

AQA

GCSE

Chemistry

SET B – Paper 2 Foundation Tier

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F

Materials

Time allowed: 1 hour 45 minutes

For this paper you must have:

- a ruler
- a calculator
- the Periodic Table (found at the end of the paper).

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 100 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 05.6 and 08.3 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.

Name:

01 The foods we eat often contain additional food colourings.

01.1 Why do foods contain colourings?

Tick **one** box.

To improve the taste

☐

To make food look more appealing

☐

To make the food last longer

☐

To make the food smell better

☐

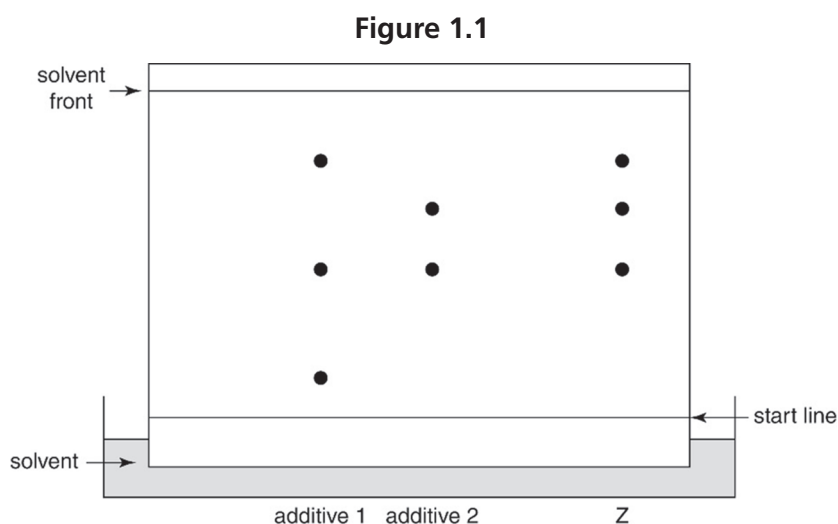
[1 mark]

01.2 A scientist analysed a food sample, Z, to check for the presence of additives.

This is the method used:

1. Draw a baseline.
2. Place a dot of each additive on the start line.
3. Place a dot of Z on the start line.
4. Place the bottom of the paper in a solvent and wait for 5 minutes.

Figure 1.1 shows the result.



Name the analysis process used by the scientist.

Tick **one** box.

Chromatography

☐

Distillation

☐

Evaporation

☐

[1 mark]

01.3 The method outlined above does not include some important details about the start line and solvent level.

Suggest **two** improvements to the method.

1.

2.

[2 marks]

01.4 How many additives are in sample Z?

Use **Figure 1.1** to help you.

Tick **one** box.

2 ☐

3 ☐

4 ☐

7 ☐

[1 mark]

Question 1 continues on the next page

01.5 Describe the differences between the dyes used in additive 1 and additive 2

.....

.....

.....

.....

[2 marks]

01.6 Calculate the R_f value for the dye that has travelled the furthest in additive 1

Use **Figure 1.1** and the equation:

$$R_f = \frac{\text{distance travelled by dye spot}}{\text{distance travelled by solvent front}}$$

Give your answer to 3 significant figures.

Distance travelled by dye spot =

Distance from start line to solvent front =

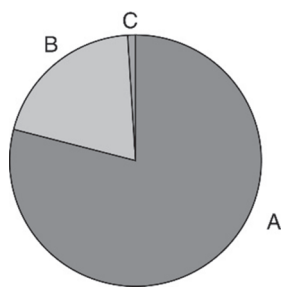
R_f value =

.....

[5 marks]

02.1 Figure 2.1 is a pie chart showing the composition of our **current** atmosphere.

Figure 2.1



Which substance is represented by segment A?

Tick **one** box.

- | | |
|----------------|--------------------------|
| Oxygen | <input type="checkbox"/> |
| Carbon dioxide | <input type="checkbox"/> |
| Nitrogen | <input type="checkbox"/> |
| Hydrogen | <input type="checkbox"/> |

[1 mark]

02.2 What percentage of our current atmosphere is made up of **carbon dioxide**?

Tick **one** box.

