SPECIMEN MATERIAL

GCSE CHEMISTRY

F

Foundation Tier Chemistry 2F

Specimen 2018 Time allowed: 1 hour 45 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 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 11.3 and 12.2 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 mixtures and analysis.

0 1 . 1 Which **two** substances are mixtures?

[2 marks]

Tick **two** boxes.

- Air ☐
- Carbon dioxide ☐
- Graphite ☐
- Sodium Chloride ☐
- Steel ☐

0 1 . 2 Draw **one** line from each context to the correct meaning.

[2 marks]

Context	Meaning
	A substance that has had nothing added to it
Pure substance in chemistry	A single element or a single compound
	A substance containing only atoms which have different numbers of protons
Pure substance in everyday life	A substance that can be separated by filtration
	A useful product made by mixing substances

0 1 . 3 What is the test for chlorine gas?

[1 mark]

Tick **one** box.

- A glowing splint relights ☐
- A lighted splint gives a pop ☐
- Damp litmus paper turns white ☐
- Limewater turns milky ☐

0 1 . 4 A student tested a metal chloride solution with sodium hydroxide solution.

A brown precipitate formed.

What was the metal ion in the metal chloride solution?

[1 mark]

Tick **one** box.

- Calcium ☐
- Copper(II) ☐
- Iron(II) ☐
- Iron(III) ☐

Turn over for the next question

0 2 The word equation shows the reaction between anhydrous cobalt chloride and water.

anhydrous cobalt chloride (blue) + water $\rightleftharpoons$ hydrated cobalt chloride (pink)

0 2 . 1 Name the type of reaction shown by the sign $\rightleftharpoons$

[1 mark]

0 2 . 2 When the student added water to anhydrous cobalt chloride what happened?

[1 mark]

0 2 . 3 A student measured the temperature rise when anhydrous cobalt chloride was added to water.

The student's results are shown in **Table 1**.

Table 1

	Trial 1	**Trial 2**	**Trial 3**
Temperature rise in °C	8.5	8.2	8.2

Calculate the mean temperature rise.

[1 mark]

Temperature = _____ °C

0 2 . 4 When water was added to anhydrous cobalt chloride an exothermic reaction took place.

Name the type of reaction when hydrated cobalt chloride reacts to form anhydrous cobalt chloride and water.

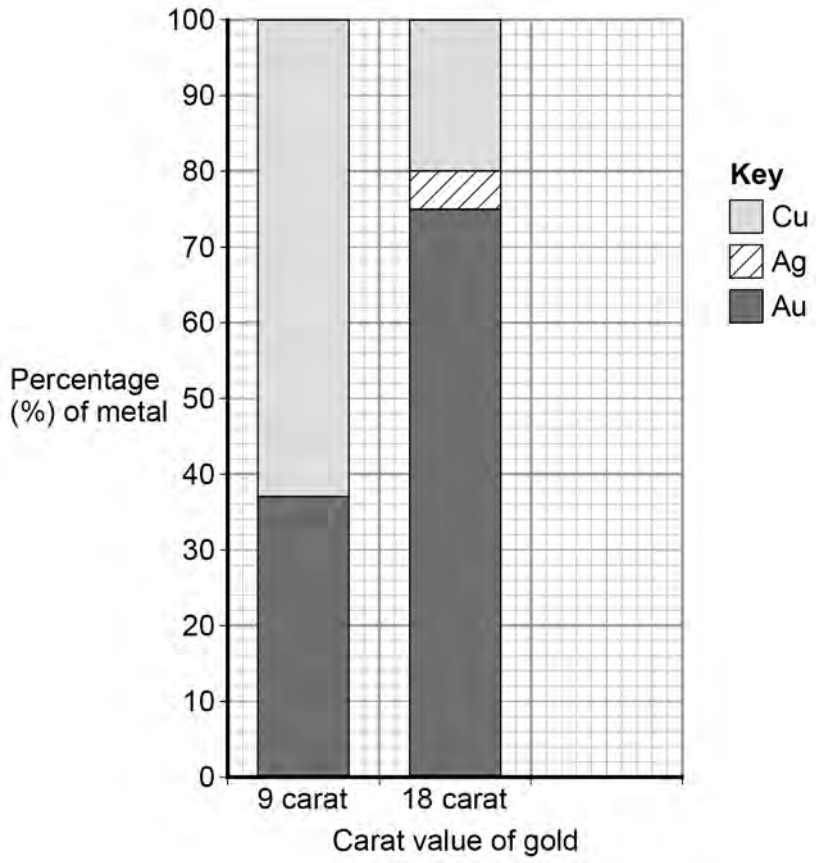
[1 mark]

Turn over for the next question

0 3 Gold is mixed with other metals to make jewellery.

