AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.10.1.4

Alternative methods of extracting metals (HT only)

Past-paper questions

Tier	**Higher**
Question groups	**5**
Available paper years	**2007–2023**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 01

November 2007 | CHY1A | Original Q4 | Legacy

QUESTION FOUR

Jobs for bacteria – metal miners

Copper is found in the Earth's crust as the ore copper sulfide.

Traditionally, copper-rich ores are roasted and smelted to extract the metal.

Copper compounds can now be extracted from low-grade ores by bioleaching. In one type of bioleaching, the copper compounds are extracted from heaps of the crushed ore using bacteria.

- The bacteria live in the ore and gain their energy by slowly breaking down the copper compounds.
- The bacteria produce acidic solutions in which the copper compounds dissolve from the rocks and can be collected.
- The bacteria usually live at 35 °C to 40 °C. This means that breakdown of the compounds takes place only very slowly in the heaps of crushed ore.
- If these bacteria could work at a temperature 10 °C higher, then it is estimated that the rate of breakdown of the compounds would be twice as fast.

4A Which of the following is a disadvantage of extracting copper by bioleaching rather than by the traditional method?

1 Bioleaching allows us to use low-grade ores.

2 Bioleaching is more economical.

3 Bioleaching is slower.

4 Bioleaching uses less energy.

4B Copper compounds can be extracted more quickly from the ore in tanks at a temperature of 75 °C.

Where might bacteria able to work at this temperature be found?

1 in rivers running through rainforests

2 in polluted rivers

3 in streams on the sides of active volcanoes

4 in tropical seas

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 01 · continued

4C About 20% of the world's copper is now extracted from low-grade ores by bioleaching.

Some scientists think that this figure will steadily increase in the next few years.

An increase in the use of bioleaching may **not** happen if . . .

1 the price of copper increases dramatically.

2 large new deposits of high-grade ore are discovered.

3 the cost of energy rises quickly.

4 sulfur dioxide levels in the atmosphere reach dangerous levels.

4D Copper can be obtained from solutions containing copper compounds by . . .

1 electrolysis.

2 oxidation.

3 fractionation.

4 combustion.

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 02

June 2013 | CH1HP | Original Q2 | Legacy

2 Metals are extracted from their ores.

Many copper ores contain only 2% of copper compounds.

2 (a) Copper is now extracted from ores containing a low percentage of copper compounds.

Suggest **two** reasons why.

