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GCSE (9–1) Combined Science (Chemistry) A (Gateway Science)

J250/04 Paper 4, C4–C6 and CS7 (PAGs C1–C5)
(Foundation Tier)

Wednesday 13 June 2018 – Morning

Time allowed: 1 hour 10 minutes

You must have:
- a ruler (cm/mm)
- the Data Sheet (for Chemistry A (inserted))

You may use:
- a scientific or graphical calculator
- an HB pencil

First name									
Last name									
Centre number						Candidate number				

INSTRUCTIONS
- The Data Sheet will be found inside this document.
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

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SECTION A

Answer **all** questions.

You should spend a maximum of 20 minutes on this section.

1 Large scale desalination is used to make drinking water from seawater in hot countries.

What is the name of the technique used to remove the dissolved salts from seawater to get drinking water?

A Chromatography

B Evaporation

C Filtration

D Simple distillation

Your answer ☐ **[1]**

2 Which statement about catalysts is correct?

A A catalyst decreases the rate of many different reactions.

B A catalyst for one reaction will be the catalyst for many different reactions.

C A catalyst has no effect on the rate of the reaction.

D A catalyst usually increases the rate of a reaction.

Your answer ☐ **[1]**

3 Look at the table.

	State at room temperature	Electronic structure
A	Gas	2.7
B	Gas	2.8.7
C	Liquid	2.8.7
D	Solid	2.7

Which row in the table has the correct information about chlorine?

Your answer ☐ **[1]**

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4 Iron can be extracted from its ore by heating it with carbon.

Which statement is the correct explanation for this?

A Iron is above carbon in the reactivity series.

B Iron is above copper in the reactivity series.

C Iron is below carbon in the reactivity series.

D Iron is below sodium in the reactivity series.

Your answer ☐ **[1]**

5 Look at the table.

	Nitrogen	**Oxygen**	**Carbon dioxide**
A	21%	78%	0.04%
B	80%	15%	5%
C	70%	20%	10%
D	78%	21%	0.04%

Which row in the table shows the correct percentages of gases in the present day atmosphere?

Your answer ☐ **[1]**

6 Look at the equation for the reaction between nitrogen and hydrogen to make ammonia.

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

The reaction forms a **dynamic equilibrium**.

Which of the following describes dynamic equilibrium?

A All the reactants and products are gases.

B The rate of the backward reaction is greater than the rate of the forward reaction.

C The rate of the forward and backward reactions are equal.

D The rate of the forward reaction is greater than the rate of the backward reaction.

Your answer ☐ **[1]**

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7 The Group 0 elements are unreactive.

Why are they unreactive?

A They all exist as single atoms.

B They are all gases.

C They have a full outer electron shell.

D They need one electron to gain a full outer electron shell.

Your answer ☐ **[1]**

8 Look at the boiling points of some Group 7 elements.

Element	Boiling point in °C
Fluorine	−188
Chlorine	−34
Bromine	59

What is the most likely boiling point of iodine?