Figure 2 shows the composition of different carat values of gold.

Figure 2



0 3 . 1 What is the percentage of gold in 12 carat gold?

[1 mark]

Tick **one** box.

12 %	☐	**30 %**	☐	**50 %**	☐	**80 %**	☐

0 3 . 2 Give the percentage of silver in 18 carat gold.

[1 mark]

Use **Figure 2** to answer this question.

Percentage = _____ %

0 3 . 3 Suggest **two** reasons why 9 carat gold is often used instead of pure gold to make jewellery.

[2 marks]

1 _____

_____

2 _____

_____

Turn over for the next question

Turn over for the next question

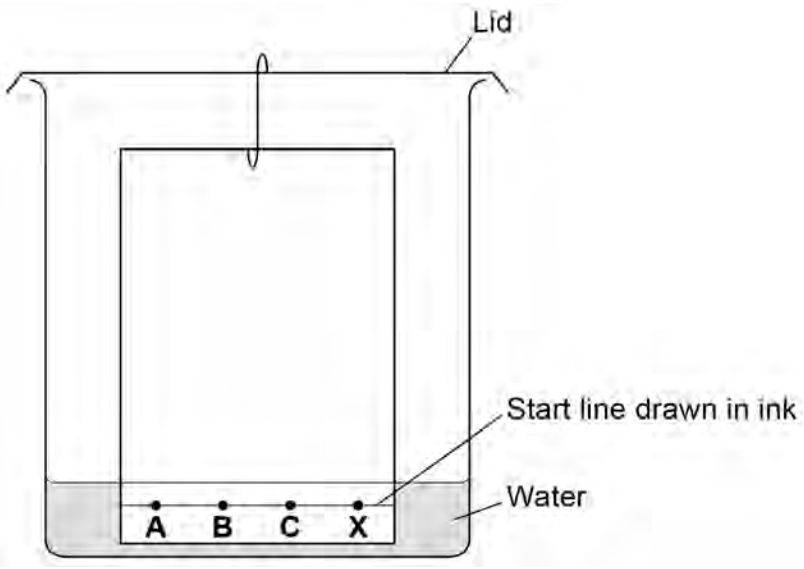
0 4 A student investigated a food colouring using paper chromatography.

This is the method used.

1. Put a spot of food colouring **X** on the start line.
2. Put spots of three separate dyes, **A**, **B** and **C**, on the start line.
3. Place the bottom of the paper in water and leave it for several minutes.

0 4 . 1 **Figure 3** shows the apparatus the student used.

Figure 3



Give **two** mistakes the student made in setting up the experiment.

[2 marks]

Tick **two** boxes.