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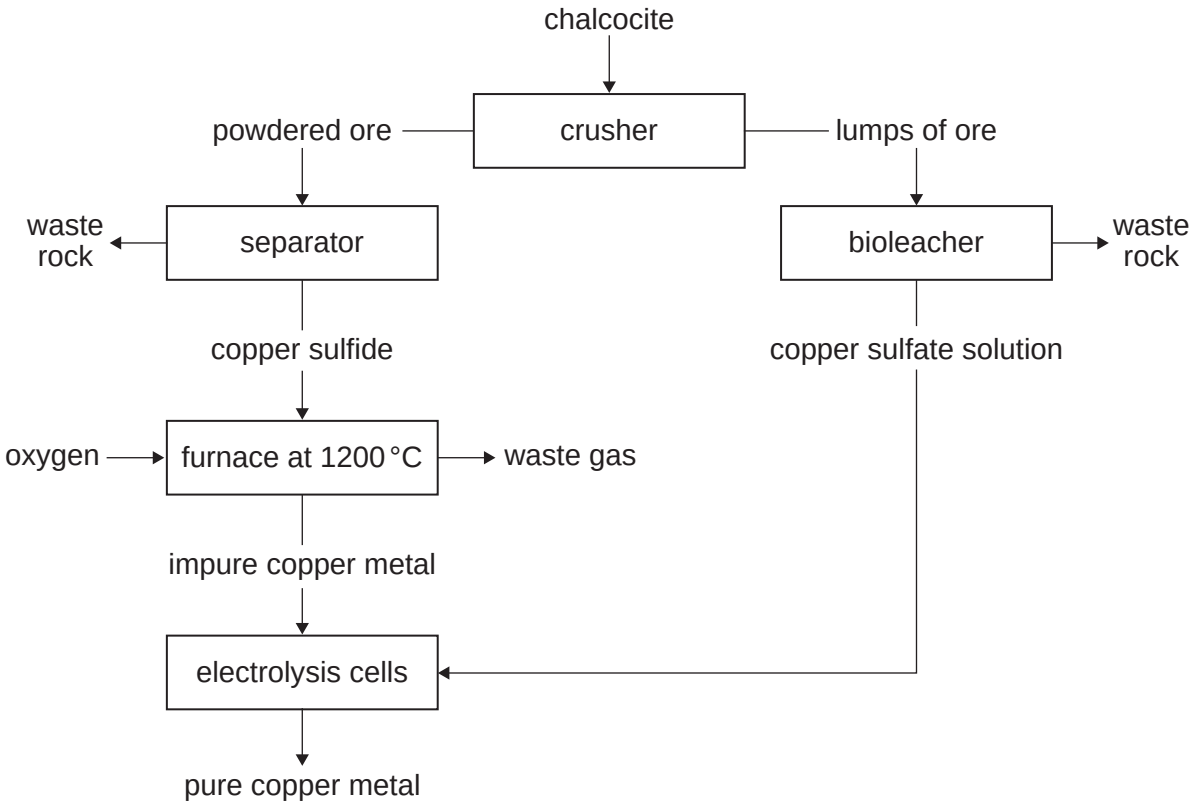
.....

(2 marks)

2 (b) Chalcocite, an ore of copper, contains copper sulfide.
The flow diagram shows how copper metal is extracted from chalcocite.



4.10.1.4 Alternative methods of extracting metals (HT only)

Question 02 · continued

2 (b) (i) Suggest **one** reason why it is difficult to dispose of the waste rock.

.....

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(1 mark)

2 (b) (ii) The reaction in the furnace could cause environmental pollution.
Explain how.

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(2 marks)

2 (b) (iii) The extraction of pure copper is expensive.
Give **one** reason why.

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(1 mark)

2 (b) (iv) Pure copper is produced by electrolysis of copper sulfate solution.

Which electrode do the copper ions move towards?
Give a reason for your answer.

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(2 marks)

2 (b) (v) Large areas of land are contaminated with copper compounds.
Phytomining can be used to remove these copper compounds from the land.

What is used in phytomining to remove copper compounds from the land?

.....

.....

(1 mark)

9

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 03

June 2014 | CH1HP | Original Q4 | Legacy

4 Where copper ore has been mined there are areas of land that contain very low percentages of copper compounds.

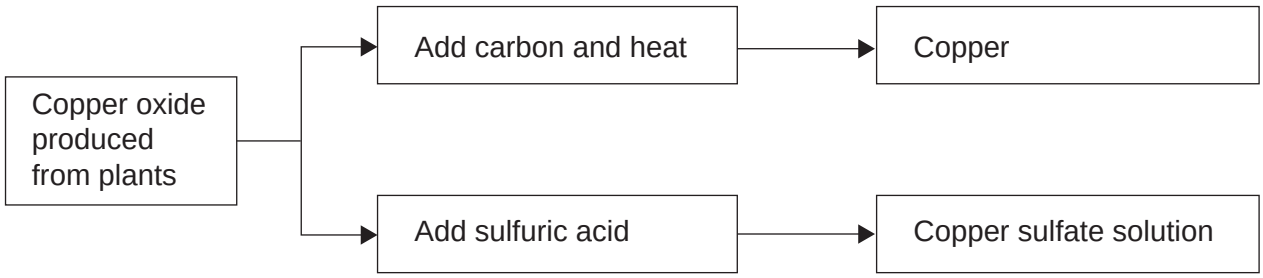
One way to extract the copper is to grow plants on the land.

