



0 1

This question is about organic compounds.

Hydrocarbons can be cracked to produce smaller molecules.

The equation shows the reaction for a hydrocarbon,  $C_{18}H_{38}$



0 1

. 1

Which product of the reaction shown is an alkane?

[1 mark]

Tick **one** box.

$C_2H_4$

$C_3H_6$

$C_4H_8$

$C_6H_{14}$

0 1

. 2

**Table 1** shows the boiling point, flammability and viscosity of  $C_{18}H_{38}$  compared with the other hydrocarbons shown in the equation.

**Table 1**

	<b>Boiling point</b>	<b>Flammability</b>	<b>Viscosity</b>
<b>A</b>	highest	lowest	highest
<b>B</b>	highest	lowest	lowest
<b>C</b>	lowest	highest	highest
<b>D</b>	lowest	highest	lowest

Which letter, **A**, **B**, **C** or **D**, shows how the properties of  $C_{18}H_{38}$  compare with the properties of  $C_2H_4$ ,  $C_3H_6$ ,  $C_4H_8$  and  $C_6H_{14}$ ?

[1 mark]

Tick **one** box.

**A**

**B**

**C**

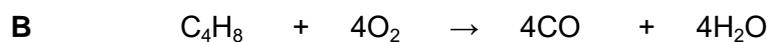
**D**

**0 1** . **3** The hydrocarbon  $C_4H_8$  was burnt in air.

Incomplete combustion occurred.

Which equation, **A**, **B**, **C** or **D**, correctly represents the incomplete combustion reaction?

[1 mark]



Tick **one** box.

**A**

**B**

**C**

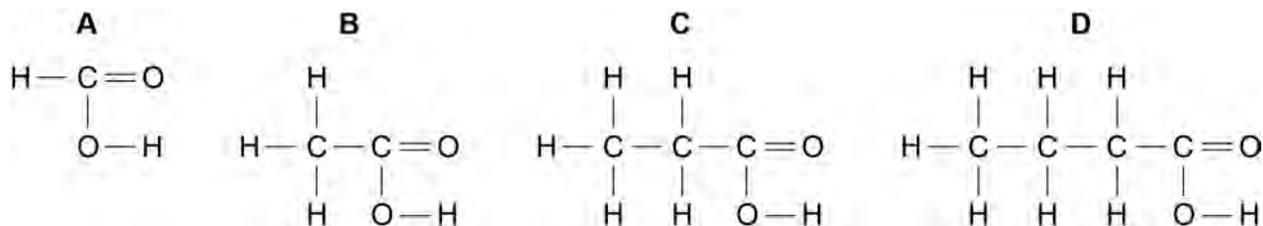
**D**

Question 1 continues on the next page

**0 1** . **4** Propanoic acid is a carboxylic acid.

Which structure, **A**, **B**, **C** or **D**, shows propanoic acid?

[1 mark]



Tick **one** box.

- |          |  |                          |
|----------|--|--------------------------|
| <b>A</b> |  | <input type="checkbox"/> |
| <b>B</b> |  | <input type="checkbox"/> |
| <b>C</b> |  | <input type="checkbox"/> |
| <b>D</b> |  | <input type="checkbox"/> |

**0 1** . **5** Propanoic acid is formed by the oxidation of which organic compound?

[1 mark]

Tick **one** box.

- |           |                          |
|-----------|--------------------------|
| Propane   | <input type="checkbox"/> |
| Propene   | <input type="checkbox"/> |
| Propanol  | <input type="checkbox"/> |
| Polyester | <input type="checkbox"/> |

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**0 2** Water from a lake in the UK is used to produce drinking water.

**0 2** . **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 \_\_\_\_\_

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

**[3 marks]**

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\_\_\_\_\_

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**Question 2 continues on the next page**

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**0 2 . 3** Some countries make drinking water from sea water.

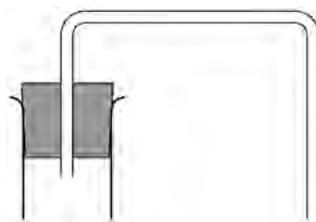
Complete **Figure 1** to show how you can distil salt solution to produce and collect pure water.

Label the following:

- pure water
- salt solution.

[3 marks]

**Figure 1**



**0 2 . 4** How could the water be tested to show it is pure?

Give the expected result of the test for pure water.

**[2 marks]**

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**0 2 . 5** Why is producing drinking water from sea water expensive?