The lid was on the beaker. ☐

The paper did not touch the bottom of the beaker. ☐

The spots were too small. ☐

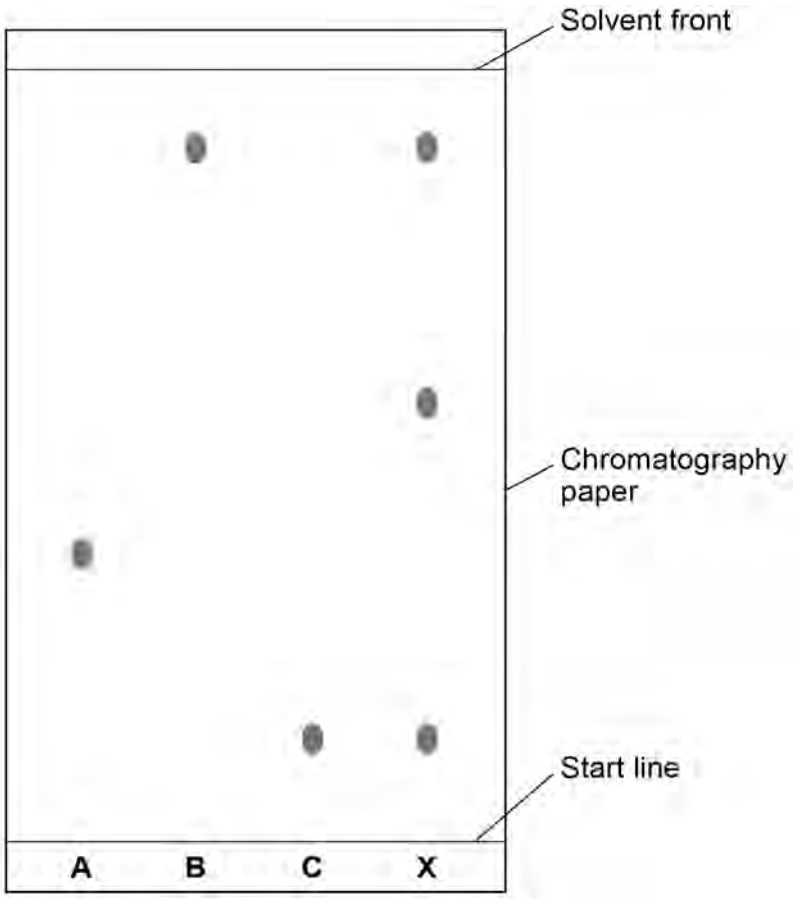
The start line was drawn in ink. ☐

The water level was above the spots. ☐

Another student set the experiment up correctly.

Figure 4 shows the student's results.

Figure 4



0 4 . 2 How many dyes were in **X**?

[1 mark]

Tick **one** box.

1		**3**		**4**		**6**	

0 4 . 3 Which dye, **A**, **B** or **C**, is **not** in **X**?

[1 mark]

Write your answer in the box.

0 4 . 4 Use **Figure 4** to complete **Table 1**.

Calculate the value for R_f for dye **A**.

[5 marks]

Table 1

	Distance in mm
Distance moved by dye **A**	……..
Distance from start line to solvent front	…….

Use the equation:

$$R_f = \frac{\text{distance moved by dye } \mathbf{A}}{\text{distance moved by solvent}}$$

Give your answer to two significant figures.

R_f value = _____

Turn over for the next question

0 5 Greenhouse gases affect the temperature of the Earth.

0 5 . 1 Which gas is a greenhouse gas?

[1 mark]

Tick **one** box.

- Argon ☐
- Methane ☐
- Nitrogen ☐
- Oxygen ☐

0 5 . 2 An increase in global temperature will cause climate change.

What is **one** possible effect of climate change?

[1 mark]

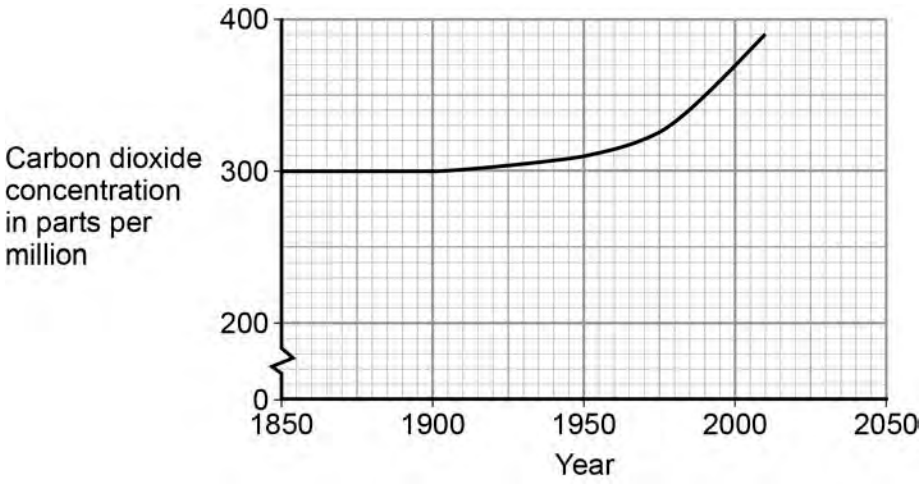
Tick **one** box.

- Deforestation ☐
- Global dimming ☐
- Sea levels rising ☐
- Volcanic activity ☐

Carbon dioxide is also a greenhouse gas.

Figure 5 shows how the concentration of carbon dioxide in the atmosphere has changed since 1850.

Figure 5



0 5 . 3 Which process is the reason for the change in carbon dioxide concentration shown on **Figure 5**?

[1 mark]

Tick **one** box.

- Burning of fossil fuels ☐
- Carbon capture ☐
- Formation of sedimentary rocks ☐
- Photosynthesis ☐

Question 5 continues on the next page

0 5 . 4 Give **three** conclusions that can be made from **Figure 5**.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

0 6 **Table 2** gives information about four alcohols.

Table 2

Alcohol	Formula	Melting point in °C	Boiling point in °C
Methanol	CH_3OH	-94	65
Ethanol	CH_3CH_2OH	-118	78
Propanol	$CH_3CH_2CH_2OH$	-129	97
Butanol	$CH_3CH_2CH_2CH_2OH$	-89	118

0 6 . 1 Which alcohol in **Table 2** is liquid over the greatest temperature range?

[1 mark]

0 6 . 2 Which statement is correct?

[1 mark]

Tick **one** box.

