OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL GCSE

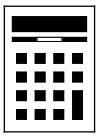
CHEMISTRY

Paper 1

Thursday 5 November 2020 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.
- Pencil should only be used for drawing.
- 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.

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.

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

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

Do not write outside the box

0 1 This question is about carboxylic acids and esters.

Table 1 gives some information about carboxylic acids.

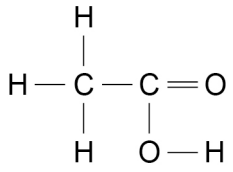
Table 1

Name	Formula	Boiling Point in °C
Methanoic acid	HCOOH	101
Ethanoic acid	CH_3COOH	118
Propanoic acid	C_2H_5COOH	141
Butanoic acid	C_3H_7COOH	**X**
Pentanoic acid	**Y**	186

0 1 . 1 What is the displayed structure of ethanoic acid?

[1 mark]

Tick (✓) **one** box.



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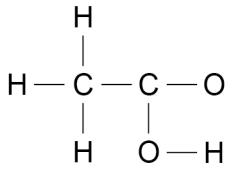

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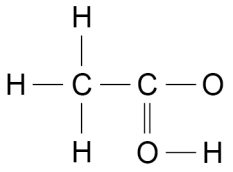

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0 1 . 2 What is the boiling point **X** in **Table 1**?

[1 mark]

Tick (✓) **one** box.

94 °C ☐

134 °C ☐

164 °C ☐

194 °C ☐

0 1 . 3 What is the formula **Y** in **Table 1**?

[1 mark]

Tick (✓) **one** box.

C_4H_8COOH ☐

C_4H_9COOH ☐

$C_4H_{10}COOH$ ☐

$C_4H_{11}COOH$ ☐

Question 1 continues on the next page

Vinegar contains ethanoic acid.

A student did a titration to find the mass of ethanoic acid in vinegar.

Figure 1 shows the apparatus used.

Figure 1

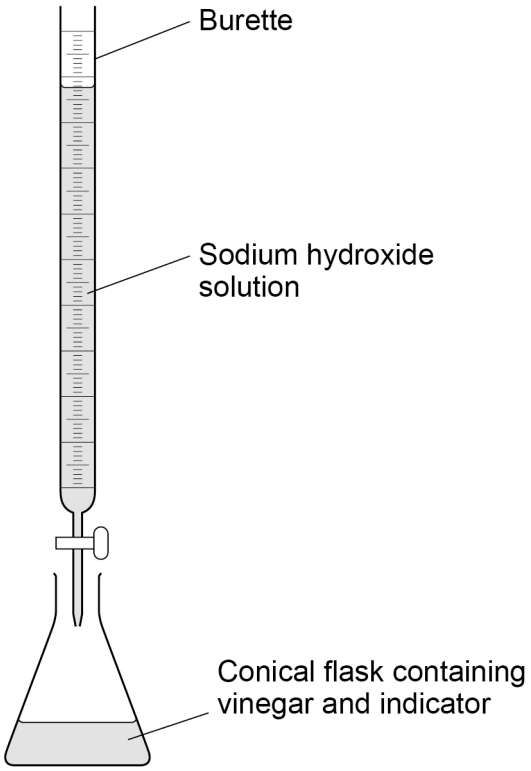

Table 2 shows the results of the titration.

Table 2

	Titration			
	1	**2**	**3**	**4**
Volume of sodium hydroxide used in cm^3	20.35	20.30	20.25	20.35

Do not write outside the box

0 1 . 4 Calculate the mean volume of sodium hydroxide solution used.

Use **Table 2**.

[2 marks]

Mean volume of sodium hydroxide solution = _____ cm^3

0 1 . 5 The student calculated that 30 g of vinegar contained 1.2 g of ethanoic acid.

Calculate the percentage of ethanoic acid in the vinegar.

[2 marks]

Percentage of ethanoic acid = _____ %

0 1 . 6 Which is a property of carboxylic acids?

[1 mark]

Tick (✓) **one** box.

- Dissolve in water to produce alkaline solutions ☐
- Ionise completely in water ☐
- Oxidise to form alcohols ☐
- React with carbonates to produce carbon dioxide ☐

Question 1 continues on the next page

Do not write outside the box

0 1 . 7 Ethanoic acid reacts with ethanol to produce ethyl ethanoate and one other substance.

