OXFORD

INTERNATIONAL AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

INTERNATIONAL GCSE

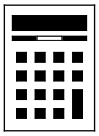
CHEMISTRY

Paper 1

Monday 4 November 2019 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a pencil and a ruler
- a scientific calculator
- the Periodic Table (enclosed).



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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show all your working.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a scientific calculator where appropriate.
- A Periodic Table is provided as a loose insert.

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

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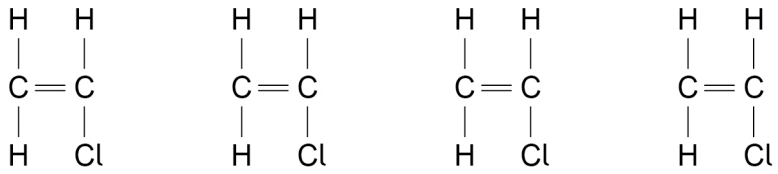
0 1 This question is about polymers.

Figure 1 shows molecules that join together to produce a polymer.

Figure 1



0 1 . 1 How many **different elements** are in the molecules in **Figure 1**?

[1 mark]

0 1 . 2 What is the name of molecules that join together to produce a polymer?

Tick (✓) **one** box.

[1 mark]

Alkanes ☐

Fullerenes ☐

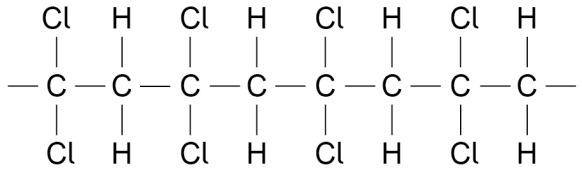
Monomers ☐

Do not write outside the box

0 1 . 3 Which structure represents part of the polymer produced from the molecules in **Figure 1**?

Tick (✓) **one** box.

[1 mark]



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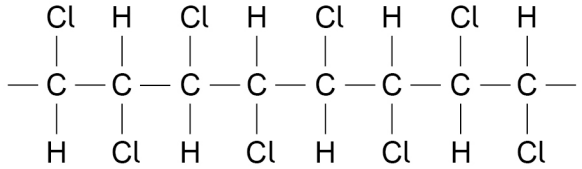

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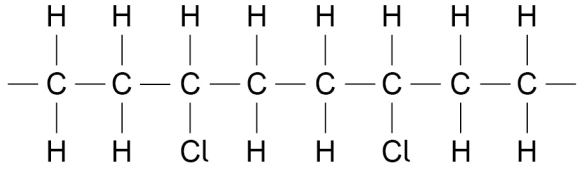

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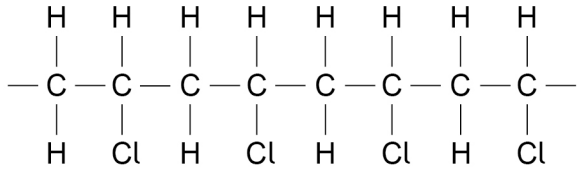

☐

0 1 . 4 Many polymers are **not** biodegradable.

Give **one** environmental problem caused by the waste disposal of polymers that are **not** biodegradable.

[1 mark]

_____

_____

Question 1 continues on the next page

Do not write outside the box

Table 1 shows some properties of four polymers, **A**, **B**, **C** and **D**.

Table 1

Polymer	Melting point in °C	Flexibility	Solubility in water
A	60	flexible	insoluble
B	160	flexible	insoluble
C	200	rigid	soluble
D	does not melt	rigid	insoluble

0 1 . 5 Which polymer in **Table 1** is the most suitable to make a container for measuring hot water?

[1 mark]

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 6 Polymers **A**, **B** and **C** are described as thermosoftening polymers.

Give the name used to describe polymer **D**.

[1 mark]

0 1 . 7 Give **one** difference in the structure of polymer **D** compared with polymers **A**, **B** and **C**.

[1 mark]

7

Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 2 A coin is made of three metals.

Table 2 shows the mass of each metal in the coin.