- A molecule of ethanol has 5 hydrogen atoms ☐
- Butanol has the highest boiling point ☐
- Methanol has the largest molecules ☐
- Propanol has the highest melting point ☐

Question 6 continues on the next page

0 6 . 3 A molecule of methanol has five single covalent bonds.

Draw the missing bonds in **Figure 6** to complete the displayed formula for methanol.

[1 mark]

Figure 6

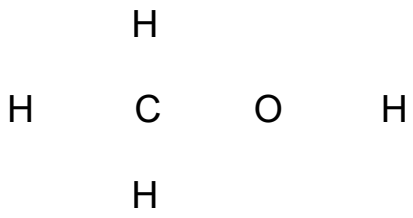
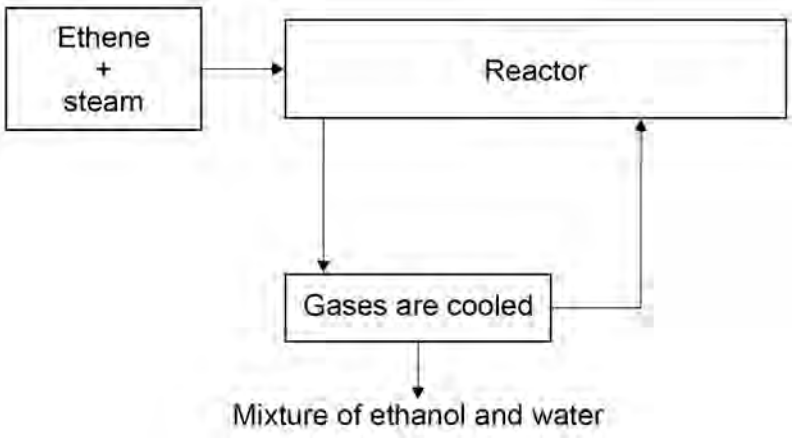


Figure 7 shows a flow diagram of the process to produce ethanol.

Figure 7



0 6 . 4 Complete the word equation for the reaction to produce ethanol.

[1 mark]

_____ + _____ → ethanol

0 6 . 5 What happens to the unreacted ethene?

[1 mark]

0 6 . 6 Wine contains ethanol.
A bottle of wine was left open in air.
After a few days, the wine tasted of vinegar.
Vinegar is a solution of ethanoic acid in water.

Explain how oxidation causes the wine to taste of vinegar after a few days.

[3 marks]

Turn over for the next question

0 7 . 1 Nitrogen and hydrogen are passed over iron to produce ammonia in the Haber Process.

Balance the equation for the reaction.

[1 mark]

N_2 + H_2 → NH_3

0 7 . 2 What is iron used for in the Haber process?

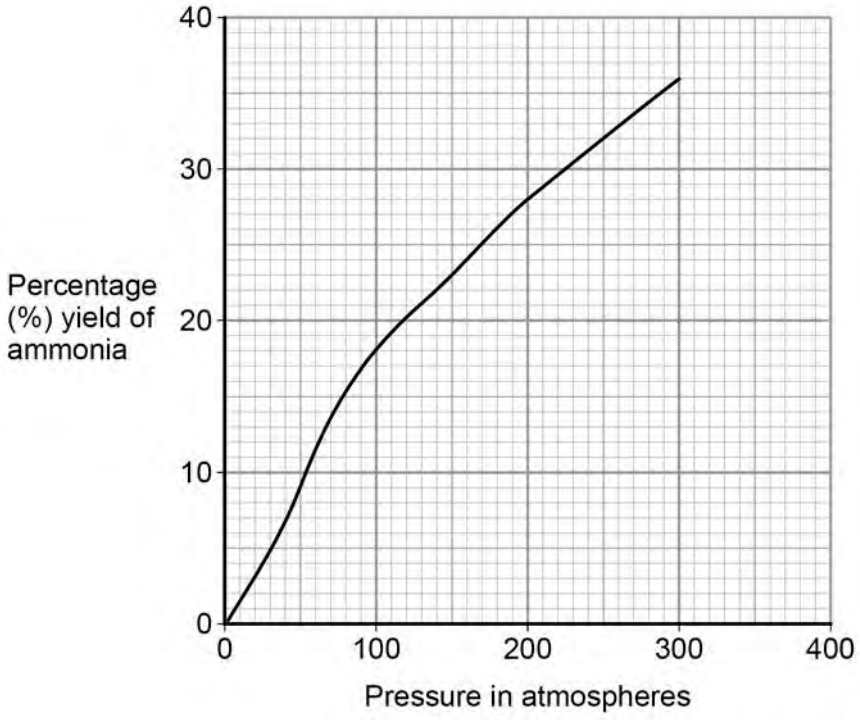
[1 mark]

Tick **one** box.

