

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# GCSE ADDITIONAL SCIENCE CHEMISTRY

# F

Foundation Tier Unit Chemistry C2

Wednesday 14 June 2017

Morning

Time allowed: 1 hour

### Materials

For this paper you must have:

- a ruler
- the Chemistry Data Sheet (enclosed).

You may use a calculator.

### Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 6 should be answered in continuous prose. In this question you will be marked on your ability to:
  - use good English
  - organise information clearly
  - use specialist vocabulary where appropriate.

### Advice

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

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
<b>TOTAL</b>	

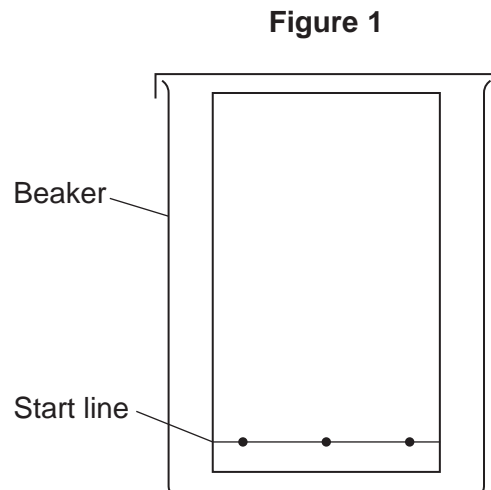


Answer **all** questions in the spaces provided.

**1** This question is about methods of analysis.

**1 (a)** A student used paper chromatography to identify colours in an ink.

**Figure 1** shows the apparatus the student used.



**1 (a) (i)** Why should the student use a pencil and not a pen to draw the start line?

[1 mark]

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**1 (a) (ii)** The student put water in the beaker.

Use the correct answer from the box to complete the sentence.

[1 mark]

above

below

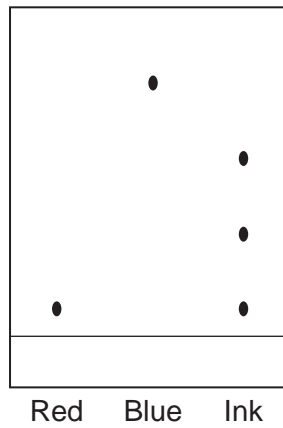
on

The water level should be \_\_\_\_\_ the start line drawn by the student.



1 (a) (iii) Figure 2 shows the student's results.

Figure 2



Give **two** conclusions about the colours in the ink.

[2 marks]

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Question 1 continues on the next page

Turn over ►



1 (b) Gas chromatography is an instrumental method of analysis.