What is the other substance?

[1 mark]

Tick (✓) **one** box.

Carbon dioxide ☐

Hydrogen ☐

Methane ☐

Water ☐

0 1 . 8 Ethyl ethanoate is an ester.

Which is a use of esters?

[1 mark]

Tick (✓) **one** box.

Bleach ☐

Fertiliser ☐

Perfume ☐

0 1 . 9 Which is the ester functional group?

[1 mark]

Tick (✓) **one** box.

–C=C– ☐

–COO– ☐

–OH ☐

11

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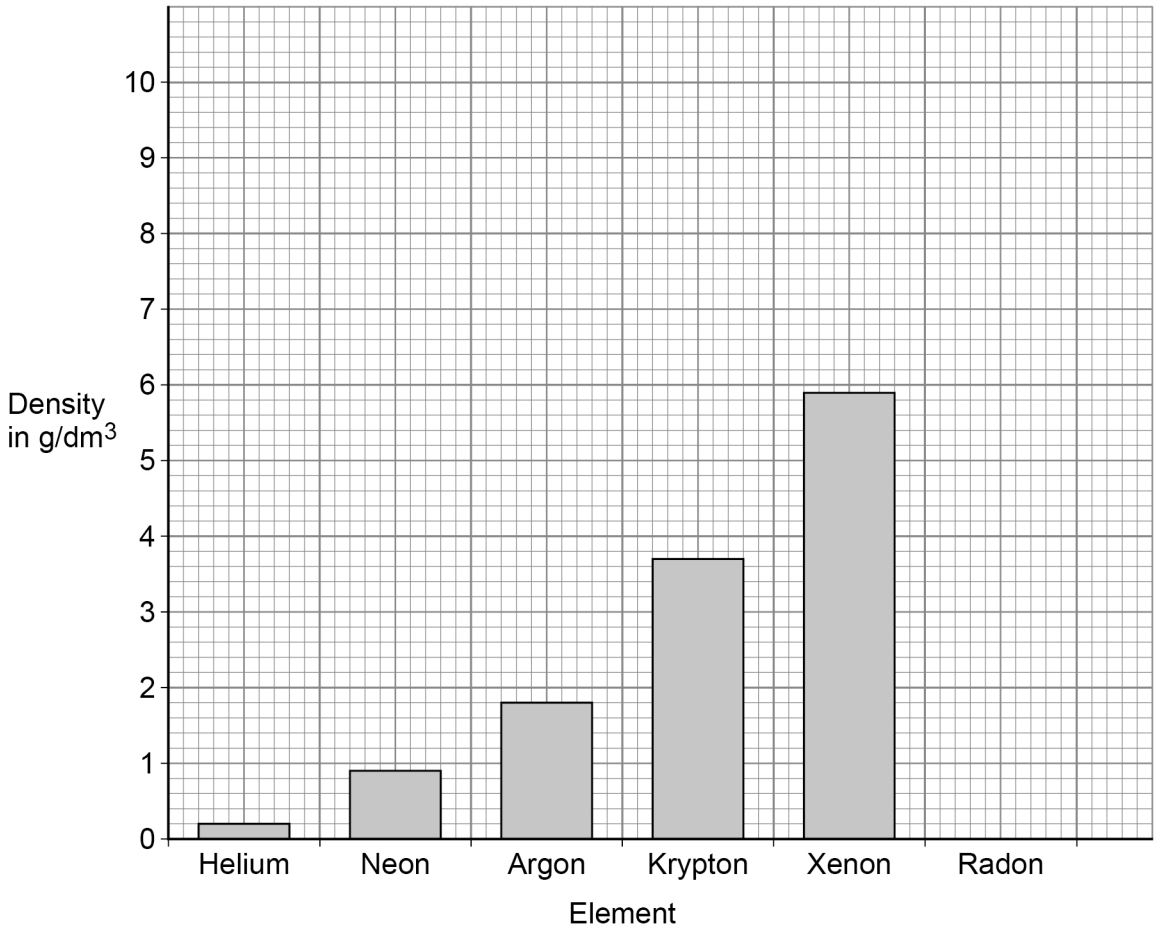
0 2 This question is about elements in Group 0 and in Group 1 of the periodic table.