Table 2

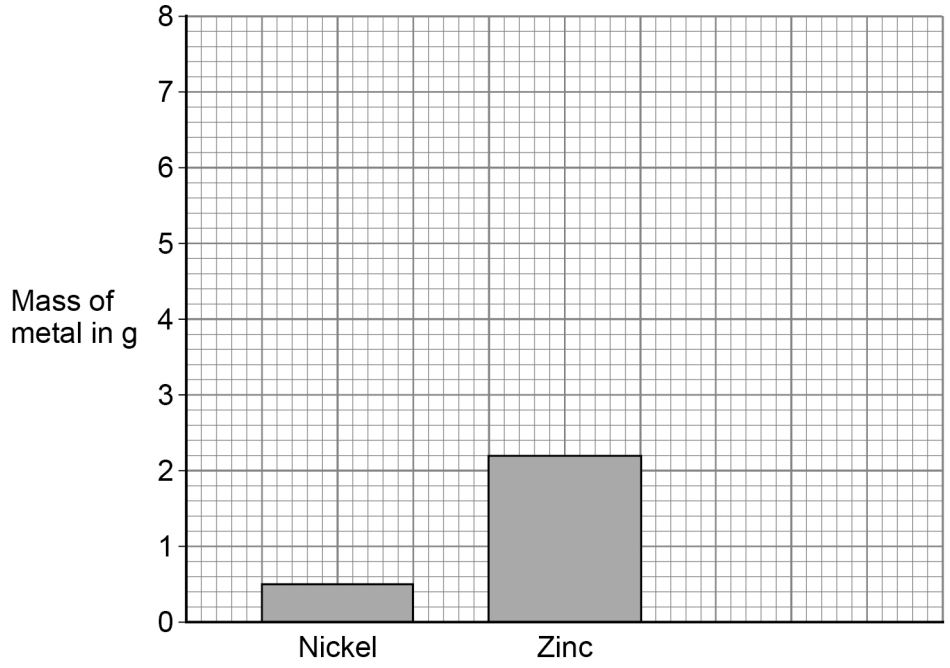
Metal	Mass of metal in g
Nickel	0.5
Zinc	2.2
Copper	6.8

0 2 . 1 Complete **Figure 2**.

Use data from **Table 2**.

[2 marks]

Figure 2



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0 2 . 2 Calculate the percentage of copper in the coin.

Give your answer to 2 significant figures.

[4 marks]

Percentage of copper = _____ %

0 2 . 3 Copper is used to make water pipes.

Which **two** properties make copper suitable for making water pipes?

Tick (✓) **two** boxes.

[2 marks]

- Can be bent ☐
- Forms ionic compounds ☐
- Good conductor of electricity ☐
- Has a high density ☐
- Unreactive ☐

0 2 . 4 Complete the sentence about copper.

Choose the answer from the box.

[1 mark]

bonded	delocalised	fixed	metallic

Copper can conduct electricity because the structure of copper has

_____ electrons.

Do not write outside the box

Copper can be extracted using a displacement reaction.

Scrap iron is used to displace copper from copper sulfate solution.

0 2 . 5 Complete the word equation for the reaction.

[1 mark]

iron + copper sulfate → _____ + _____

0 2 . 6 Why does iron displace copper from copper sulfate solution?

[1 mark]

0 2 . 7 Suggest why the iron used is scrap iron.

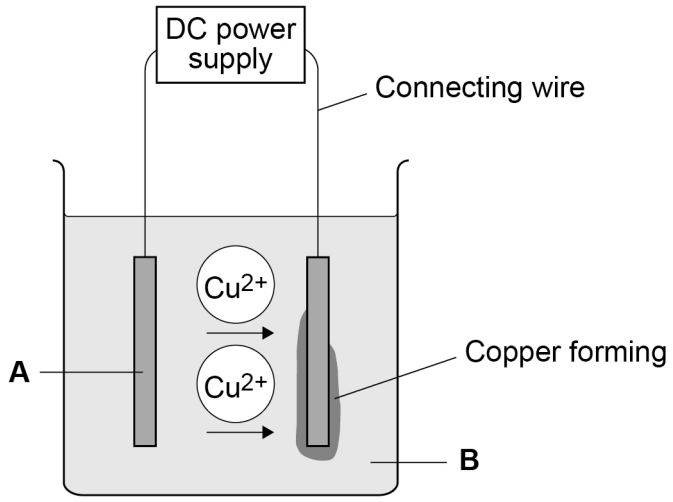
[1 mark]

Do not write outside the box

Copper can also be extracted from solutions of copper salts by electrolysis.