A −20 °C

B 50 °C

C 184 °C

D 350 °C

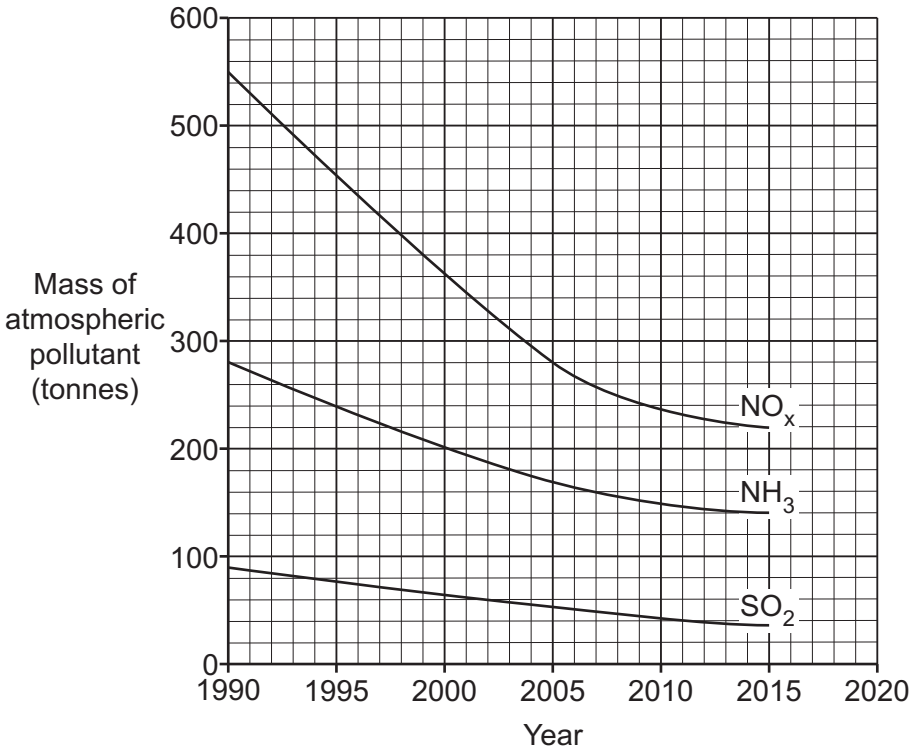
Your answer ☐ **[1]**

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9 The graph shows how the masses of three atmospheric pollutants have changed in one city since 1990.

The atmospheric pollutants are:

- Oxides of nitrogen, NO_x
- Ammonia, NH_3
- Sulfur dioxide, SO_2



In which year was 280 tonnes of **oxides of nitrogen** present in the atmosphere?

A 1990

B 2000

C 2005

D 2010

Your answer ☐ **[1]**

10 Look at the graph in question 9.

Which statement is true based on the data on the graph?

A In 2015 the level of oxides of nitrogen was higher than the levels of sulfur dioxide or ammonia.

B The levels of all three pollutants fell by the same amount between 1990 and 2015.

C The level of ammonia fell the most between 1990 and 2015.

D The level of sulfur dioxide decreased by more than half between 2000 and 2015.

Your answer ☐ **[1]**

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SECTION B

Answer **all** questions.

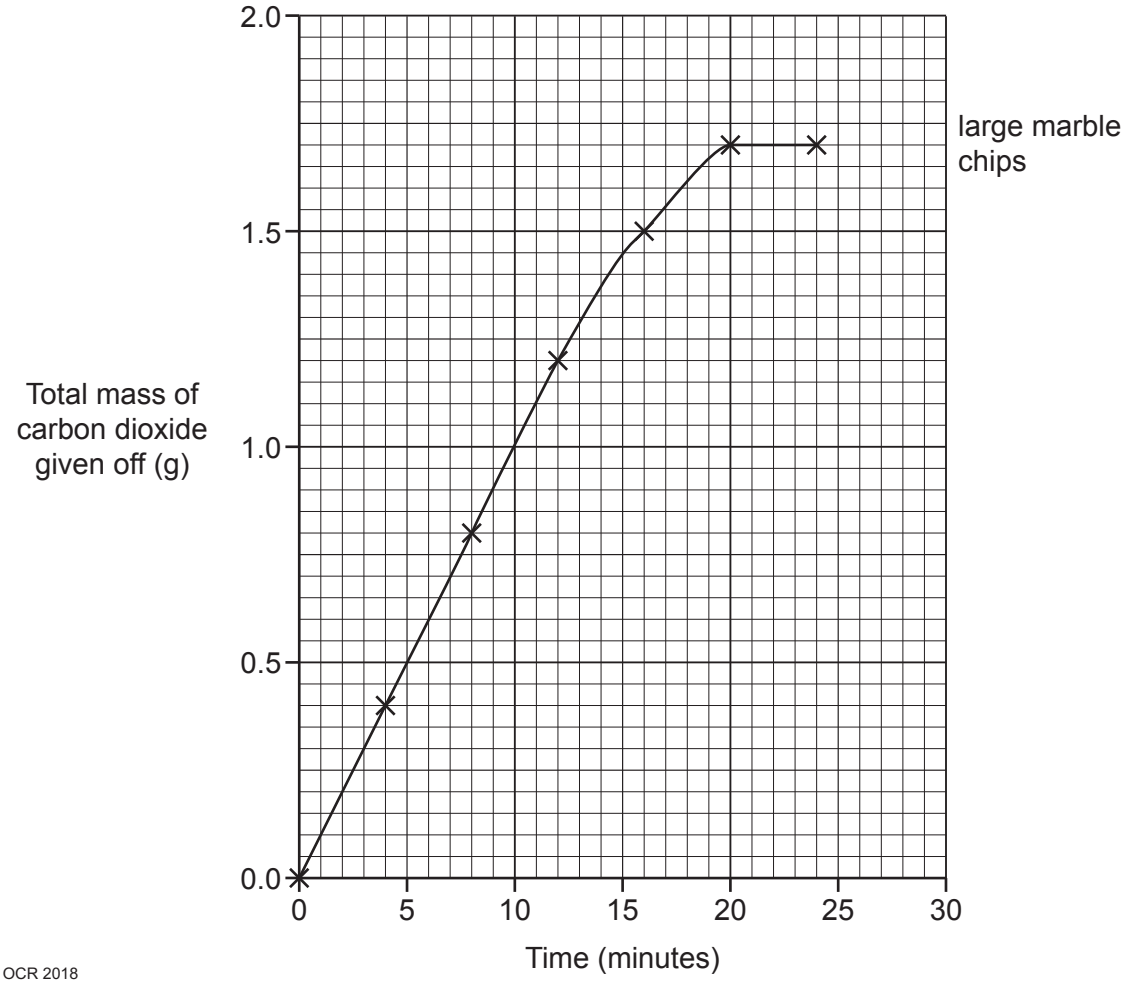
11 A student investigates the rate of reaction between marble chips and hydrochloric acid.