- catalyst ☐
- fuel ☐
- monomer ☐
- reactant ☐

0 7 . 3 **Figure 8** shows how the percentage yield of ammonia changes with pressure.

Figure 8



Describe the trend shown in **Figure 8**.

[1 mark]

0 7 . 4 Use **Figure 8** to determine the difference in percentage yield of ammonia at 150 atmospheres pressure and 250 atmospheres pressure.

[2 marks]

Difference in percentage yield of ammonia = _____ %

Turn over for the next question

0 8 This question is about hydrocarbons.

0 8 . 1 The names and formulae of three hydrocarbons in the same homologous series are:

Ethane	C_2H_6
Propane	C_3H_8
Butane	C_4H_{10}

The next member in the series is pentane.

What is the formula of pentane?

[1 mark]

0 8 . 2 Which homologous series contains ethane, propane and butane?

[1 mark]

Tick **one** box.

- Alcohols ☐
- Alkanes ☐
- Alkenes ☐
- Carboxylic acids ☐

0 8 . 3 Propane (C_3H_8) is used as a fuel.

Complete the equation for the complete combustion of propane.

[2 marks]

C_3H_8 + $5O_2$ → 3 _____ + 4 _____

0 8 . 4 Octane (C_8H_{18}) is a hydrocarbon found in petrol.

Explain why octane is a hydrocarbon.

[2 marks]

0 8 . 5 **Table 3** gives information about the pollutants produced by cars using diesel or petrol as a fuel.

Table 3

Fuel	Relative amounts of pollutants		
	Oxides of Nitrogen	Particulate matter	Carbon dioxide
Diesel	31	100	85
Petrol	23	0	100

Compare the pollutants from cars using diesel with those from cars using petrol.

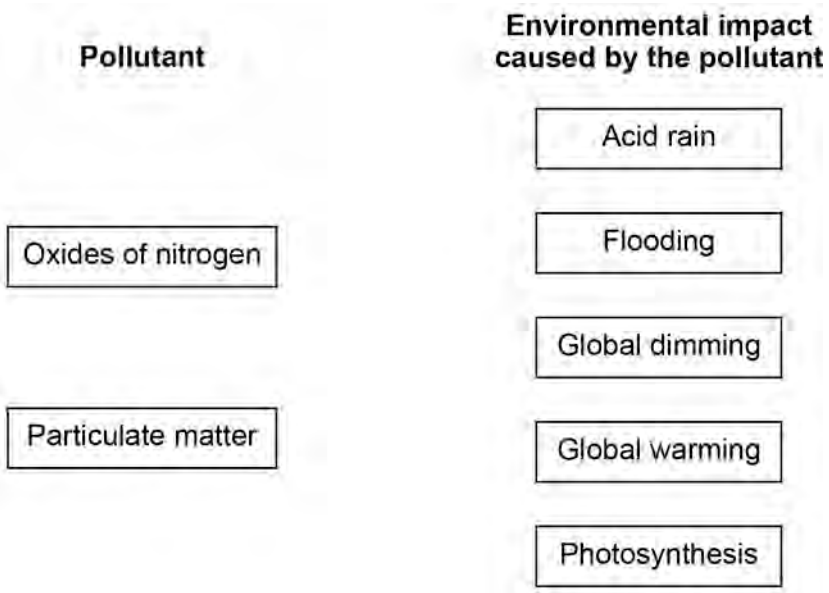
[3 marks]

Question 8 continues on the next page

0 8 . 6 Pollutants cause environmental impacts.

Draw **one** line from each pollutant to the environmental impact caused by the pollutant.

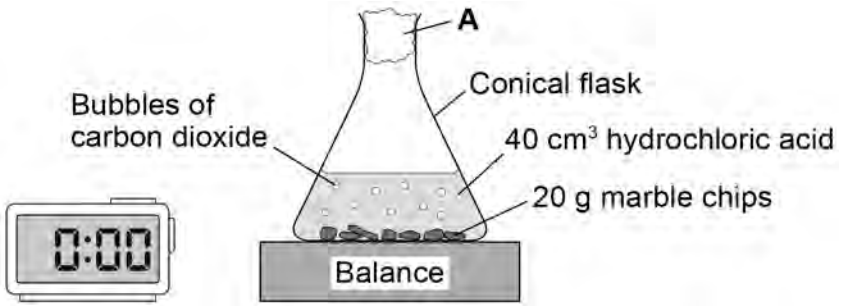
[2 marks]



0 9 A student investigated the rate of reaction between marble chips and hydrochloric acid.