**[1 mark]**

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**Turn over for the next question**

**0 3**

**Figure 2** shows four 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 2**

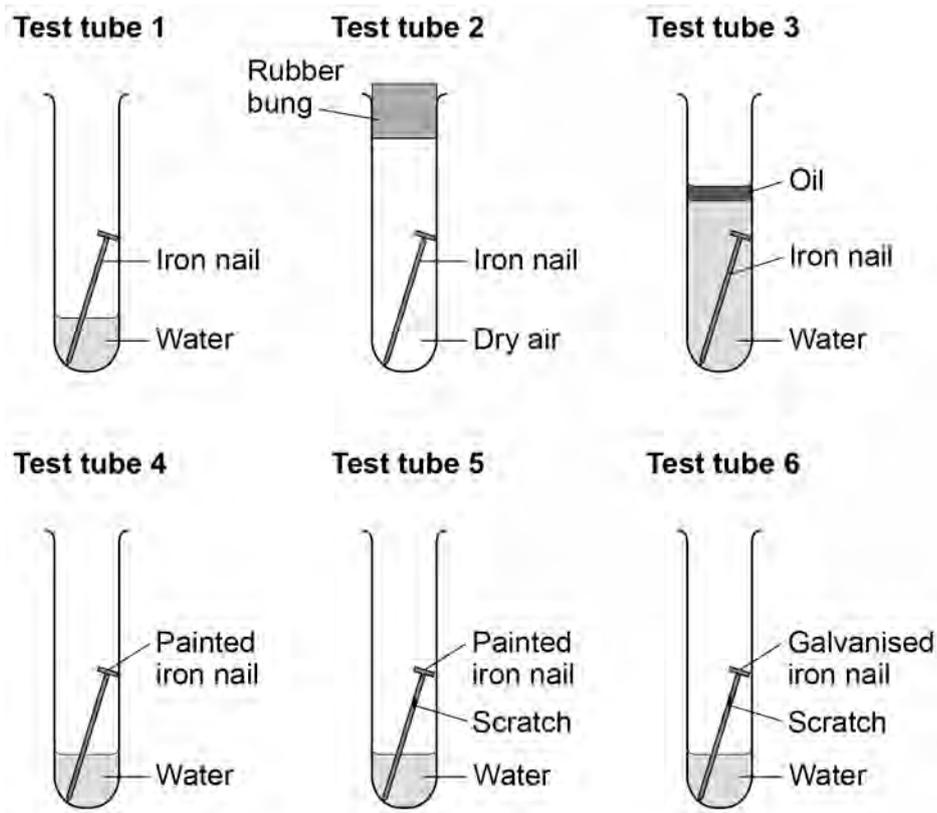


Table 2 shows the student's measurements.

Table 2

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

0 3 . 1 What is the resolution of the balance the student used?

[1 mark]

Tick **one** box.

$1 \times 10^{-3}$  g

$1 \times 10^{-2}$  g

$1 \times 10^{-1}$  g

$1 \times 10^2$  g

Question 3 continues on the next page

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**0 3** . **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]**

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Difference in percentage increase in mass = \_\_\_\_\_ %