Figure 3 shows the apparatus used.

Figure 3



0 2 . 8 What are labels **A** and **B** on **Figure 3**?

Draw **one** line from each label to the correct description.

[2 marks]

Label	Description
	Copper sulfate solution
A	Liquid copper
	Negative electrode
	Neutral electrode
B	Positive electrode
	Sulfuric acid solution

Question 2 continues on the next page

Do not write outside the box

0 2 . 9 The half equation for the production of copper is:

$$Cu^{2+} + 2e^{-} \longrightarrow Cu$$

What happens to copper ions in this reaction?

Complete the sentence.

Choose the answers from the box.

[2 marks]

decomposed	gained	lost	oxidised	reduced	shared

Copper ions are _____ because electrons are _____ .

16

Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 3 This question is about conservation of mass.

0 3 . 1 Complete the sentence.

[1 mark]

Mass is conserved in a chemical reaction because no _____

are lost or made.

0 3 . 2 2.24 g of iron is heated with excess sulfur.

$$Fe(s) + S(s) \longrightarrow FeS(s)$$

Calculate the maximum mass of iron sulfide that can be produced.

Relative atomic masses (A_r): S = 32 Fe = 56

[3 marks]

_____

_____

_____

_____

_____

Maximum mass of iron sulfide = _____ g

Do not write outside the box

A teacher wanted to demonstrate the conservation of mass using the reaction between iron and sulfur.

$$Fe(s) + S(s) \longrightarrow FeS(s)$$

This is the method used.

1 Add a mixture of iron powder and sulfur powder to a test tube.
2 Measure the mass of the test tube and contents.
3 Heat the test tube strongly for 5 minutes in a fume cupboard.
4 Allow the test tube to cool.
5 Measure the mass of the test tube and contents again.

Table 3 shows the teacher's results.

Table 3

	Mass in g
Test tube and contents before reaction	31.10
Test tube and contents after reaction	30.85

0 3 . 3 The students concluded that mass was **not** conserved.

Explain how the results in **Table 3** can be used to justify this conclusion.

[2 marks]

0 3 . 4 The students also observed that the mixture bubbled during the reaction. This observation was not expected.

Suggest why the bubbling meant that the teacher's demonstration could **not** prove that mass was conserved.

[2 marks]

8

Do not write outside the box

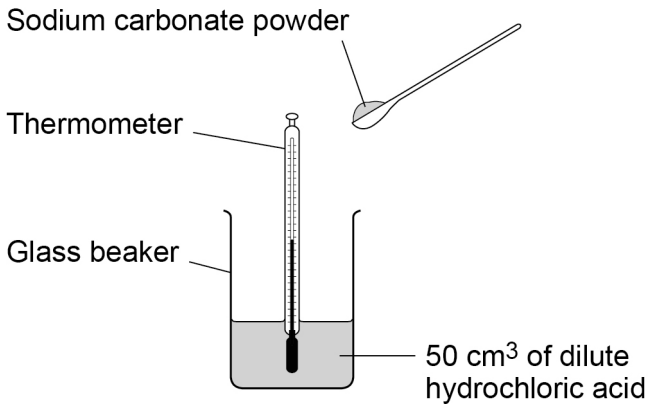
0 4 A student investigated the energy change for a chemical reaction.

This is the method used.

1 Measure 50 cm^3 of dilute hydrochloric acid into a glass beaker.
2 Record the starting temperature of the acid.
3 Add 4.0 g of sodium carbonate powder to the glass beaker.
4 Record the highest temperature of the mixture.

Figure 4 shows the apparatus used.

Figure 4



0 4 . 1 Name **one** piece of apparatus that is suitable to measure 50 cm^3 of dilute hydrochloric acid.