Figure 9 shows the apparatus the student used.

Figure 9



0 9 . 1 What is **A**?

[1 mark]

Tick **one** box.

- cotton wool ☐
- limestone ☐
- poly(ethene) ☐
- rubber bung ☐

Question 9 continues on the next page

0 9 . 2 **Table 4** shows the student's results for one investigation.

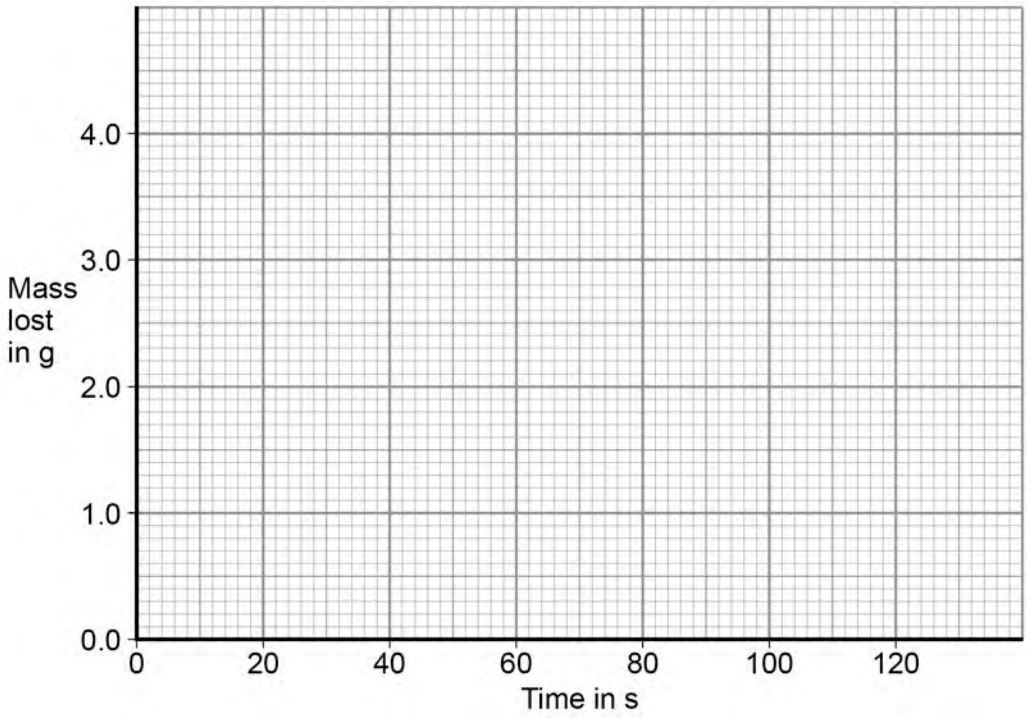
Table 4

Time in s	Mass lost in g
0	0.0
20	1.6
40	2.6
60	2.9
80	3.7
100	4.0
120	4.0

On **Figure 10**:
- Plot these results on the grid.
- Draw a line of best fit.

[3 marks]

Figure 10



0 9 . 3 Use **Figure 10** to complete **Table 5**.

[2 marks]

Table 5

Mass lost after 0.5 minutes	…….. g
Time taken to complete the reaction	…….. s

0 9 . 4 The equation for the reaction is:

$2HCl(aq) + CaCO_3(s) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

Explain why there is a loss in mass in this investigation.

[2 marks]

Question 9 continues on the next page

0 9 . 5 Another student investigated the rate of a different reaction.

Table 6 shows the results from the different reaction.

Table 6

Mass lost when the reaction was complete	9.85 g
Time taken to complete the reaction	2 minutes 30 seconds

Calculate the mean rate of the reaction using **Table 6** and the equation:

[2 marks]

$$\text{mean rate of reaction} = \frac{\text{mass lost in g}}{\text{time taken in s}}$$

Give your answer to two decimal places.

Mean rate of reaction = _____ g/s

0 9 . 6 The student measured the change in mass of the reactants.

Describe another method, other than measuring the change in mass of the reactions, that the student could have used to find the rate of the reaction between marble chips and hydrochloric acid.

[2 marks]

0 9 . 7 Another student planned to investigate the effect of temperature on the rate of reaction.
The student predicted that the rate of reaction would increase as the temperature was increased.

Give **two** reasons why the student's prediction is correct.

[2 marks]

Tick **two** boxes.

- The particles are more concentrated. ☐
- The particles have a greater mass. ☐
- The particles have a larger surface area. ☐
- The particles have more energy. ☐
- The particles move faster. ☐

Turn over for the next question

1 0 Water from a lake in the UK is used to produce drinking water.