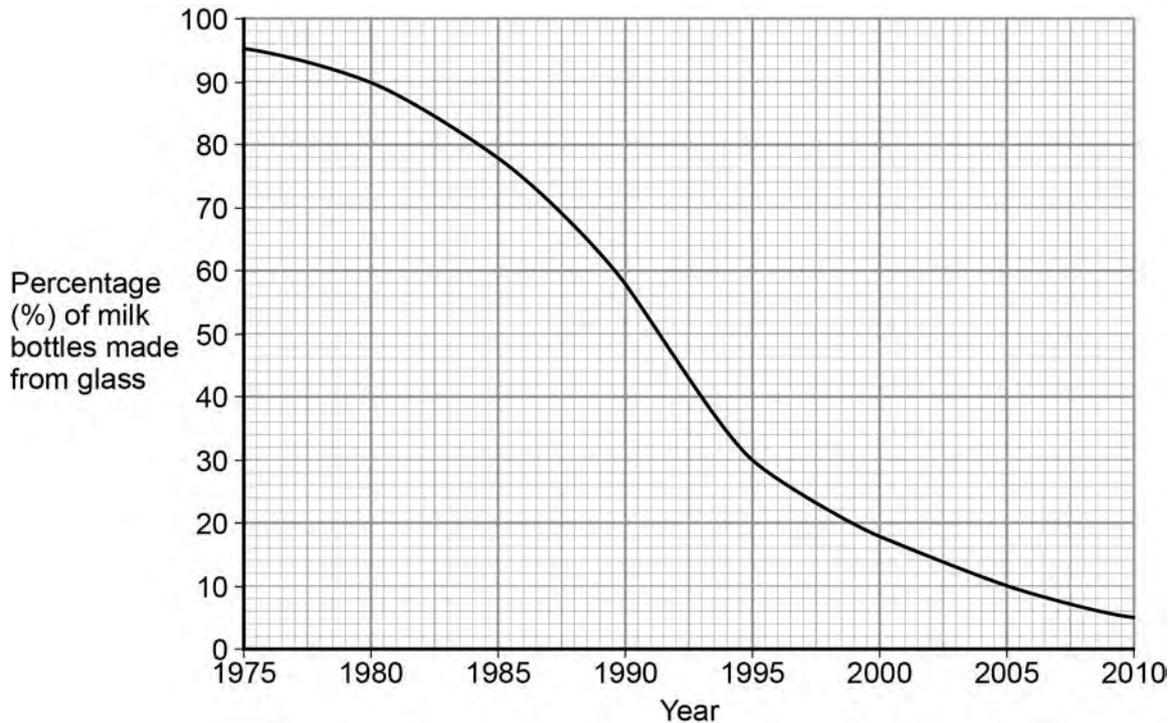


**0 4**

Plastic and glass can be used to make milk bottles.

**Figure 3** shows the percentage of milk bottles made from glass between 1975 and 2010.

**Figure 3**

**0 4****. 1**

Plot the points and draw a line on **Figure 3** to show the percentage of milk bottles made from materials **other** than glass between 1975 and 2010.

**[3 marks]**

**Question 4 continues on the next page**

**Table 3** gives information about milk bottles.

**Table 3**

	<b>Glass milk bottle</b>	<b>Plastic milk bottle</b>
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 <sup>3</sup>	0.5 dm <sup>3</sup> , 1 dm <sup>3</sup> , 2 dm <sup>3</sup> , 3 dm <sup>3</sup>
Percentage (%) of recycled material used in new bottles	50 %	10 %

- 0 4 . 2** 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]**

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This question is about the temperature of the Earth's atmosphere.

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Give **one** reason why it is difficult to produce models for future climate change.

[1 mark]

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0	5
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Describe how carbon dioxide helps to maintain temperatures on Earth.

[3 marks]

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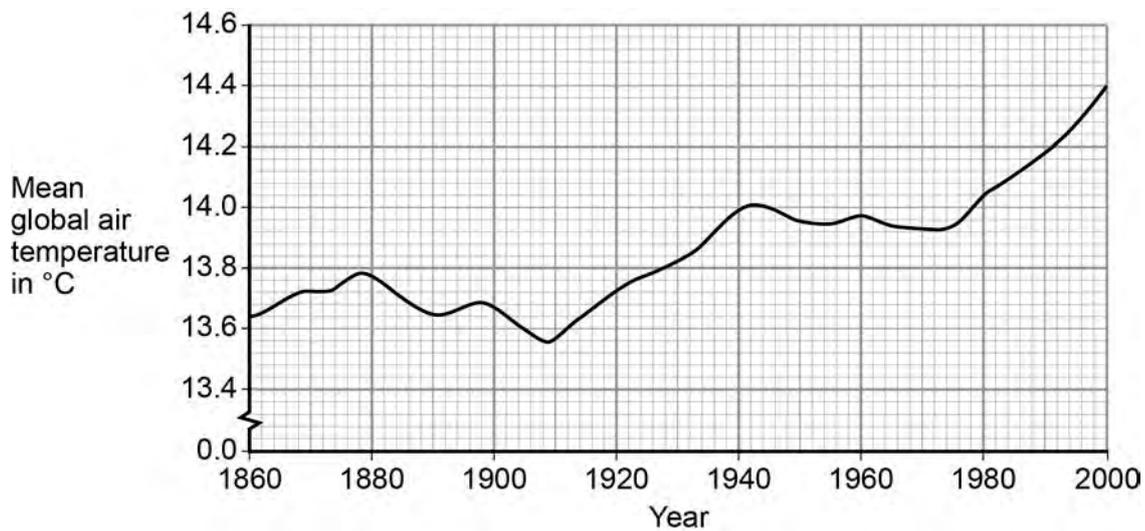
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Figure 4 shows the change in mean global air temperature from 1860 to 2000.

Figure 4



0 5 . 3

Explain how human activities have contributed to the main trend shown from 1910 in Figure 4.

[3 marks]

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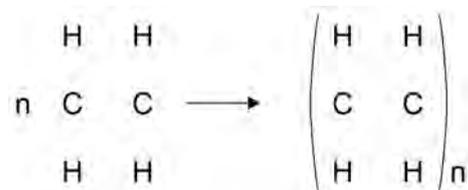
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Turn over for the next question

**0 6** Ethene is used to produce poly(ethene).

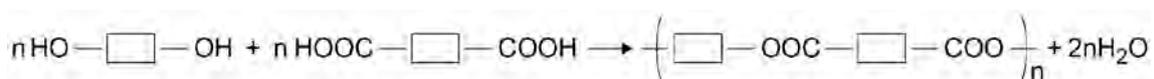
**0 6** . **1** Draw the bonds to complete the displayed formulae of ethene and poly(ethene) in the equation.