[1 mark]

_____

0 4 . 2 The student used a glass beaker in the experiment.

Suggest **one** change the student could make to the glass beaker to improve the accuracy of the results.

Give the reason for your answer.

[2 marks]

Change _____

_____

Reason _____

_____

Do not write outside the box

0 4 . 3 An important instruction is missing between **step 3** and **step 4** in the student's method.

What is the missing instruction?

Give **one** reason why this instruction improves the accuracy of the temperature recorded in **step 4**.

[2 marks]

Missing instruction _____

_____

Reason _____

_____

Question 4 continues on the next page

Do not write outside the box

Table 4 shows the student's results.

Table 4

	Temperature in °C
Starting temperature	20.1
Highest temperature reached	25.9

0 4 . 4 What is the resolution of the thermometer that the student used?

Look at the data in **Table 4**.

[1 mark]

_____ °C

0 4 . 5 Calculate the energy released (Q), in kilojoules (kJ), for the reaction between dilute hydrochloric acid and sodium carbonate.

Use the results in **Table 4**.

Assume 50 cm^3 of solution was produced with a density of 1.0 g/cm^3

Use the equation: $Q = mc\Delta T$

Where:
- Q = energy released in J
- m = mass in g
- c = specific heat capacity = 4.2 J/g°C
- ΔT = temperature change in °C

[3 marks]

_____

_____

_____

_____

_____

Energy released (Q) = _____ kJ

Do not write outside the box

0 4 . 6 The student repeated the experiment using potassium carbonate instead of sodium carbonate.

The student reacted 4.14 g of potassium carbonate (K_2CO_3) with an excess of dilute hydrochloric acid.

The student used the results to calculate that the energy released was 1.035 kJ.

Calculate the enthalpy change (ΔH) for the reaction.

Give your answer in kilojoules per mole of potassium carbonate.

Relative formula mass (M_r): $K_2CO_3 = 138$

[3 marks]

Enthalpy change (ΔH) = _____ kJ/mol

Question 4 continues on the next page

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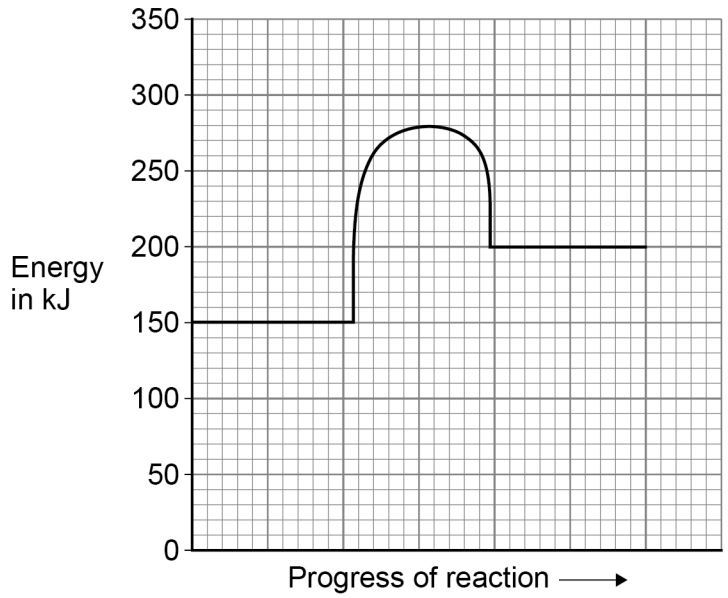
Figure 5 shows an energy level diagram for a different reaction.

Figure 5



0 4 . 7 Calculate the overall energy change for the reaction.

Use **Figure 5**.

[1 mark]

Overall energy change = _____ kJ

0 4 . 8 Calculate the activation energy for the reaction.

Use **Figure 5**.

[1 mark]

Activation energy = _____ kJ

14

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 5 Sulfur trioxide is produced from the reversible reaction between sulfur dioxide and oxygen.

$$2SO_2\,(g) + O_2\,(g) \rightleftharpoons 2SO_3\,(g)$$

0 5 . 1 The position of the equilibrium depends on the initial concentrations of the reactants.