Both experiments use 50 cm^3 of hydrochloric acid and an excess of marble chips.

He measures the total mass of carbon dioxide given off for different sizes of marble chips.

Look at his results.

Time (minutes)	Total mass of carbon dioxide given off (g)	
	Large marble chips	Small marble chips
0	0.0	0.0
4	0.4	0.8
8	0.8	1.4
12	1.2	1.6
16	1.5	1.7
20	1.7	1.7
24	1.7	1.7



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(a) The student has plotted his results for the large marble chips on the graph.

(i) Plot the results for the **small** marble chips. **[2]**

(ii) Draw a line of best fit. **[1]**

(b) Look at the line for the **large** marble chips.

(i) How long does it take for the reaction to finish?

Answer = ... minutes **[1]**

(ii) What mass of carbon dioxide is given off after 15 minutes?

Answer = ... g **[1]**

(c) The reaction is faster with small marble chips.

Write down **two** ways that the graph shows this is correct.

1 .....

.....

2 .....

.....

[2]

(d) Both small and large marble chips give off the same mass of carbon dioxide at the end of the experiments.

Suggest why.

..... **[1]**

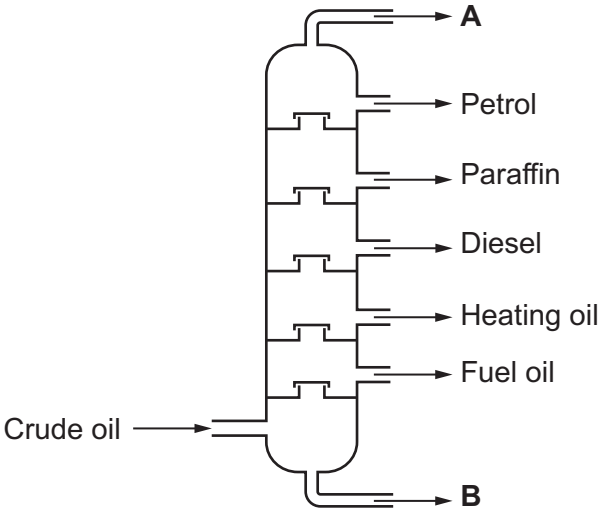
(e) A balance was used to measure the amount of carbon dioxide given off.

Write down the name of a different piece of equipment that could be used to measure the amount of carbon dioxide produced.

..... **[1]**

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12 Crude oil can be separated into useful substances called fractions.



(a) Write down the name of the process that separates crude oil into fractions.

..... **[1]**

(b) Name the fractions **A** and **B**.

A .....

B .....

[2]

(c) Here are the boiling ranges for petrol and diesel.

Fraction	Approximate boiling range (°C)	Number of carbons
Petrol	30–80	5–10
Diesel	205–290	13–17

(i) How do the sizes of molecules in petrol and diesel differ?