**[2 marks]**



**0 6** . **2** Polyesters are made by a different method of polymerisation.

The equation for the reaction to produce a polyester can be represented as:



Compare the polymerisation reaction used to produce poly(ethene) with the polymerisation reaction used to produce a polyester.

**[4 marks]**

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**0 7**

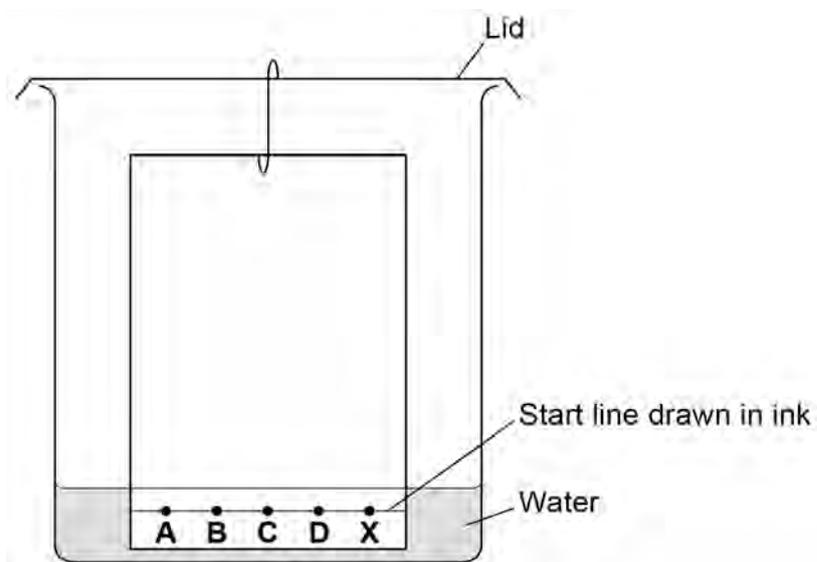
A student investigated food dyes using paper chromatography.

This is the method used.

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

**Figure 5** shows the apparatus the student used.

**Figure 5**

**0 7 . 1**

Write down **two** mistakes the student made in setting up the experiment and explain what problems one of the mistakes would cause.

**[2 marks]**

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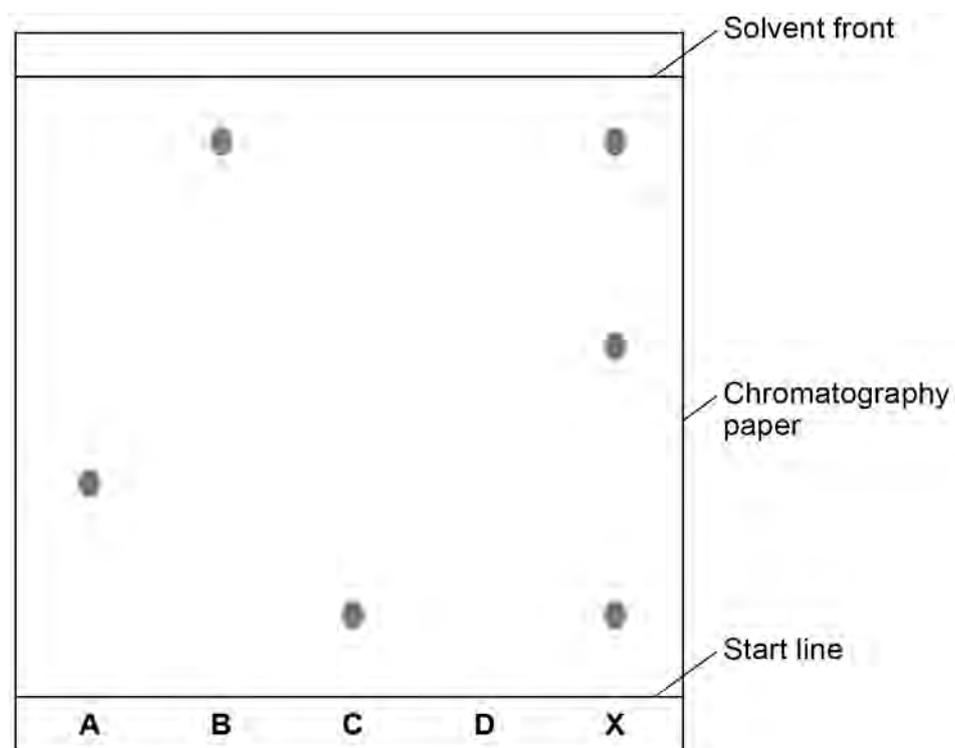
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**Question 7 continues on the next page**

Another student set up the apparatus correctly.