1 (b) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

neutralised

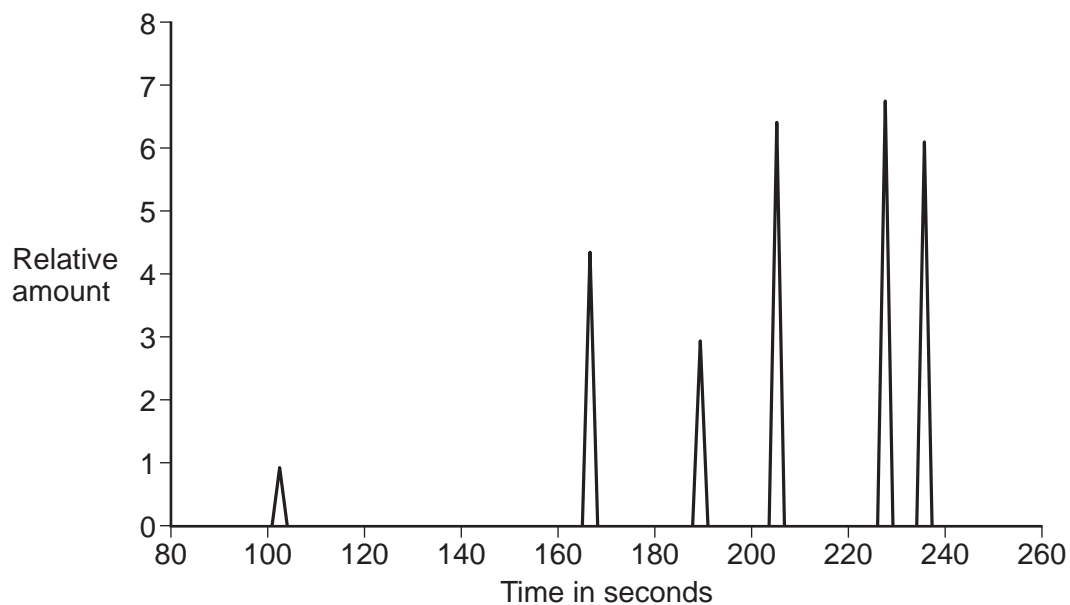
reduced

separated

The mixture of compounds in gas chromatography is \_\_\_\_\_.

1 (b) (ii) Figure 3 shows the results from a gas chromatograph.

Figure 3



How many compounds were in the sample?

[1 mark]

\_\_\_\_\_

1 (b) (iii) Give **one** advantage of using instrumental methods of analysis.

[1 mark]

\_\_\_\_\_



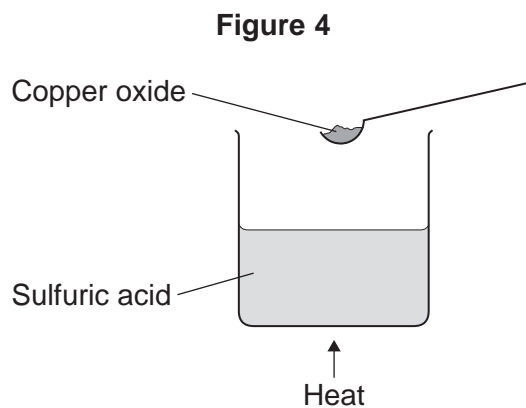
2 This question is about sulfuric acid, copper sulfate and ethene.

2 (a) A student added copper oxide to sulfuric acid to make copper sulfate.

The word equation for the reaction is:



Figure 4 shows the first stage of the student's method.

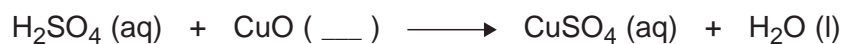


2 (a) (i) The state symbol for CuO is missing from the equation below.

Use the correct answer from the box to complete the equation.

[1 mark]

aq	g	l	s
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2 (a) (ii) Why is the sulfuric acid heated?

[1 mark]

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Question 2 continues on the next page

Turn over ►



2 (a) (iii) Which of these values could be the pH of sulfuric acid?

[1 mark]

Tick (✓) **one** box.

1

7

11

14

2 (a) (iv) Why does the student continue to add copper oxide until some is left at the end of the reaction?

[1 mark]

Tick (✓) **one** box.

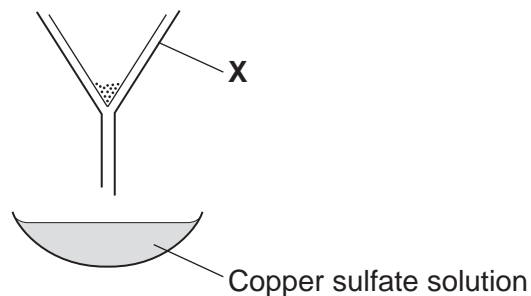
To make bigger copper sulfate crystals.

To make sure all the copper oxide has reacted.

To make sure all the sulfuric acid has reacted.

2 (b) **Figure 5** shows the second stage of the student's method.

**Figure 5**



2 (b) (i) Name the apparatus labelled **X** on **Figure 5**.

[1 mark]

\_\_\_\_\_

2 (b) (ii) What could the student do to the copper sulfate solution to get copper sulfate crystals?

[1 mark]

\_\_\_\_\_  
\_\_\_\_\_

2 (c) The student weighed the copper sulfate crystals.

Why was the mass of the copper sulfate crystals less than the student expected?

[1 mark]

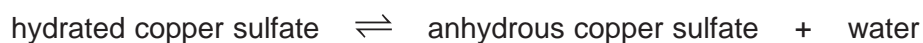
Tick (✓) **one** box.

The student added too much copper oxide.

The student left some copper sulfate crystals in the apparatus.

The student weighed the copper sulfate crystals when they were wet.