- | | |
|-----|--------------------------|
| >1% | <input type="checkbox"/> |
| 20% | <input type="checkbox"/> |
| 79% | <input type="checkbox"/> |
| 33% | <input type="checkbox"/> |

[1 mark]

Question 2 continues on the next page

02.3 The amount of carbon dioxide and other greenhouse gases emitted over the life cycle of a product, service or event is called a *carbon footprint*.

State **two** ways in which we can reduce our carbon footprint.

1.

2.

[2 marks]

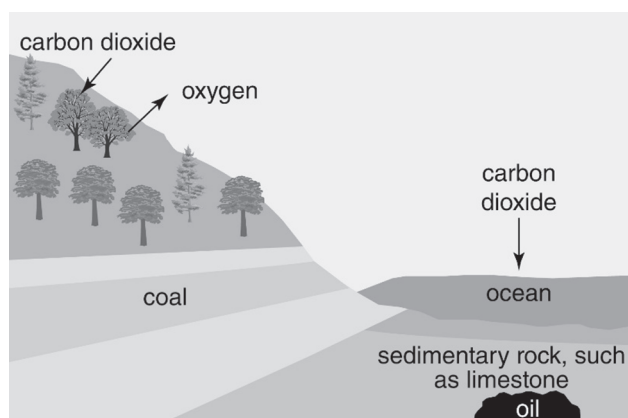
02.4 It is thought that, when Earth was first formed, carbon dioxide made up more than 95% of the atmosphere.

Carbon dioxide levels are much lower than that level now, because it can be removed from our atmosphere in various ways.

Describe what happened to reduce the high levels of carbon dioxide present in Earth's early atmosphere.

Use your own knowledge, and **Figure 2.2**, to help you.

Figure 2.2



.....

.....

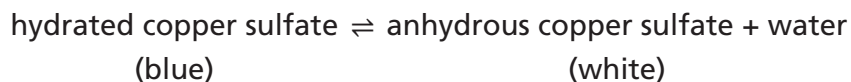
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.....

.....

[3 marks]

- 03 A group of students were carrying out the thermal decomposition of hydrated copper sulfate. In the reaction, hydrated copper sulfate, anhydrous copper sulfate and water are produced.



03.1 What does the \rightleftharpoons symbol mean?

[1 mark]

03.2 What happens to the colour of copper sulfate when water is added to anhydrous copper sulfate?

[1 mark]

03.3 When the hydrated copper sulfate decomposes it takes in energy.

It is an **endothermic** reaction.

Name the type of reaction that occurs when anhydrous copper sulfate reacts with water.

[1 mark]

03.4 The students misplaced their container of copper sulfate. They decided to carry out some chemical tests on the substance they *thought* was copper sulfate.

Copper sulfate consists of copper(II) ions and sulfate ions.

The students carried out three tests, two of which were to try to identify copper(II) ions:

1. flame test
2. sodium hydroxide test
3. sulfate test

Identify the colour of the flame that the students would have seen when placing the substance in a flame, if copper(II) ions were present.

Tick **one** box.

Green	<input type="checkbox"/>
Lilac	<input type="checkbox"/>
Crimson	<input type="checkbox"/>
Yellow	<input type="checkbox"/>

[1 mark]

Question 3 continues on the next page

03.5 Identify the result that the students would have seen when using sodium hydroxide solution to test if copper(II) ions were present.

Tick **one** box.

Blue precipitate

☐

Lilac precipitate

☐

Crimson precipitate

☐

Yellow precipitate

☐

[1 mark]

03.6 Describe how to carry out the test for sulfates.

Include the name of any chemicals you would need.

State the result you would expect to see if sulfate ions were present.

Method

.....
.....

Result if sulfate ions are present

.....

[3 marks]

03.7 Copper sulfate is used in formulations that increase copper levels in soil. It is used in fungicides, amongst other things.