1 0 . 1 What are the two main steps used to treat water from lakes?

Give a reason for each step.

[2 marks]

Step 1 _____

Reason _____

Step 2 _____

Reason _____

1 0 . 2 Explain why it is more difficult to produce drinking water from waste water than from water in lakes.

[3 marks]

_____

_____

_____

_____

_____

_____

1 0 . 3 Some countries make drinking water from sea water.

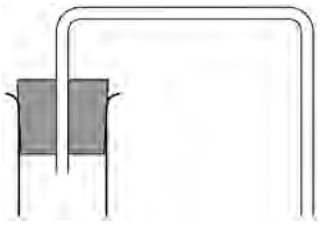
Complete **Figure 11** to show how you can distil salt solution to produce and collect pure water.

Label the following:

- pure water
- salt solution

[3 marks]

Figure 11



Question 10 continues on the next page

1 0 . 4 How could the water be tested to show it is pure?

Give the expected result of the test for pure water.

[2 marks]

1 0 . 5 Why is producing drinking water from sea water expensive?

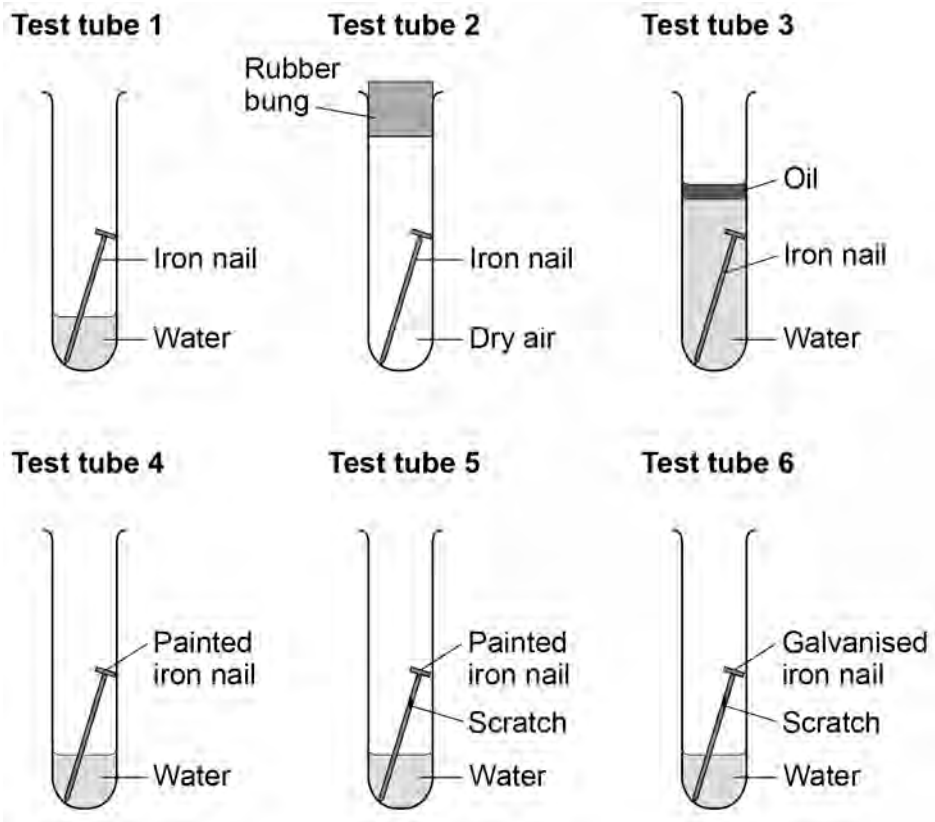
[1 mark]

1 1 **Figure 12** shows six test tubes a student set up to investigate the rusting of iron.

This is the method used for each test tube.

1. Measure the mass of the nail using a balance.
2. Leave the nail in the test tube for 6 days.
3. Measure the mass of the nail after 6 days.

Figure 12



Question 11 continues on the next page

Table 7 shows the student's measurements.

Table 7

Test tube	Mass of nail in g	Mass of nail after 6 days in g
1	8.45	8.91
2	8.46	8.46
3	8.51	8.51
4	9.65	9.65
5	9.37	9.45
6	9.79	9.79

1 1 . 1 What is the resolution of the balance the student used?

[1 mark]

Tick **one** box.

1×10^{-3} g ☐

1×10^{-2} g ☐

1×10^{-1} g ☐

1×10^{2} g ☐

1 1 . 2 Calculate the difference in percentage increase in mass after 6 days of the nail in test tube **1** and the nail in test tube **5**.