2 (d) The equation shows the reaction when blue hydrated copper sulfate crystals are heated.



2 (d) (i) What colour is anhydrous copper sulfate?

[1 mark]

\_\_\_\_\_

2 (d) (ii) What would you see if water is added to anhydrous copper sulfate?

[1 mark]

\_\_\_\_\_

Turn over ►



**2 (e)** Ethene and sulfuric acid are used to make many substances.

**Table 1** shows data about wealth of countries, ethene production and sulfuric acid production.

**Table 1**

Country	Wealth of country in billions of dollars	Ethene production in kilotonnes	Sulfuric acid production in kilotonnes
<b>A</b>	4000	13 900	36 000
<b>B</b>	1300	4 400	6 600
<b>C</b>	1290	2 700	26 000
<b>D</b>	460	1 500	2 500

**2 (e) (i)** Use the correct answer from the box to complete the sentence.

[1 mark]

alloys	chlorine	graphite	polymers
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Ethene is used to make \_\_\_\_\_ .

**2 (e) (ii)** Describe the relationship, if any, between the wealth of a country and the production of ethene.

[1 mark]

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**2 (e) (iii)** Describe the relationship, if any, between the wealth of a country and the production of sulfuric acid.

[1 mark]

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**3** This question is about oxygen and substances containing oxygen.

**3 (a)** Oxygen is a gas at room temperature.

**3 (a) (i)** What type of bonding holds the atoms together in oxygen?

**[1 mark]**

Tick (✓) **one** box.

Covalent

Ionic

Metallic

**3 (a) (ii)** Which **two** statements about oxygen are true?

**[2 marks]**

Tick (✓) **two** boxes.

Oxygen consists of a giant lattice.

Oxygen consists of small molecules.

Oxygen conducts electricity.

Oxygen is an alloy.

Oxygen has a low boiling point.

**Question 3 continues on the next page**

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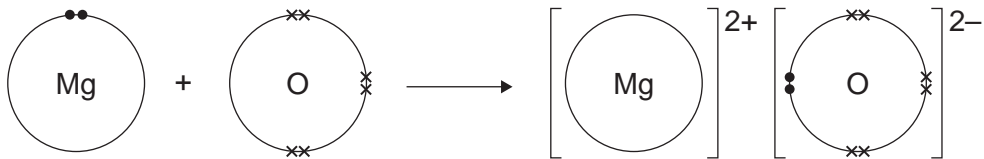
**3 (b)** Magnesium oxide is produced when magnesium reacts with oxygen.

**3 (b) (i)** **Figure 6** shows what happens to the electrons in the outer shells when a magnesium atom reacts with an oxygen atom.

The dots (●) and crosses (×) represent electrons.

Only the outer electrons are shown.

**Figure 6**



Describe, in terms of electrons, what happens when a magnesium atom reacts with an oxygen atom to produce magnesium oxide.

**[4 marks]**

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**3 (b) (ii)** Nanoparticles of magnesium oxide can be made.

Which **two** statements about nanoparticles are true?

[2 marks]

Tick (✓) **two** boxes.

Nanoparticles are very small atoms.

Nanoparticles can return to their original shape after being deformed.

Nanoparticles contain a few hundred atoms.

Nanoparticles contain millions of molecules.

Nanoparticles have a high surface area to volume ratio.

**3 (c)** Silicon dioxide has a very high melting point.

Silicon dioxide does not conduct electricity when molten.

Use the correct answer from the box to complete the sentence.

[1 mark]

giant covalent

giant ionic

metallic

The structure of silicon dioxide is \_\_\_\_\_ .

10

**Turn over for the next question.**

**Turn over ►**



4 This question is about sodium chloride.

4 (a) Calculate the relative formula mass ( $M_r$ ) of sodium chloride (NaCl).

Relative atomic masses ( $A_r$ ): Na = 23; Cl = 35.5

[1 mark]

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Relative formula mass ( $M_r$ ) = \_\_\_\_\_

4 (b) A student reacted hydrochloric acid and sodium hydroxide solution to produce sodium chloride and another product.

Use the correct answer from the box to complete the word equation for the reaction.