Describe what is meant by the term *formulation*.

Explain why substances like this must be formulated.

.....
.....

.....

[2 marks]

04 Pure iron is soft and bends easily, and is not very useful.

04.1 In science, what does the term *pure substance* mean?

[1 mark]

04.2 Pure iron is alloyed with other metals to make steel, which is more useful.

There are different types of steel depending on which other substances are added, and how much of each substance is added.

Table 4.1 shows the composition of the formulations of different steels.

Table 4.1

Type of steel	Percentage of metals (%)			
	iron	carbon	chromium	nickel
low carbon	99.70	0.30	–	–
medium carbon	99.40	0.60	–	–
high carbon	98.85	1.15	–	–
stainless austenitic	73.20	0.80	18.00	8.00
stainless ferritic		0.10	15.00	0.05
stainless martensitic	83.40	1.20	15.00	0.40

How much **iron** is in stainless ferritic steel?

[1 mark]

04.3 Explain why metal alloys are much **harder** than pure metals.

[2 marks]

Question 4 continues on the next page

04.4 Draw **one** line from each type of steel to its use.

Type of steel	Use
	jewellery
low carbon steel	cutlery
gold alloy	car body parts
high carbon steel	cutting tools
stainless steel	jet planes
	lunchboxes

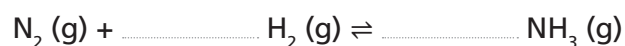
[3 marks]

04.5 Substances such as fertilisers are also formulated products.

The Haber process is used to produce fertilisers.

In the Haber process, nitrogen and hydrogen react to form ammonia.

Balance the equation for the Haber process, below.



[1 mark]

04.6 To achieve a high yield, this reaction has to happen at a specific temperature and pressure.

State the temperature and pressure that will achieve the maximum yield.

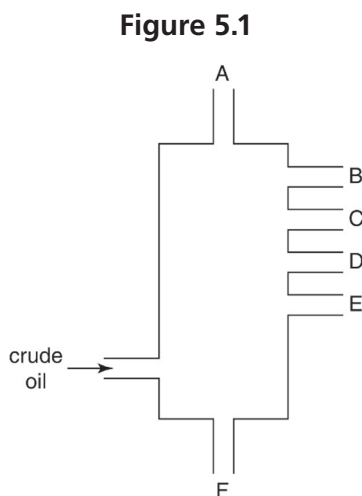
Temperature = °C

Pressure = atmospheres

[2 marks]

- 05 Crude oil is separated by fractional distillation to give products such as bitumen, diesel, petrol and LPG.

Figure 5.1 is a diagram of a fractional distillation column.



Fractional distillation allows for crude oil to be turned into useful substances.

Table 5.1 shows information about some of the useful fractions that are produced in this process.

Table 5.1

Fraction	Number of carbon atoms in the chain of the molecule	Boiling point (°C)
bitumen	70<	500–700
fuel oil	22–70	350–450
diesel	17–22	220–350
kerosene	10–16	160–220
gasoline	6–10	35–160
LPG	1–5	<35

Question 5 continues on the next page

05.1 Describe the steps involved in the process of fractional distillation of crude oil.

[4 marks]

05.2 Using **Table 5.1** and **Figure 5.1**, which letter on **Figure 5.1** represents where **LPG** is most likely to be produced?

Letter: _____

[1 mark]

05.3 Using **Table 5.1** and **Figure 5.1**, which letter on **Figure 5.1** represents where **diesel** is most likely to be produced?

Letter: _____

[1 mark]

05.4 Describe the pattern in the data between **length of carbon chain** and **boiling point of each fraction**.

Use **Table 5.1** to help you.

[1 mark]

05.5 Explain why each fraction has a range for their boiling point and not an exact temperature.

05.6 Many of the substances produced in fractional distillation can be used as fuels.

Fuels often contain combinations of hydrogen, carbon, sulfur and oxygen.

Describe the impact the formed pollutants can have on the atmosphere.

