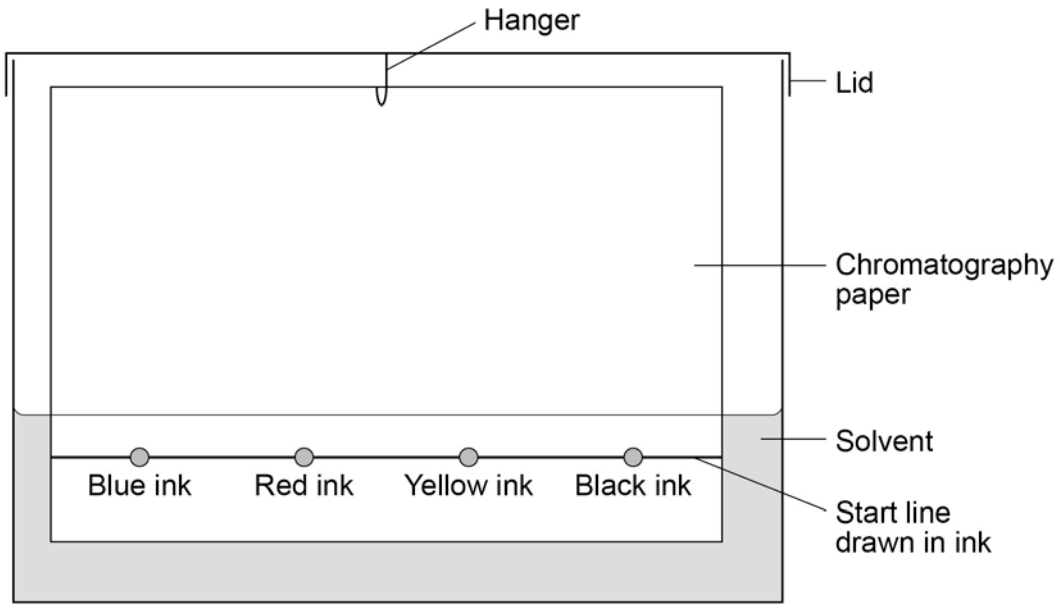
Tick **one** box.

- Ammonia ☐
- Carbon monoxide ☐
- Nitrogen ☐
- Sulfur dioxide ☐

0 5 A student used paper chromatography to investigate the colours in different inks.

Figure 5 shows the apparatus the student used.

Figure 5



0 5 . 1 The student made **two** mistakes in setting up the apparatus.

Identify the **two** mistakes.

Describe the problem each mistake would cause.

[4 marks]

Mistake 1 _____

Problem _____

_____

_____

Mistake 2 _____

Problem _____

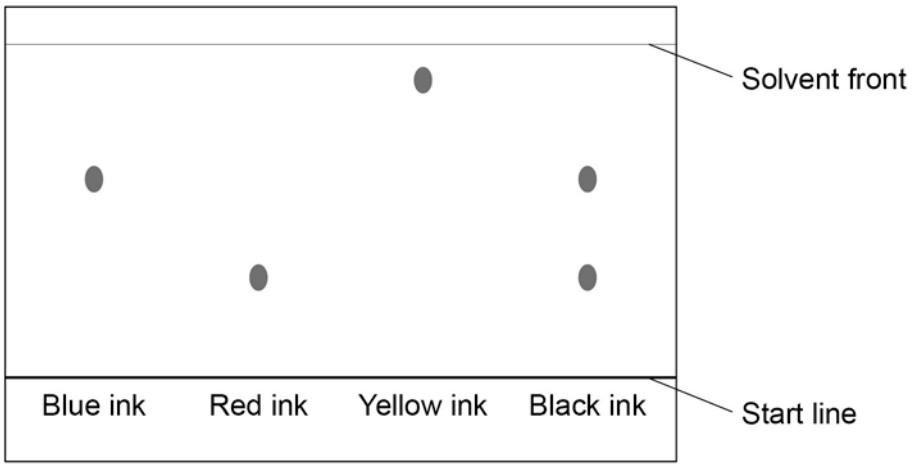
_____

_____

0 5 . 2 The student then set up the apparatus without making any mistakes.

Figure 6 shows his results.

Figure 6



What colours are in the black ink?

[1 mark]

0 5 . 3 Which of the inks is the most soluble in the solvent?

Give a reason for your answer.

[2 marks]

Ink

Reason

0 5 . 4 Use **Figure 6** to complete **Table 4**, then calculate the R_f value for red ink.

[5 marks]

Table 4

	Distance in mm
Distance moved by red ink	……
Distance from start line to solvent front	……

The R_f value for red ink is calculated using the equation.

$$R_f = \frac{\text{distance moved by red ink from the start line}}{\text{distance moved by solvent from the start line}}$$

Give your answer to two significant figures.

R_f value = _____

0 5 . 5 How can you tell from **Figure 6** that the R_f value for the blue ink is greater than the R_f value for the red ink?

[1 mark]

0 6 . 1 The hydrocarbon $C_{16}H_{34}$ can be cracked.

Balance the equation for cracking $C_{16}H_{34}$

[1 mark]

$C_{16}H_{34}$ → _____ C_2H_4 + C_8H_{18}

0 6 . 2 Describe the differences between cracking and distillation.

[2 marks]

0 6 . 3 What type of reaction is cracking?

[1 mark]

Tick **one** box.

- Combustion ☐
- Decomposition ☐
- Neutralisation ☐
- Precipitation ☐

0 6 . 4 Ethene is used to make poly(ethene).

Poly(ethene) is used to make plastic bags.

Table 5 shows data from a Life Cycle Assessment (LCA) for a plastic bag and a paper bag.