**Figure 6** shows the student's results. The result for dye **D** is not shown.

**Figure 6**



**0 7 . 2** Calculate the  $R_f$  value of dye **A**

Give your answer to two significant figures.

**[3 marks]**

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$R_f$  value = \_\_\_\_\_

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**0 7** . **3** Dye **D** has an  $R_f$  value of 0.80. Calculate the distance that dye **D** moved on the chromatography paper.

[1 mark]

Distance moved by dye **D** = \_\_\_\_\_

**0 7** . **4** Explain how the different dyes in **X** are separated by paper chromatography.

[4 marks]

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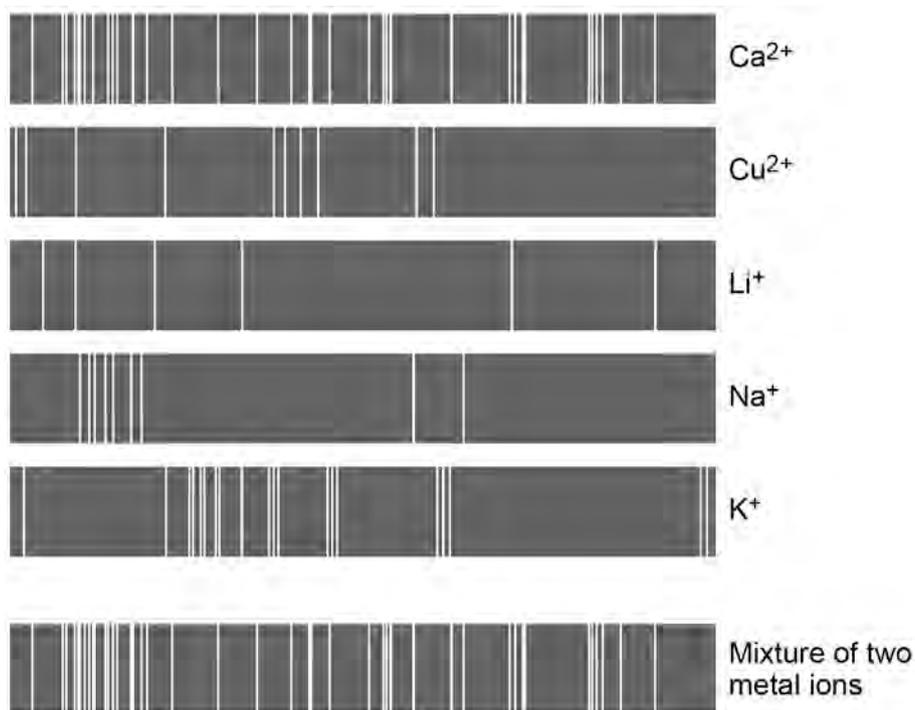
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**Question 7 continues on the next page**

**0 7 . 5** Flame emission spectroscopy can be used to analyse metal ions in solution.

**Figure 7** gives the flame emission spectra of five metal ions, and of a mixture of two metal ions.

**Figure 7**



Use the spectra to identify the **two** metal ions in the mixture.

[2 marks]

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**0 7 . 6** Explain why a flame test could **not** be used to identify the two metal ions in the mixture.

[2 marks]

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**0 7** . **7** Two students tested a green compound **X**.  
The students added water to compound **X**.  
Compound **X** did not dissolve.

The students then added a solution of ethanoic acid to compound **X**.  
A gas was produced which turned limewater milky.

Student **A** concluded that compound **X** was sodium carbonate.  
Student **B** concluded that compound **X** was copper chloride.

Which student, if any, was correct?

Explain your reasoning.

**[4 marks]**

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**Turn over for the next question**

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**0 8** Fertilisers are used to improve agricultural productivity.

**0 8** . **1** Ammonium nitrate is used in fertilisers.

Name the **two** compounds used to manufacture ammonium nitrate.

**[1 mark]**

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**0 8** . **2** A fertiliser contains the following information on the label:

**NPK value = 14 : 11 : 11**

Explain why this information is useful to farmers.