Figure 2 shows the densities of the elements in Group 0.

Figure 2



0 2 . 1 Describe the trend in density from helium to xenon.

Use **Figure 2**.

[1 mark]

0 2 . 2 The density of radon is 9.8 g/dm^3

Draw a bar on **Figure 2** for radon.

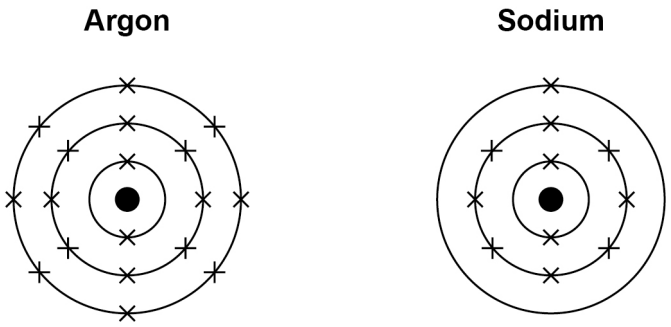
[1 mark]

Question 2 continues on the next page

Do not write outside the box

0 2 . 3 **Figure 3** shows the electronic structure of an atom of argon and an atom of sodium.

Figure 3



Give **one** similarity and **one** difference between the electronic structures of argon and sodium.

[2 marks]

Similarity _____

_____

Difference _____

_____

Do not write outside the box

Sodium is in Group 1 of the periodic table.

0 2 . 4 What is the symbol for a sodium ion?

[1 mark]

Tick (✓) **one** box.

Na ☐

Na^+ ☐

Na^- ☐

0 2 . 5 Explain why the reactivity of the elements changes going down Group 1.

[4 marks]

9

Turn over for the next question

Do not write outside the box

0 3 This question is about sodium chloride (NaCl).

0 3 . 1 Sodium chloride can be produced by reacting sodium with chlorine.

Balance the equation for this reaction.

[1 mark]

$$\_\_\_\_\_ Na\,(s) + Cl_2\,(g) \rightarrow \_\_\_\_\_ NaCl\,(s)$$

0 3 . 2 Give the meaning of the state symbol (s).

[1 mark]

0 3 . 3 Sodium chloride is a pure compound.

What is meant by 'pure'?

[1 mark]

0 3 . 4 A scientist tests the purity of a sample of sodium chloride.

The scientist measures the melting point of the sodium chloride sample.

The melting point of sodium chloride in the data book is 801 °C

The sodium chloride sample melts between 797–799 °C

Give **two** reasons why this is **not** a pure sample of sodium chloride.

[2 marks]

1

2

Do not write outside the box

A student separates a mixture of soluble sodium chloride and insoluble sand to give:

- pure dry sodium chloride
- dry sand.

This is the method used.

1 Add 5 g of the mixture to a beaker.

2 Add 50 cm^3 of water to the beaker.

3 Allow the sand to settle then pour off the solution into an evaporating basin.

4 Heat the solution until half of the water has evaporated then leave in a dry place.

5 Allow the left-over sand to dry in a warm place.

0 3 . 5 Name **one** piece of equipment that the student can use to measure 50 cm^3 of water in step **2**.

[1 mark]

0 3 . 6 Give **two** ways the student can ensure all the sodium chloride dissolves in step **2**.

[2 marks]

1

2

0 3 . 7 Give **one** improvement to the method in step **3**.

[1 mark]