Give **two other** conditions that can affect the position of the equilibrium.

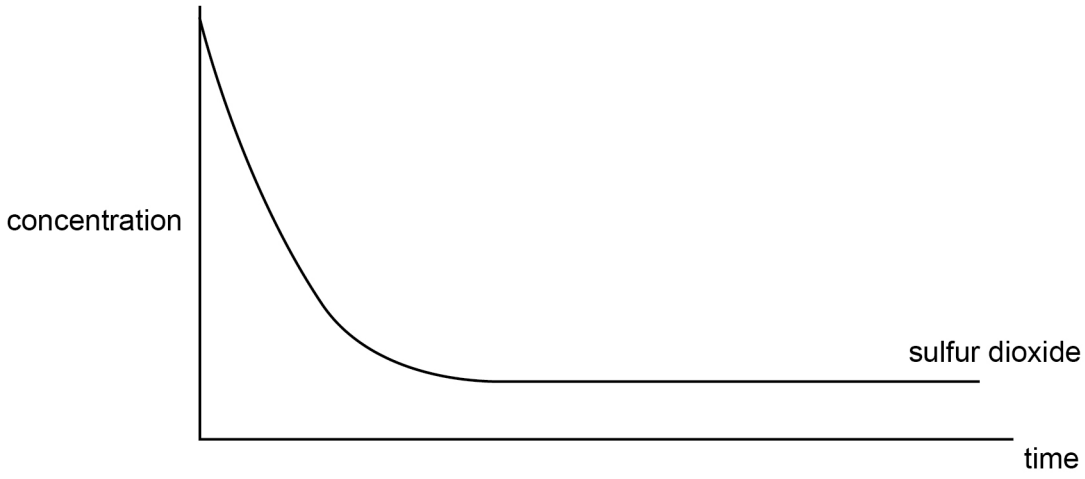
[2 marks]

1 _____

2 _____

Figure 6 shows the concentration of sulfur dioxide during the reversible reaction.

Figure 6



0 5 . 2 How can you tell from the graph in **Figure 6** that the rate of the forward reaction decreases with time?

[1 mark]

_____

_____

Do not write outside the box

0 5 . 3 Explain why the rate of the forward reaction decreases with time.
Refer to particles and collisions in your answer.

[2 marks]

0 5 . 4 Draw a line on the graph in **Figure 6** to show the concentration of sulfur trioxide during the reversible reaction.

[1 mark]

0 5 . 5 Compare the rates of the forward and backward reactions at equilibrium.

[1 mark]

Question 5 continues on the next page

Do not write outside the box

0 5 . 6 Sulfur trioxide reacts with water to produce sulfuric acid.

$$SO_3(g) + H_2O(l) \longrightarrow H_2SO_4(aq)$$

5.00×10^7 cm^3 of sulfur trioxide gas is reacted completely with water.

125 dm^3 of sulfuric acid is produced.

Calculate the concentration of the sulfuric acid in mol/dm^3

The volume of one mole of any gas at room temperature and pressure is 24.0 dm^3

[4 marks]

Concentration of sulfuric acid = _____ mol/dm^3

11

Do not write outside the box

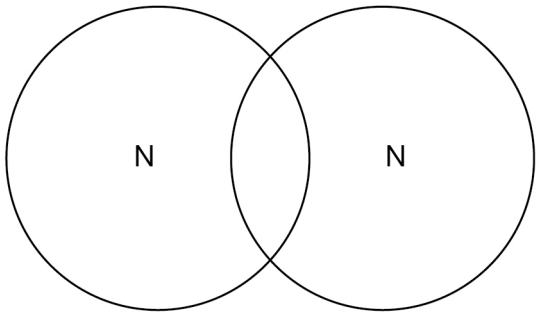
0 6 . 1 Nitrogen exists as molecules of N_2

Complete **Figure 7** to show the arrangement of the outer shell electrons in N_2

Use dots or crosses to represent the electrons.

[2 marks]

Figure 7



0 6 . 2 Nitrogen can react with oxygen at the high temperatures inside car engines.

Nitrogen dioxide gas is produced.

Balance the equation for the reaction.