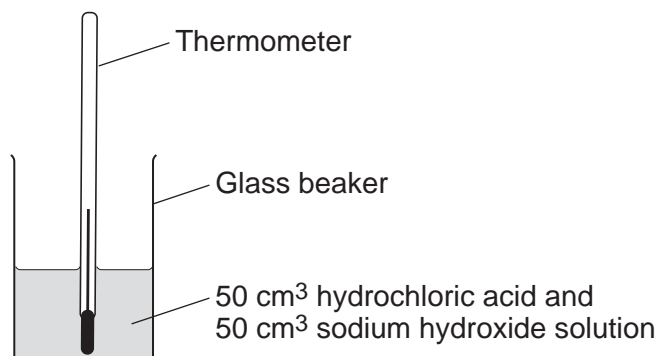
[1 mark]

chlorine	hydrogen	oxygen	water
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hydrochloric acid + sodium hydroxide  $\longrightarrow$  sodium chloride + \_\_\_\_\_

4 (c) **Figure 7** shows the apparatus the student used to measure the temperature change in the reaction between hydrochloric acid and sodium hydroxide solution.

**Figure 7**



The student:

- measured 50 cm<sup>3</sup> hydrochloric acid into a glass beaker
- measured the temperature of the hydrochloric acid
- added 50 cm<sup>3</sup> of sodium hydroxide solution
- measured the highest temperature of the solution
- repeated the experiment with insulation around the glass beaker.



- 4 (c) (i) Suggest **one** reason why the insulation around the glass beaker gives more accurate results.

[1 mark]

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- 4 (c) (ii) The student did the investigation using the insulation three times.

**Table 2** shows the results.

**Table 2**

Experiment number	Temperature of acid before reaction in °C	Highest temperature of solution in °C	Temperature change in °C
1	20	33	13
2	20	34	14
3	19	32	

Calculate the temperature change in **Experiment 3**.

Write your answer in **Table 2**.

[1 mark]

- 4 (c) (iii) How does **Table 2** show that the results are repeatable?

[1 mark]

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- 4 (c) (iv) Complete the sentence.

[1 mark]

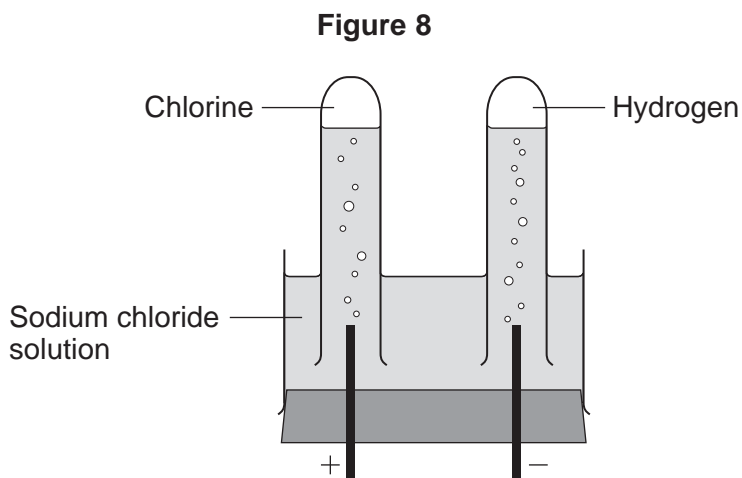
The temperature increase shows that the reaction between hydrochloric acid and sodium hydroxide is \_\_\_\_\_ .

**Question 4 continues on the next page**

Turn over ►



- 4 (d)** A student investigated the electrolysis of sodium chloride solution, as shown in **Figure 8**.



- 4 (d) (i)** State, in terms of ions, why sodium chloride solution conducts electricity.

[1 mark]

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- 4 (d) (ii)** Chlorine is produced at the positive electrode.

Why are chloride ions attracted to the positive electrode?

[1 mark]

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- 4 (d) (iii)** When sodium chloride solution is electrolysed, sodium hydroxide is also produced.

What can be manufactured from sodium hydroxide?

[1 mark]

Tick (✓) **one** box.