9

Do not write outside the box

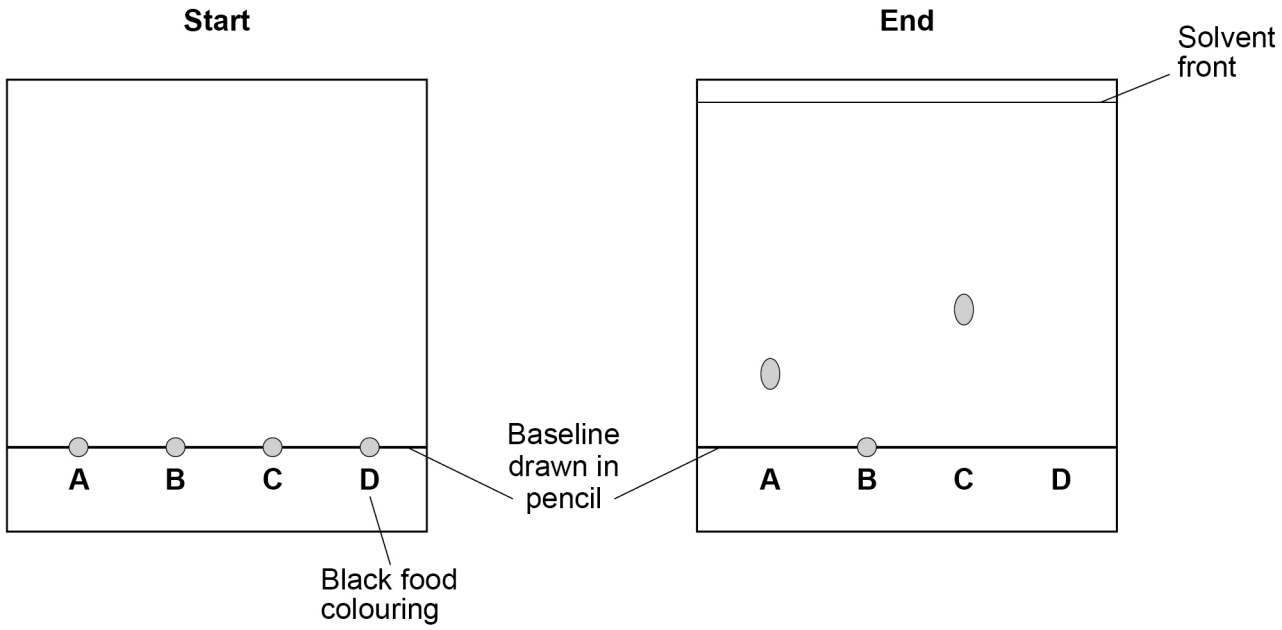
0 4 A student analysed black food colouring using chromatography.

On a sheet of chromatography paper the student placed spots of:

- three known food colours labelled **A**, **B** and **C**
- the black food colouring labelled **D**.

Figure 4 shows the experiment at the start and at the end.

Figure 4



0 4 . 1 The black food colouring contained the colours **A**, **C** and one unknown colour.

Complete **Figure 4** to show the positions of the three spots produced by the black food colouring (**D**).

[2 marks]

0 4 . 2 Give **one** reason why the baseline is drawn in pencil rather than in ink.

[1 mark]

Do not write outside the box

0 4 . 3 Which food colour in **Figure 4** is insoluble in the solvent?

Give **one** reason for your answer.

[2 marks]

Food colour _____

Reason _____

_____

0 4 . 4 The student analysed the chromatogram.

Table 3 shows the student's measurements for food colour **A**.

Table 3

Distance from baseline to solvent front	15 mm
Distance from baseline to food colour A	3 mm

Calculate the R_f value of food colour **A**.

Use **Table 3**.

[2 marks]

_____

_____

_____

R_f = _____

7

Turn over for the next question

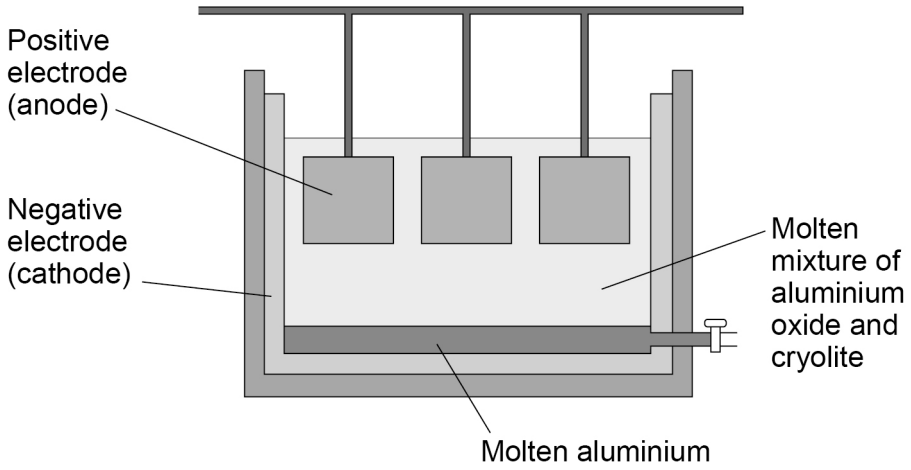
Do not write outside the box

0 5 This question is about aluminium.