[1 mark]

$$N_2 + O_2 \longrightarrow NO_2$$

0 6 . 3 Give **one** environmental problem caused by the release of oxides of nitrogen into the atmosphere.

[1 mark]

Question 6 continues on the next page

Do not write outside the box

0 6 . 4 Carbon monoxide is a toxic gas.

Most of the carbon in petrol is oxidised to carbon dioxide in a car engine.

Small amounts of carbon monoxide are also produced.

Explain why carbon monoxide is produced.

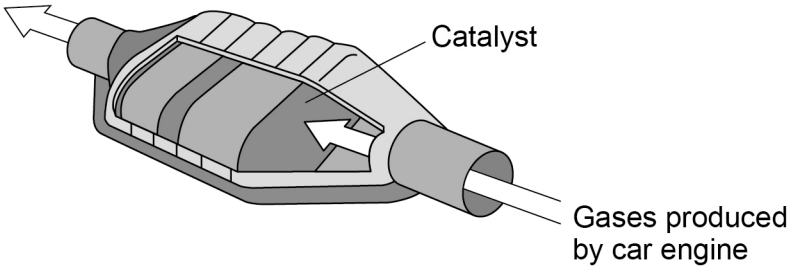
[2 marks]

Catalytic converters are fitted to the exhaust systems of cars.

Catalytic converters can remove nitrogen dioxide and carbon monoxide from gases produced by the car engine.

Figure 8 shows a catalytic converter.

Figure 8



0 6 . 5 Nitrogen dioxide reacts with carbon monoxide on the surface of the catalyst.

nitrogen dioxide + carbon monoxide → nitrogen + **X**

Name product **X**.

[1 mark]

Do not write outside the box

The catalyst in the catalytic converter is made of small particles of different sizes.

Some of these particles are nanoparticles.

0 6 . 6 Give the approximate size of a nanoparticle.

[1 mark]

0 6 . 7 The total cost of the catalyst is reduced by using nanoparticles rather than larger particles.

Give **one** reason why the total cost is reduced.

[1 mark]

9

Turn over for the next question

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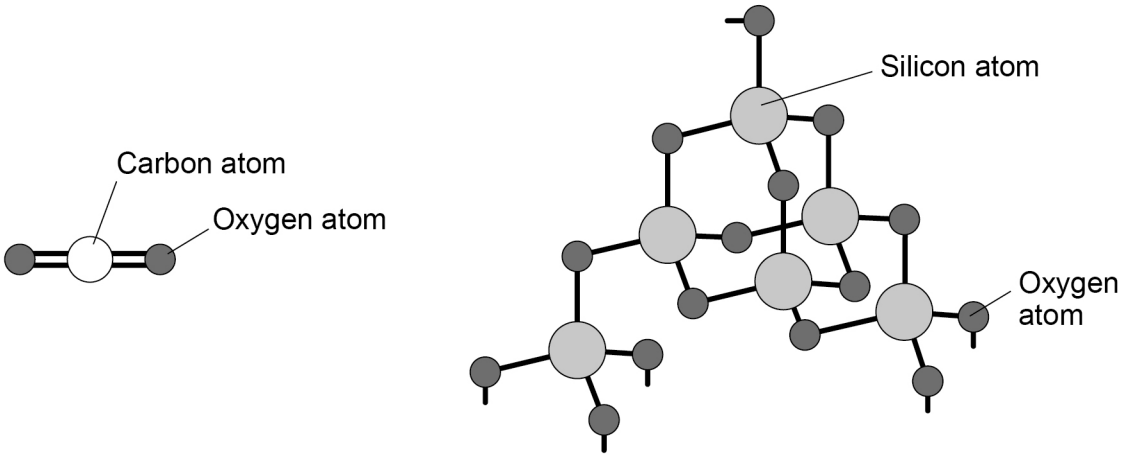
0 7 . 1 Carbon and silicon have many similar properties.

Give **one** reason why.

[1 mark]

Figure 9 shows the structures of carbon dioxide and silicon dioxide.

Figure 9



Carbon dioxide

Silicon dioxide

0 7 . 2 The structures of carbon dioxide and silicon dioxide contain the same type of bond.