Table 5

	Plastic bag	**Paper bag**
Raw materials	Crude oil or natural gas	Wood
Energy used in MJ	1.5	1.7
Mass of solid waste in g	14	50
Mass of CO_2 produced in kg	0.23	0.53
Volume of fresh water used in dm^3	255	4 520

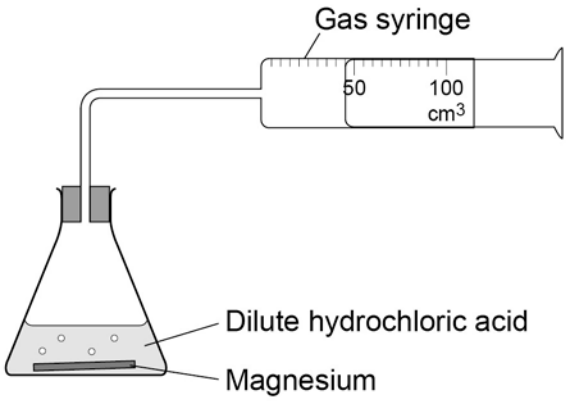
A company stated: 'A Life Cycle Assessment shows that using plastic bags has less environmental impact than using paper bags'.

Evaluate this statement. Use your knowledge and the information from **Table 5**.

[6 marks]

0 7 A student investigated the rate of the reaction between magnesium and dilute hydrochloric acid.
The student used the apparatus shown in **Figure 7** to collect the gas produced.

Figure 7



0 7 . 1 Outline a plan to investigate how the rate of this reaction changed when the concentration of the hydrochloric acid was changed.

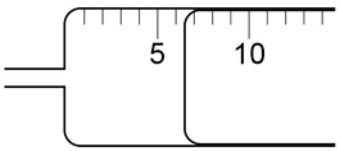
- Describe how you would do the investigation and the measurements you would make.
- Describe how you would make it a fair test.

You do **not** need to write about safety precautions.

[6 marks]

0 7 . 2 **Figure 8** shows the gas syringe during one of the experiments.

Figure 8



What is the volume of gas collected?

[1 mark]

Tick **one** box.

5.3 cm^3 ☐

6.0 cm^3 ☐

6.5 cm^3 ☐

7.0 cm^3 ☐

Question 7 continues on the next page

0 7 . 3 **Figure 9** shows the student's results for one concentration of hydrochloric acid.

Figure 9

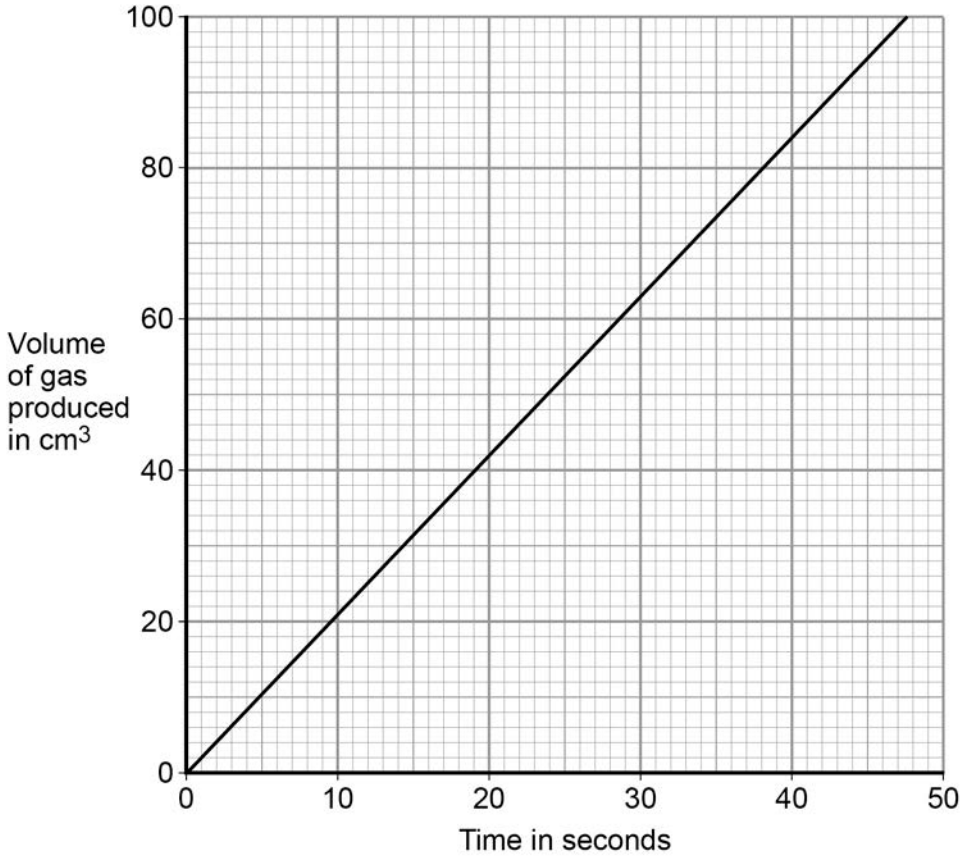


Table 6 shows the student's results when the concentration was two times greater than the results on **Figure 9**.

Table 6

Time in seconds	Volume of gas produced in cm^3
0	0
10	35
15	52
20	80
30	87

Plot the results in **Table 6** on the grid in **Figure 9**.
Draw a line of best fit.

[3 marks]

0 7 . 4 Give **one** conclusion about how the rate of reaction changed when the concentration of hydrochloric acid was changed.

[1 mark]

END OF QUESTIONS

Copyright information

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements in future papers if notified. If you have any queries please contact the Copyright Team, AQA, Stag Hill House, Guildford, GU2 7XJ.

Copyright © 2016 AQA and its licensors. All rights reserved.