**[2 marks]**

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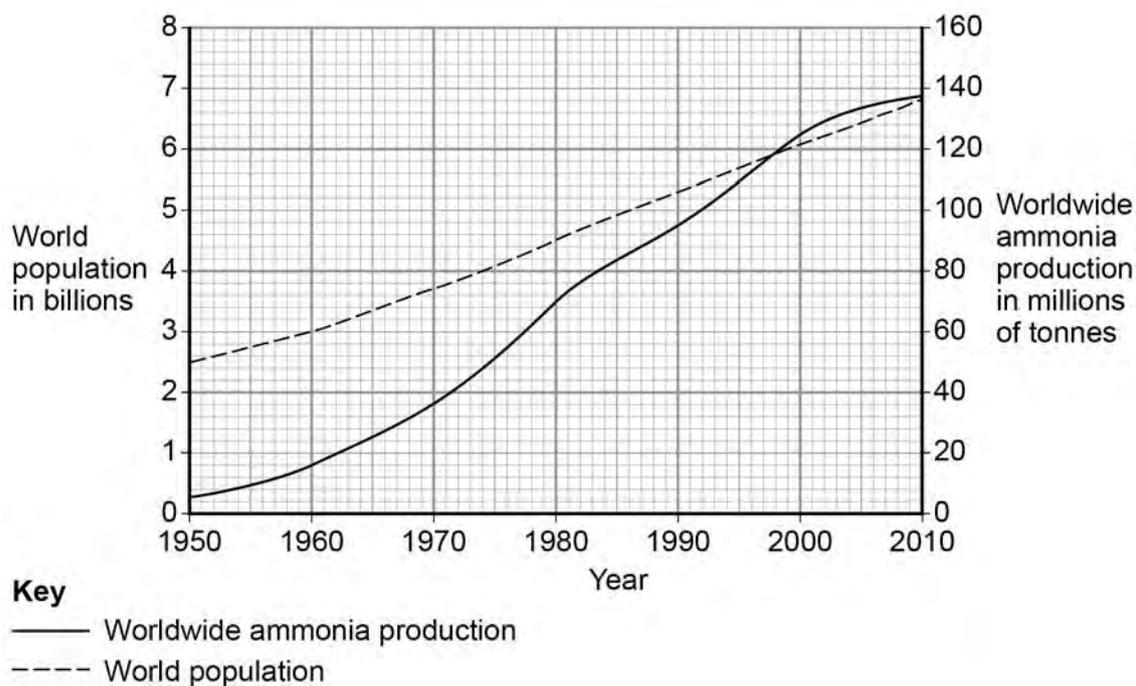
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**0 8** . **3** **Figure 8** shows worldwide ammonia production and world population from 1950 to 2010.

**Figure 8**



Use **Figure 8** and your knowledge to explain the relationship between ammonia production and world population.

**[3 marks]**

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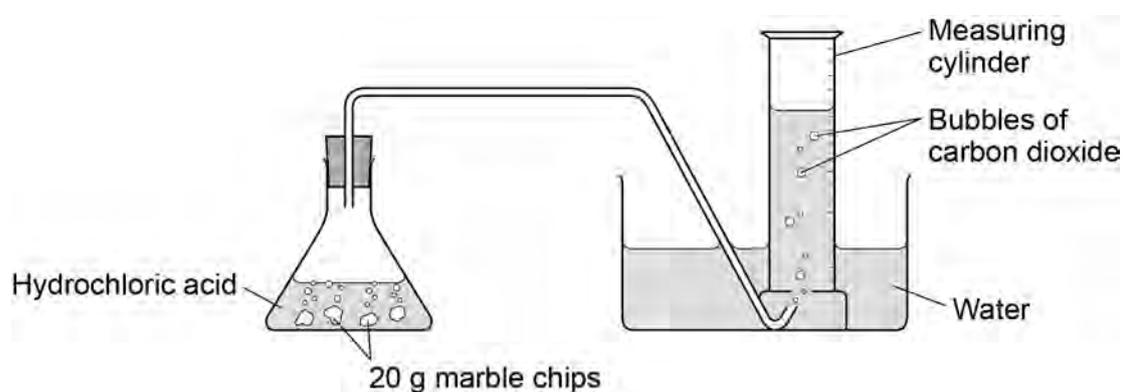
**0 9**

Marble chips are mainly calcium carbonate ( $\text{CaCO}_3$ ).

A student investigated the rate of reaction between marble chips and hydrochloric acid (HCl).

**Figure 9** shows the apparatus the student used.

**Figure 9**

**0 9****1**

Complete and balance the equation for the reaction between marble chips and hydrochloric acid.