Turn over >

06 A student is investigating how temperature affects the rate of a reaction.

She is investigating how the temperature of 1 mol/dm³ hydrochloric acid affects how quickly a strip of magnesium reacts.

This is her method:

1. Place 25 cm³ of 20 °C 1 g/dm³ hydrochloric acid into a test tube.
2. Using scissors and a ruler, cut a 2 cm strip of magnesium.
3. Place the 2 cm strip of magnesium into the test tube with the acid. Start the timer.
4. When the magnesium is fully reacted, stop the timer.
5. Repeat steps 1–4 using different temperatures of 1 g/dm³ hydrochloric acid.
6. Repeat the investigation so you have three sets of results for each temperature.

06.1 Identify **two** control variables in this investigation.

1.
2.

[2 marks]

06.2 One source of inaccuracy in this experiment is the length of the magnesium strip.

Suggest an alternative method that would help overcome this.

.....
.....

[1 mark]

06.3 The student's results are shown in **Table 6.1**

Table 6.1

Temperature of 1 g / dm ³ hydrochloric acid (°C)	Time taken for the magnesium to react (s)			Mean time taken for the magnesium to react (s)
20	73	73	76	74
30	70	60	57	
40	37	33	36	35
50	24	26	24	25
60	14	16	13	14

Calculate the mean for the set of results at 30 °C

.....

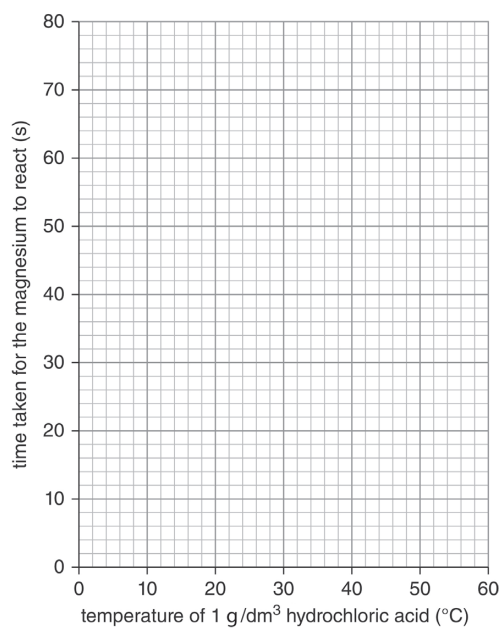
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Mean = s [2 marks]

Question 6 continues on the next page

06.4 Plot these results on the grid below.

Draw a line of best fit.



[3 marks]

06.5 Give a conclusion about how temperature affects the rate of a reaction.

Use your graph to help you.

Use collision theory to help explain your conclusion.

.....

.....

.....

.....

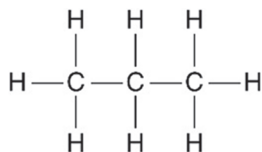
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[3 marks]

07 This question is about alkanes, alkenes and polymers.

Compound A



07.1 What is the formula of **Compound A**?

.....

[1 mark]

07.2 State the chemical name of **Compound A**.

.....

[1 mark]

07.3 Draw the structure of an **alkene** with the same number of carbons as **Compound A**.



[1 mark]

07.4 Long alkanes can be decomposed into shorter alkanes by the process of **cracking**.

Give **two** methods of cracking that can be used.

1.

2.

[2 marks]

Question 7 continues on the next page

07.5 Describe a chemical test to show whether a product of cracking is **unsaturated**.

Describe the result you would expect.

Test

.....

Result

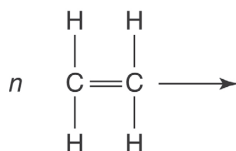
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[2 marks]

07.6 Ethene has the formula C_2H_4

We can use ethene to make poly(ethene), which is used in everyday life.

Complete the equation below to show the formation of poly(ethene) from ethene.