..... **[1]**

(ii) Explain why the boiling range for petrol is different from the boiling range for diesel.

.....

.....

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..... **[3]**

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(d) Not enough petrol is made from crude oil to meet world demand.

Oil refineries make more petrol using a process called **cracking**.

Describe how cracking makes more petrol from other hydrocarbons.

Include the conditions needed.

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..... **[3]**

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13 Complete the sentences about how the Earth's atmosphere has evolved.

Choose words from the list.

argon	**condensed**
melted	**nitrogen**
oxygen	**sunlight**
thunderstorms	**volcanoes**

The earliest atmosphere was made up of ammonia, carbon dioxide and water vapour.

These gases were released by ..... .

The water vapour ..... to form the oceans.

Ammonia was converted by bacteria in the soil to make ..... .

The earliest plants photosynthesised.

They absorbed carbon dioxide and released ..... gas.

[4]

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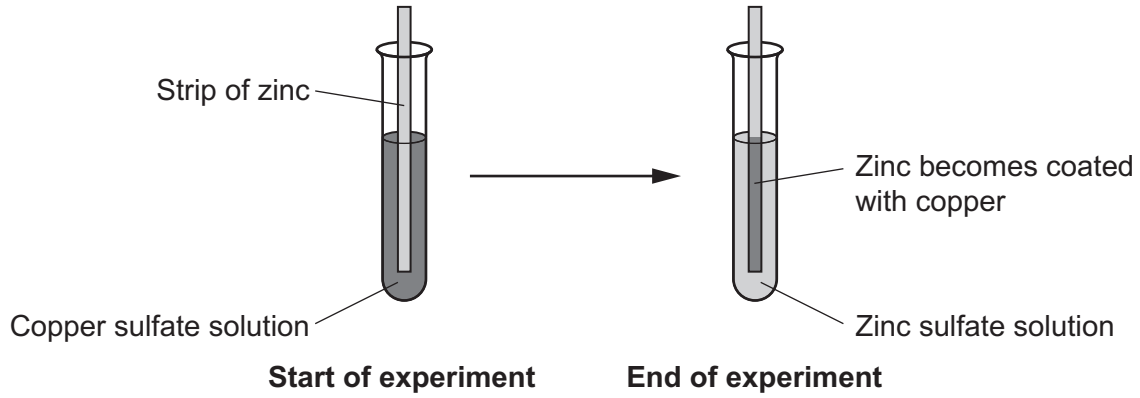
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14 A student investigates the reactivity of some metals with metal salts.

The diagram shows one of the experiments that he does.



He repeats the experiment using other metals and solutions.

Look at his results.

Solution	Metal added				
	Silver	Zinc	Magnesium	Copper	Iron
Copper sulfate	✗	✓	✓		✓
Zinc sulfate	✗		✓	✗	✗
Silver nitrate		✓	✓	✓	✓
Magnesium sulfate	✗	✗		✗	✗
Iron sulfate	✗	✓	✓	✗	

✓ = Metal reacts
✗ = Metal does not react

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(a) Use the results to place the metals in order of reactivity.

Most reactive metal .....

.....

.....

.....

Least reactive metal .....

Explain your reasoning.

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..... **[4]**

(b) Write a **word equation** for the reaction between copper and silver nitrate solution.