Name the type of bond.

[1 mark]

Do not write outside the box

0 7 . 3 Carbon dioxide is a gas at room temperature.

Silicon dioxide is a solid at room temperature.

Explain why carbon dioxide and silicon dioxide have different states at room temperature.

Use **Figure 9** and your own knowledge.

[5 marks]

7

Turn over for the next question

Do not write outside the box

0 8 **Table 5** gives information about elements **G**, **J**, and **L**.

The letters **G**, **J**, and **L** are **not** the symbols of the elements.

Table 5

Element	**G**	**J**	**L**
Melting point in °C	1083	181	1535
Density in g/cm^3	8.92	0.53	7.86
Hardness in arbitrary units	2.5	0.6	4.5
Electrical conductivity in arbitrary units	6×10^7	1×10^7	1×10^7
Reaction with water	No reaction	Very fast reaction	Very slow reaction
Formulae of chlorides	**G** Cl **G** Cl_2	**J** Cl	**L** Cl_2 **L** Cl_3
Colour of chlorides	white blue/green	white	green yellow

A student concludes that metals **G**, **J** and **L** are transition metals.

Evaluate the student's conclusion.

[6 marks]

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Extra space

6

Turn over for the next question

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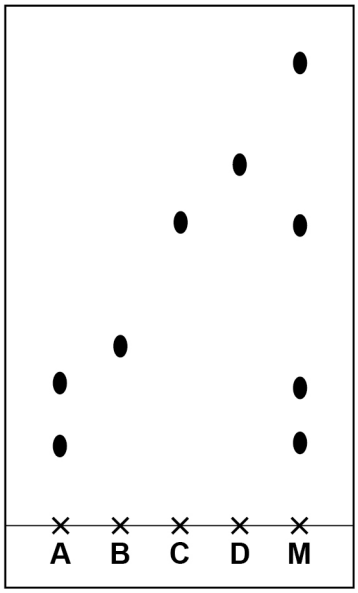
0 9 Colourings are used in drinks.
A scientist investigated an unknown colouring **M**.

The scientist used chromatography to compare **M** with known colourings **A**, **B**, **C** and **D**.

Figure 10 shows the results.

Figure 10



0 9 . 1 Suggest why it is important to investigate unknown colourings before they are used in drinks.

[1 mark]

Do not write outside the box

0 9 . 2 The results in **Figure 10** show that colouring **M** is a mixture.

Give **three** conclusions about the composition of this mixture.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

0 9 . 3 The results in **Figure 10** show that **M** is **not** a pure substance.

What is meant by a 'pure' substance?

[1 mark]

_____

_____

Question 9 continues on the next page

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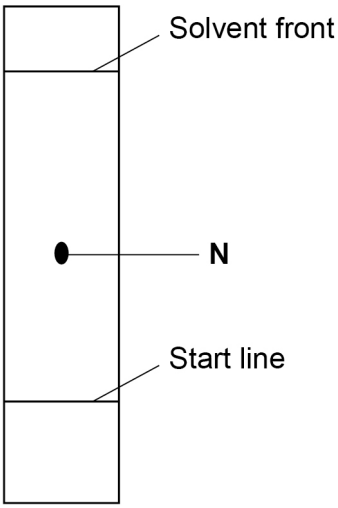
The scientist tested a different food colouring, **N**, using chromatography.

Figure 11 shows the results.

Figure 11



0 9 . 4 Calculate the R_f value of **N**.

Use **Figure 11**.

[3 marks]

R_f value = _____

Do not write outside the box

0 9 . 5 The scientist repeated the chromatography experiment in **Figure 11**, using a different solvent.

Food colouring **N** was less soluble in the new solvent.

Explain what effect, if any, this change would have on the R_f value of **N**.

[2 marks]

0 9 . 6 The scientist repeated the chromatography experiment in **Figure 11**, using a longer piece of chromatography paper.

The chromatography experiment was left to run for a longer time.

Explain what effect, if any, this change would have on the R_f value of **N**.

[2 marks]

12

END OF QUESTIONS

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