**[2 marks]**



**Question 9 continues on the next page**

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

**Table 4**

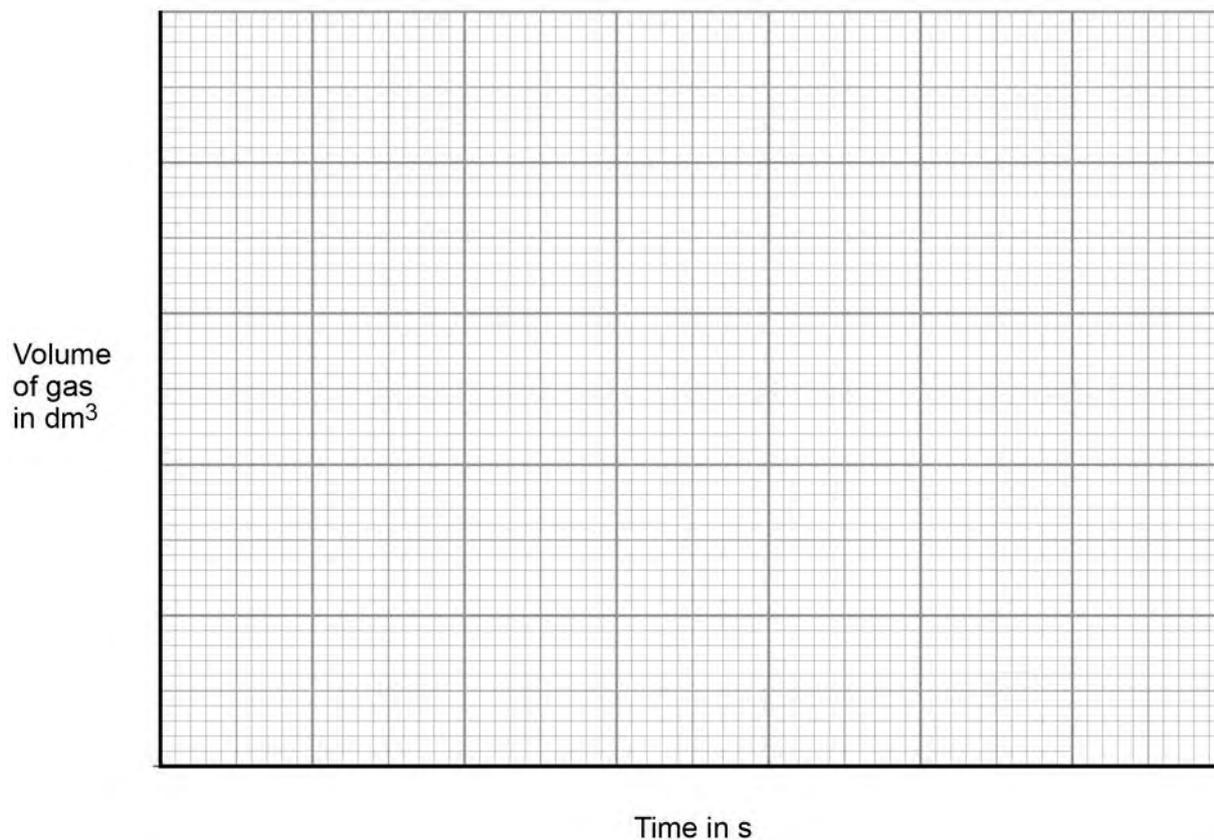
<b>Time in s</b>	<b>Volume of gas in dm<sup>3</sup></b>
0	0.000
30	0.030
60	0.046
90	0.052
120	0.065
150	0.070
180	0.076
210	0.079
240	0.080
270	0.080

On **Figure 10**:

- Plot these results on the grid.
- Draw a line of best fit.

**[4 marks]**

Figure 10



0 9 . 3

Sketch a line on the grid in **Figure 10** to show the results you would expect if the experiment was repeated using 20 g of smaller marble chips.

Label this line **A**.

[2 marks]

Question 9 continues on the next page

- 0 9** . **4** Explain, in terms of particles, how and why the rate of reaction changes during the reaction of calcium carbonate with hydrochloric acid.