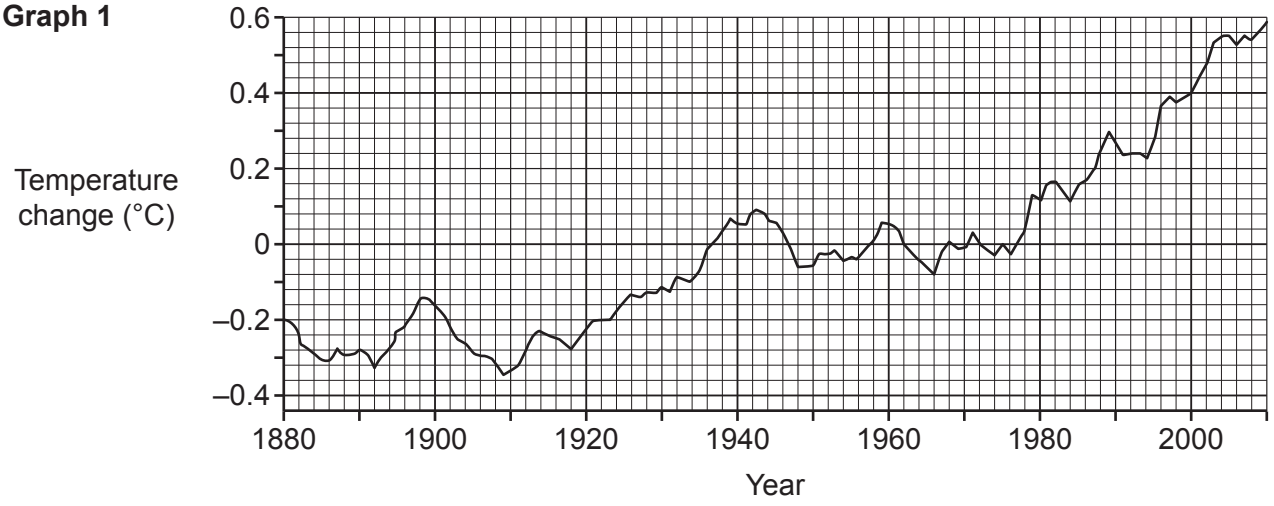
..... **[1]**

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15 Look at the graphs.

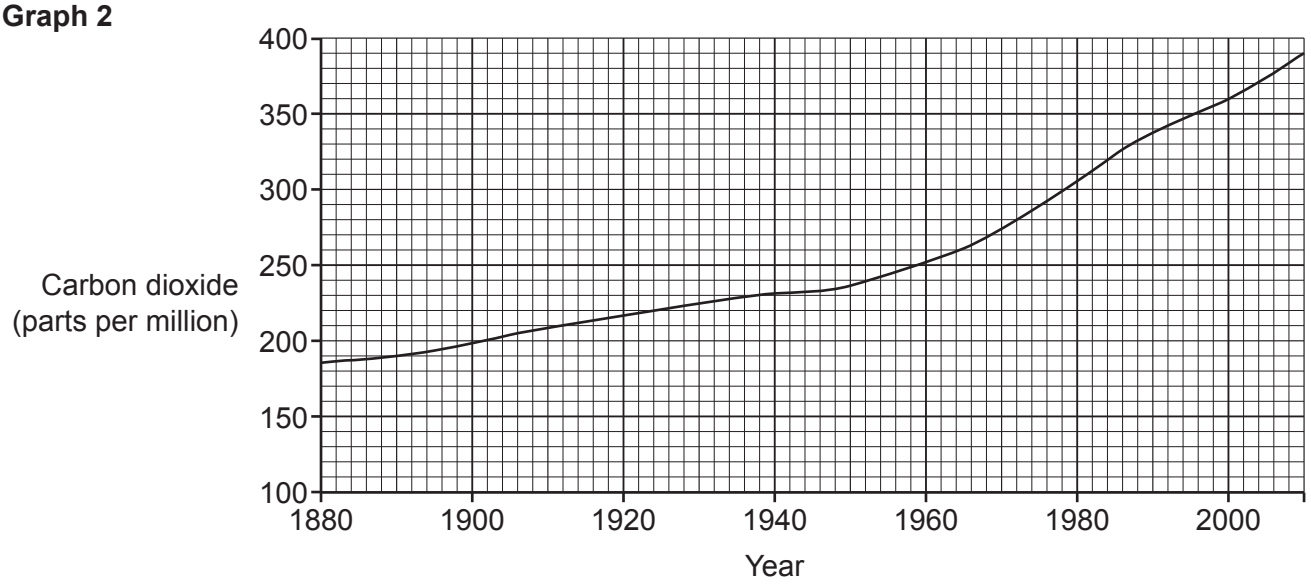
Graph 1 shows how the Earth's temperature has changed between 1880 and 2010.

Graph 1



Graph 2 shows how the amount of carbon dioxide in the air has changed between 1880 and 2010.

Graph 2



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(a) In **graph 1**, how much has the Earth's temperature increased between 1880 and 2000?

Answer = ... °C **[1]**

(b) In **graph 2**, what is the difference between the amount of carbon dioxide in the air between 1880 and 2000?

Answer = ... parts per million **[1]**

(c) Some scientists believe that **graph 1** and **graph 2** show that increased levels of carbon dioxide have increased the Earth's temperature.