Alloys

Poly(ethene)

Soap



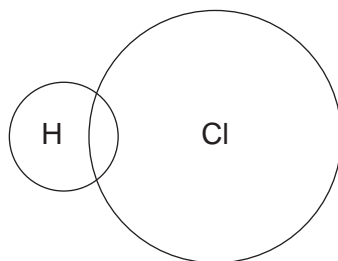
4 (d) (iv) The products chlorine and hydrogen react to form hydrogen chloride.

Hydrogen atoms have one electron in their outer shell. Chlorine atoms have seven electrons in their outer shell.

Complete **Figure 9** to show how the outer electrons are arranged in a molecule of hydrogen chloride (HCl).

[2 marks]

Figure 9



4 (d) (v) Which calculation shows the percentage of hydrogen in hydrogen chloride?

Relative atomic masses ( $A_r$ ): H = 1; Cl = 35.5

Relative formula mass ( $M_r$ ): HCl = 36.5

[1 mark]

Tick (✓) **one** box.

$$\frac{35.5}{36.5} \times 100$$

$$\frac{1}{35.5} \times 100$$

$$\frac{1}{36.5} \times 100$$

$$\frac{1}{72.0} \times 100$$



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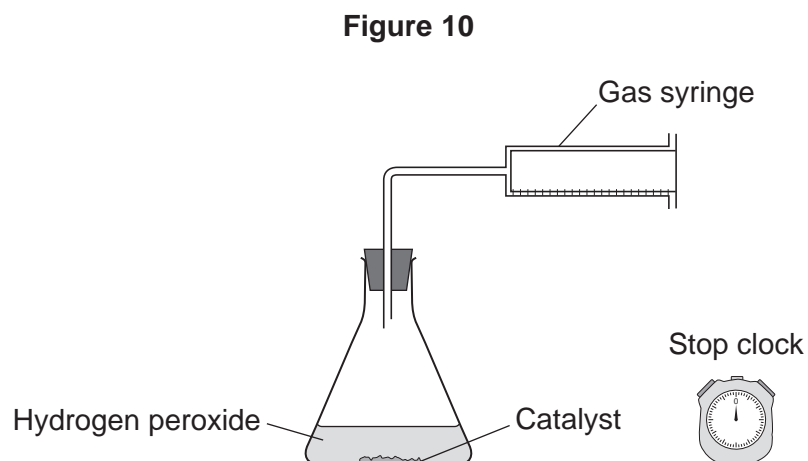


5 This question is about rates of reaction.

The equation for the decomposition of hydrogen peroxide is:



**Figure 10** shows the apparatus a student used to investigate the rate of reaction for the decomposition of hydrogen peroxide.



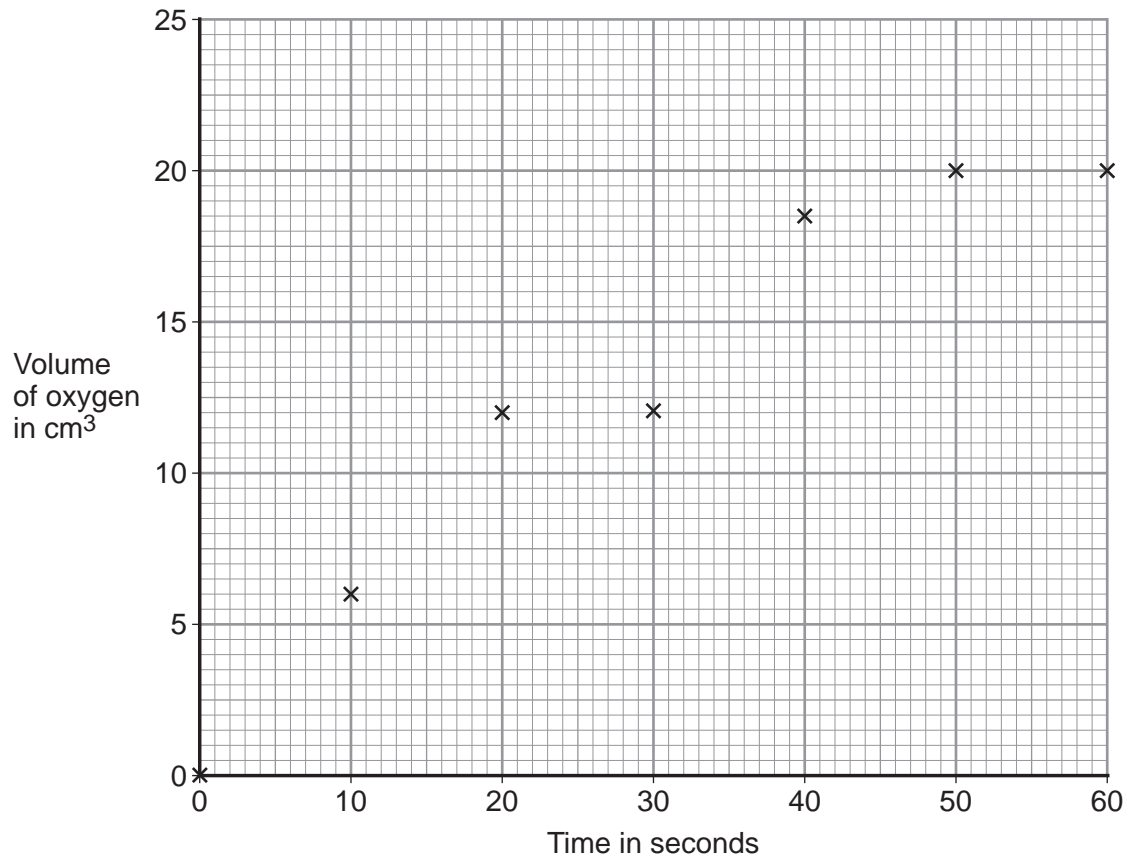
**Question 5 continues on the next page**