**[4 marks]**

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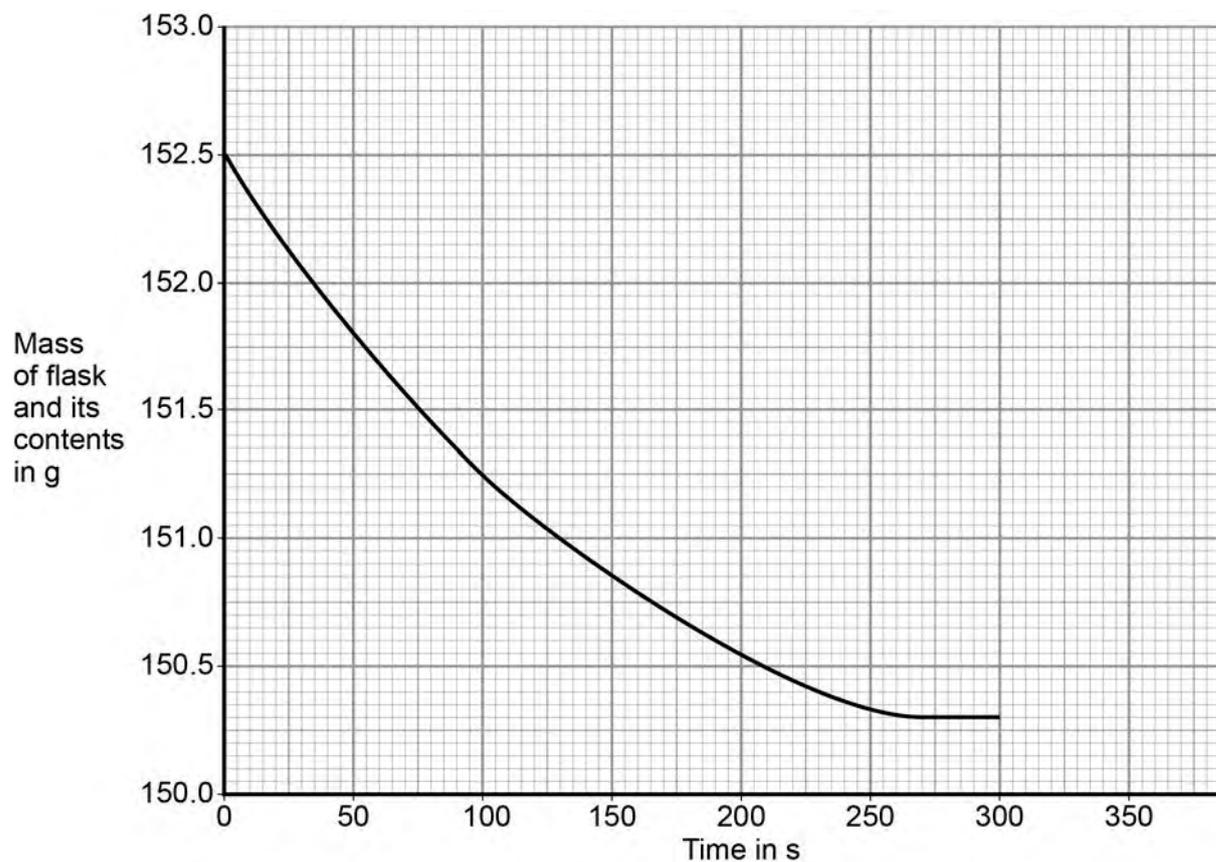
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Another student investigated the rate of reaction by measuring the change in mass.

**Figure 11** shows the graph plotted from this student's results.

**Figure 11**



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- 0 9** . **5** Use **Figure 11** to calculate the mean rate of the reaction up to the time the reaction is complete.

Give your answer to three significant figures.

**[4 marks]**

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Mean rate of reaction = \_\_\_\_\_ g/s

- 0 9** . **6** Use **Figure 11** to determine the rate of reaction at 150 seconds.

Show your working on **Figure 11**.

Give your answer in standard form.

**[4 marks]**

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Rate of reaction at 150 s = \_\_\_\_\_ g/s

**1 0**

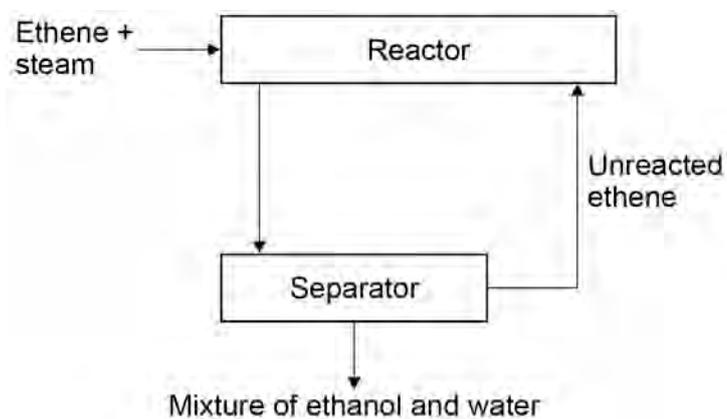
In industry ethanol is produced by the reaction of ethene and steam at 300°C and 60 atmospheres pressure using a catalyst.

The equation for the reaction is:



**Figure 12** shows a flow diagram of the process.

**Figure 12**

**1 0 . 1**

Why does the mixture from the separator contain ethanol and water?

**[1 mark]**

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**1 0** . **2** The forward reaction is exothermic.

Use Le Chatelier's Principle to predict the effect of increasing temperature on the amount of ethanol produced at equilibrium.

Give a reason for your prediction.

**[2 marks]**

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**1 0** . **3** Explain how increasing the pressure of the reactants will affect the amount of ethanol produced at equilibrium.

**[2 marks]**

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**END OF QUESTIONS**

**There are no questions printed on this page**

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