Other scientists believe that it is just a natural cycle of change.

Quote data from the graphs which support **both** of these arguments.

Evidence to support increased temperature of Earth .....

.....

.....

.....

Evidence to support a natural cycle .....

.....

.....

..... **[2]**

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16* Look at the information about three elements **X**, **Y** and **Z** in the Periodic Table.

Element	X	Y	Z
Atomic number	Less than 11	11	More than 11
Melting point (°C)	181	98	64
Number of electrons in outer shell	1	1	1
Density (g/cm^3)	0.53	0.97	0.89
Reaction with water	Reacts quickly making hydrogen	Reacts vigorously making hydrogen	Reacts explosively making hydrogen
Action of heat on the carbonates of X, Y and Z	Breaks down and makes carbon dioxide	No reaction	No reaction
Formula of chloride	XCl	YCl	ZCl
Melting point of chloride (°C)	614	801	773

Student A thinks that elements **X**, **Y** and **Z** are in the same Group of the Periodic Table.

Student B thinks they are in different Groups of the Periodic Table.

Analyse and explain the information in the table that supports **both** Student A's and Student B's conclusions.

Who do you think is correct?

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..... **[6]**

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17 A company wants to make a glass to hold a cold drink. They are considering materials **A** and **B**.

Look at the life cycle assessments for a glass made out of materials **A** and **B**.

Process	Material A		Material B	
	Energy used (MJ)	**Greenhouse gases made (g of CO_2)**	**Energy used (MJ)**	**Greenhouse gases made (g of CO_2)**
Extracting the raw materials	5.0	2.2	3.8	1.4
Manufacturing of the glass from the raw materials	0.4	0.3	0.4	0.1
Transporting the glasses to the shops	1.5	1.0	3.1	2.2
Process **W**	2.0	0.6	5.0	1.7
Total	.....	.....	.....	.....

(a) Complete the table to show the totals for each column. **[2]**

(b) Write down the name of process **W**.

..... **[1]**

(c) It costs more to transport glasses made from material **B**.

Suggest a reason why.

..... **[1]**

(d) Which material should the company choose?

Justify your answer.

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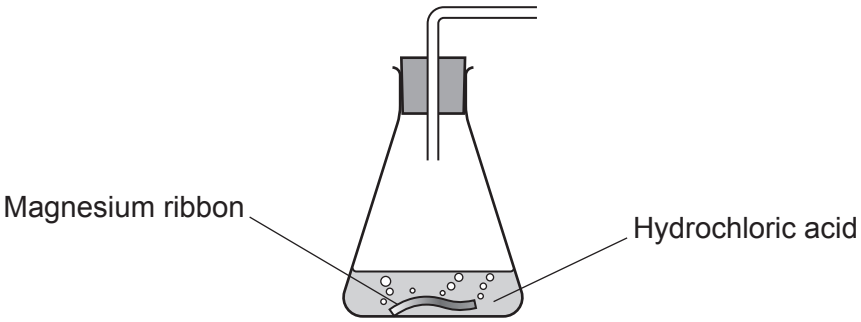
.....

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..... **[2]**

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18 A student investigates the rate of reaction between magnesium and hydrochloric acid. The reaction gives off hydrogen gas.



The student wants to investigate how changing the **concentration** of the hydrochloric acid affects the rate of reaction.

Look at her plan.

First experiment

I will put 0.5 g of magnesium ribbon into the flask.

I will add 50 cm^3 of hydrochloric acid.

I will measure how fast the gas is given off.

Second experiment

I will put another 0.5 g of magnesium ribbon into the flask.

I will add 100 cm^3 of the same hydrochloric acid.

I will measure how fast the gas is given off.

Another student thinks that the plan will not work and he does not understand exactly what he has to do.

Suggest how the plan for this investigation can be improved.

.....

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..... **[4]**

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19 The table shows some hydrocarbons from crude oil.

Name	Formula
Methane	CH_4
Propane	C_3H_8
Butane	C_4H_{10}

(a) Nonane is another hydrocarbon from crude oil.

It contains 9 carbon atoms.

Predict the formula of nonane.

..... **[1]**

(b) Write down the name of this homologous series of hydrocarbons.

..... **[1]**

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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