Aluminium is extracted from aluminium oxide using electrolysis.

Figure 5 shows the equipment used.

Figure 5



0 5 . 1 Describe what is meant by 'electrolysis'.

[2 marks]

0 5 . 2 Explain why aluminium is extracted using electrolysis and **not** by reduction with carbon.

[2 marks]

Do not write outside the box

Aluminium is extracted from a molten mixture of aluminium oxide and cryolite.

0 5 . 3 Explain why cryolite is used.

[2 marks]

0 5 . 4 Explain why the mixture must be molten for electrolysis to take place.

[2 marks]

0 5 . 5 Describe how carbon dioxide is produced at the positive electrode during the electrolysis of aluminium oxide.

[3 marks]

Question 5 continues on the next page

Do not write outside the box

Aluminium is produced at the negative electrode.

0 5 . 6 Complete the half equation for the production of aluminium.

[1 mark]

$$Al^{3+} + \_\_\_\_\_ \rightarrow Al$$

0 5 . 7 Why is the reaction at the negative electrode described as a reduction?

[1 mark]

_____

_____

13

Do not write outside the box

0 6 This question is about hydrogen peroxide.

Hydrogen peroxide decomposes into water and oxygen gas.

A student investigated the rate of decomposition of hydrogen peroxide.

This is the method used.

1 Add 25 cm^3 of hydrogen peroxide solution to a conical flask.

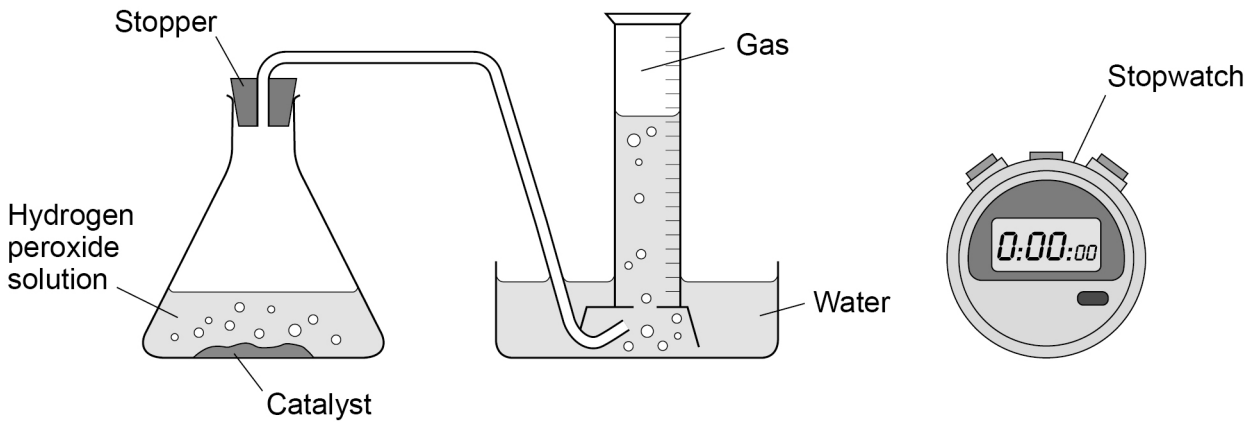
2 Add 1 g of catalyst to the conical flask.

3 Insert the stopper and start the stopwatch.

4 Measure the volume of gas collected every 30 seconds for 240 seconds.

Figure 6 shows the apparatus used.

Figure 6



0 6 . 1 What effect does a catalyst have on the rate of reaction?

[1 mark]

0 6 . 2 The student took a few seconds to insert the stopper in step **3** of the method.

How would this affect the total volume of gas collected?

[1 mark]

Question 6 continues on the next page

Do not write outside the box

Table 4 shows the student's results.

Table 4

Time in seconds	Volume of gas collected in cm^3
0	0
30	30
60	48
90	60
120	68
150	74
180	78
210	80
240	80

0 6 . 3 Give **three** conclusions from the results in **Table 4**.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

Do not write outside the box

0 6 . 4 Calculate the mean rate of reaction for the first 60 seconds.