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The graph in **Figure 11** shows the results.

**Figure 11**



**5 (a) (i)** Draw a smooth curve of best fit on **Figure 11**.

[1 mark]

**5 (a) (ii)** Give the volume of oxygen produced at 25 seconds.

[1 mark]

Volume of oxygen = \_\_\_\_\_ cm<sup>3</sup>

**5 (a) (iii)** After how many seconds does the reaction stop?

[1 mark]

Time = \_\_\_\_\_ seconds



**5 (a) (iv)** The student concluded that the rate of reaction decreases with time.

Explain how the results support this conclusion.

**[2 marks]**

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**5 (a) (v)** Calculate the mean rate of reaction during the first 10 seconds.

**[1 mark]**

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Mean rate of reaction = \_\_\_\_\_ cm<sup>3</sup> per second

**5 (b)** The student investigated the effect of concentration on the rate of the reaction.

The student repeated the experiment with greater concentrations of hydrogen peroxide.

**5 (b) (i)** The catalyst was kept the same. Give **two** other control variables.

**[2 marks]**

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**Question 5 continues on the next page**

**Turn over ►**



**5 (b) (ii)** State and explain, in terms of particles and collisions, how a greater concentration affects the rate of the reaction.

**[3 marks]**

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**5 (c)** Describe how increasing the amount of catalyst affects the results in **Figure 11**.

**[2 marks]**

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13



**Turn over for the next question**

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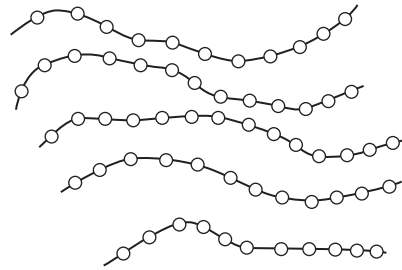
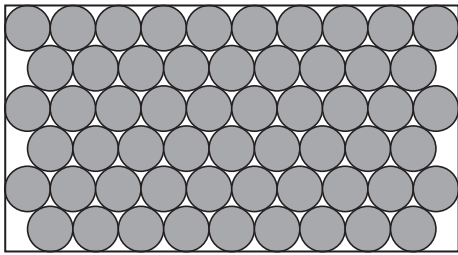


6 In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Metals and thermosoftening polymers have different properties.

Figure 12 shows structures of a metal and a thermosoftening polymer.

Figure 12



Explain how the properties of a metal and a thermosoftening polymer relate to their structures.

In your answer you should describe the structures of a metal and a thermosoftening polymer.

[6 marks]

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<b>6</b>

**END OF QUESTIONS**



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