Give your answer to **three** significant figures.

[4 marks]

Difference in percentage increase in mass = _____ %

Question 11 continues on the next page

1 1 . 3 Use the results of the student's investigations to draw conclusions about the factors affecting the rusting of iron. Include an evaluation of the effectiveness of different coatings at preventing the rusting of iron.

[6 marks]

1 1 . 4 Rust is hydrated iron(III) oxide.

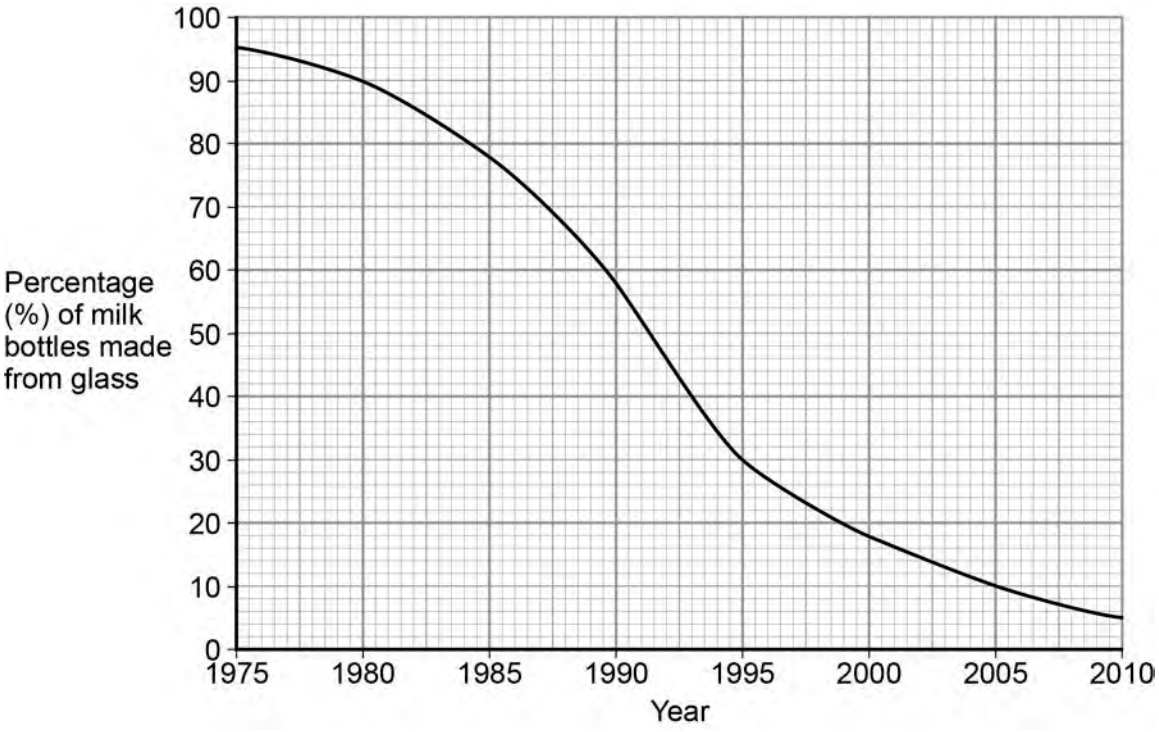
Complete the word equation for the reaction.

[2 marks]

_____ + _____ + _____ → hydrated iron(III) oxide

1 2 Plastic and glass can be used to make milk bottles.

Figure 13 shows the percentage of milk bottles made from glass between 1975 and 2010.



1 2 . 1 Plot the points and draw a line on **Figure 13** to show the percentage of milk bottles made from materials **other** than glass between 1975 and 2010.

[3 marks]

Question 12 continues on the next page

1 2 . 2 **Table 8** gives information about milk bottles.

Table 8

	Glass milk bottle	**Plastic milk bottle**
Raw materials	Sand, limestone, salt	Crude oil
Bottle material	Soda-lime glass	HD poly(ethene)
Initial stage in production of bottle material	Limestone and salt used to produce sodium carbonate.	Production of naphtha fraction.
Maximum temperature in production process	1600 °C	850 °C
Number of times bottle can be used for milk	25	1
Size(s) of bottle	0.5 dm^3	0.5 dm^3, 1 dm^3, 2 dm^3, 3 dm^3
Percentage (%) of recycled material used in new bottles	50 %	10 %

Evaluate the production and use of bottles made from soda-lime glass and those made from HD poly(ethene).

Use the information given and your knowledge and understanding to justify your choice of material for milk bottles.

[6 marks]

END OF QUESTIONS

There are no questions printed on this page