[3 marks]

08 Many objects are made from **finite resources**.

08.1 What is meant by the term *finite resource*?

[1 mark]

08.2 Identify **two** ways that we can prevent waste in the use of resources.

Tick **two** boxes.

Resource is sent to landfill

☐

Resource is recycled

☐

Resource is sent for incineration

☐

Resource is reused

☐

[2 marks]

08.3 Limestone and copper are both finite resources that can be used to make statues.

Table 8.1 gives some information about these materials.

Table 8.1

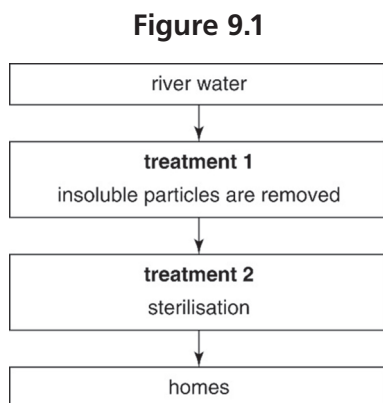
	Limestone	Copper
Extracting processes	quarrying and powdering	mining, reduction, electrolysis and alloying
Availability of raw material	readily available	rapidly reducing
Energy required to produce 1 kg of the substance	2.5 kWh	22.5 kWh
Can it be recycled?	no specific recycling systems in place; less than 5% is recycled	recycled more than any other metal used in engineering; 45% of all copper used is from recycled copper
Resistant to corrosion?	corrodes in areas where rain is more acidic	resistant; very unreactive
Average cost per kg	£2.75	£4.25

Question 8 continues on the next page

[6 marks]

09.1 For river water to be safe for human consumption, the water needs to be treated to make it potable.

Figure 9.1 shows the stages that river water goes through to be made potable.



What is the name given to the process used in **Treatment 1**?

[1 mark]

09.2 Water is sterilised in **Treatment 2** to kill any microbes that could make humans ill.

Which process is used during sterilisation?

Tick **one** box.

Adding hydrogen

☐

Neutralisation

☐

Using ultraviolet light

☐

Using microwaves

☐

[1 mark]

09.3 Another way to sterilise water is to use chlorine.

Describe the chemical test for identifying **chlorine gas**.

Describe the result you would expect.

Test

Result

[2 marks]

Question 9 continues on the next page

09.4 Table 9.1 shows the results of tests carried out on three unknown solutions.

Table 9.1

Solution	Test and result			
	Flame test	Sodium hydroxide solution	Barium chloride solution and acid added	Hydrochloric acid added; delivery tube connected to limewater
X	lilac	–	–	limewater turned cloudy
Y	–	brown precipitate	white precipitate	–
Z	–	white precipitate which dissolves in excess sodium hydroxide and goes colourless	–	–

Identify X and Y and the metal ion in Z.

Solution X is

Solution Y is

Metal ion in Z is

[5 marks]

09.5 Elements and compounds can also be identified using instrumental methods.

Suggest **one** way that instrumental methods are better than more traditional methods.

.....

[1 mark]

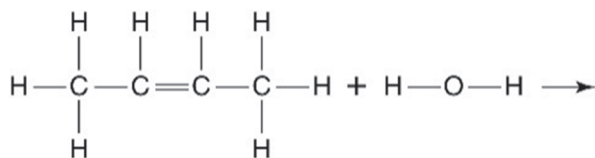
10.1 Alkenes are a family of hydrocarbons with many uses. They undergo many reactions.

What is meant by the term *hydrocarbon*?

.....
.....

[2 marks]

10.2 Complete the equation below to show the product which forms in the reaction between butene C_4H_8 and steam H_2O .



[2 marks]

10.3 What is the functional group that alcohols contain?

.....

[1 mark]

10.4 Propanoic acid is a carboxylic acid which can be made from propanol and one other reactant.

Name the other reactant.

State the type of reaction.

Reactant

Type of reaction [2 marks]

END OF QUESTIONS

Metals

Metals
Non-metals

*The lanthanides (atomic numbers 58–71) and the actinides (atomic numbers 90–103) have been omitted. The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.