Give the unit.

Use **Table 4**.

[3 marks]

Mean rate of reaction = _____ Unit = _____

0 6 . 5 A different student used the same volume of hydrogen peroxide solution and the same catalyst.

This student also added water to the reaction mixture.

Explain why the results would differ from the results in **Table 4**.

[3 marks]

11

Turn over for the next question

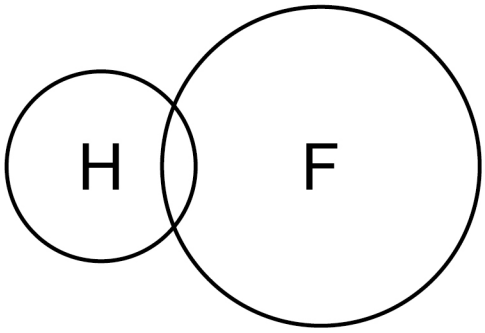
Do not write outside the box

0 7 This question is about hydrogen fluoride.

0 7 . 1 Complete **Figure 7** to show the outer shell electrons in a molecule of hydrogen fluoride.

[2 marks]

Figure 7



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0 7 . 2 Hydrogen and fluorine react to produce hydrogen fluoride.

The reaction is exothermic.

Figure 8 shows the equation for the reaction.

The reactants and product are represented by displayed structures.

Figure 8

$$H-H \;+\; F-F \;\rightarrow\; 2\,H-F$$

Table 5 gives the bond energies.

Table 5

Bond	Bond energy in kJ/mol
H – H	436
F – F	158
H – F	568

Calculate the enthalpy change of the reaction.

Use **Figure 8** and **Table 5**.

[4 marks]

Enthalpy change = _____ kJ/mol

6

Turn over ►

Do not write outside the box

0 8 This question is about chemical analysis.

0 8 . 1 Describe how to do a flame test on a solution containing a metal ion.

[2 marks]

0 8 . 2 A solution contains a mixture of calcium and lithium ions.

Suggest **one** reason why a flame test could **not** be used to identify both metal ions in the solution.

[1 mark]

Do not write outside the box

0 8 . 3 Substances can be identified using precipitation reactions.

Four bottles are unlabelled. Each bottle contains a different solution.

The solutions are:

- aluminium sulfate
- calcium iodide
- iron(II) sulfate
- magnesium sulfate.

Plan a method using precipitation reactions that would allow you to identify which bottle contains which solution.

You should include:

- the reagents used
- the observations made.

[6 marks]

9

Do not write outside the box

0 9 This question is about copper.

0 9 . 1 Copper is a transition metal.

Where are the transition metals found in the periodic table?

[1 mark]

0 9 . 2 Copper is used to make water pipes used in plumbing.

Give **two** properties which make copper suitable for making water pipes.

[2 marks]

1

2

Do not write outside the box

New ways to extract copper compounds from low grade ores are being researched.

0 9 . 3 Phytomining is a new extraction method.

Describe how phytomining is used to extract copper compounds.

[3 marks]

0 9 . 4 Another new extraction method uses bacteria to produce solutions of copper compounds.

What is the name of this method?

[1 mark]

Question 9 continues on the next page

Do not write outside the box

Copper can be obtained from a solution of copper sulfate using scrap iron.

The equation for the reaction is:

$$CuSO_4 + Fe \rightarrow Cu + FeSO_4$$

0 9 . 5 A student produces 1.27 g of copper from a solution of copper sulfate.

Calculate the minimum mass of iron required to produce 1.27 g of copper.

Relative atomic masses (A_r): Cu = 63.5 Fe = 56

[3 marks]

Minimum mass of iron = _____ g

0 9 . 6 Write the ionic equation for the reaction between copper sulfate and iron.

[2 marks]

Do not write outside the box

0 9 . 7 The mass of one mole of copper atoms is 63.5 g

The mass of one copper atom is 1.05×10^{-22} g

Calculate the number of atoms contained in one mole of copper atoms.

Give your answer to 3 significant figures.

[3 marks]

Number of copper atoms (3 significant figures) = _____

15

END OF QUESTIONS

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