The plants absorb copper compounds through their roots.

The plants are burned to produce copper oxide.

The copper oxide produced from plants can be reacted to produce copper or copper sulfate solution, as shown in **Figure 3**.

Figure 3



4 (a) (i) Complete the sentence.

[1 mark]

Using plants to extract metals is called ..... .

4 (a) (ii) Suggest **two** reasons why copper from these areas of land is **not** extracted by smelting.

[2 marks]

.....

.....

.....

.....

.....

4 (a) (iii) Complete and balance the chemical equation for the reaction of copper oxide with carbon.

[2 marks]

.....CuO + C ⟶ ..... + CO_2

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 03 · continued

4 (b) Copper is produced from copper sulfate solution by displacement using scrap iron or by electrolysis.

4 (b) (i) Use the Chemistry Data Sheet to help you to answer this question.

Give **two** reasons why scrap iron is used to displace copper.

[2 marks]

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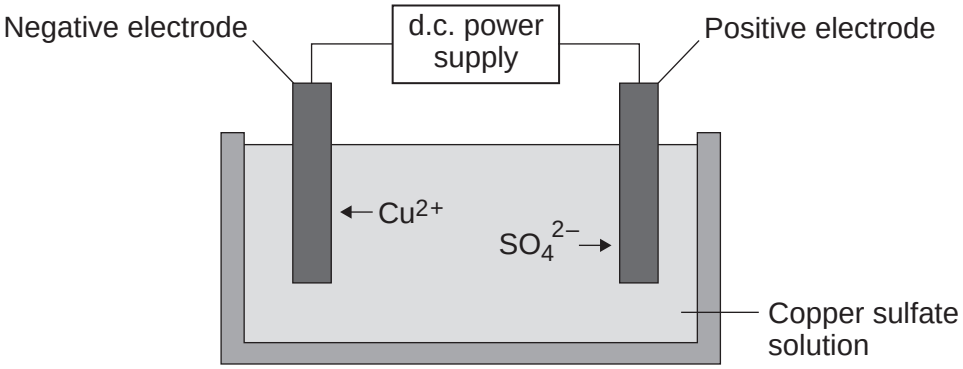
4 (b) (ii) **Figure 4** shows the electrolysis of copper sulfate solution.

Figure 4



Describe what happens to the copper ions during electrolysis.

[2 marks]

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9

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 04

November 2021 | 8462/2H | Original Q8

0 8 This question is about copper and alloys of copper.

Solders are alloys used to join metals together.

Some solders contain copper.

Table 4 shows information about three solders, **A**, **B** and **C**.

Table 4

Solder	Melting point in °C	Metals in solder
A	183	tin, copper, lead
B	228	tin, copper, silver
C	217	tin, copper, silver

0 8 . 1 Solder **B** and solder **C** are now used more frequently than solder **A** for health reasons.

Suggest **one** reason why.

Use **Table 4**.

[1 mark]

0 8 . 2 Suggest **one** reason why solders **B** and **C** have different melting points.

Use **Table 4.**

[1 mark]

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 04 · continued

Copper can be obtained by:

- processing copper ores
- recycling scrap copper.

0 8 . 3 Suggest **three** reasons why recycling scrap copper is a more sustainable way of obtaining copper than processing copper ores.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

Question 8 continues on the next page

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 04 · continued

Copper is extracted from low-grade ores by phytomining.

0 8 . 4 Describe how copper is extracted from low-grade ores by phytomining.

[4 marks]

0 8 . 5 Phytomining has **not** been widely used to extract copper.

Suggest **two** reasons why.

[2 marks]

1

2

11

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 05

June 2023 | 8462/2H | Original Q5

0 5 Copper is extracted from metal ores.

Chalcopyrite is a metal ore containing a compound with the formula $CuFeS_2$

0 5 . 1 $CuFeS_2$ reacts with oxygen to produce copper(II) sulfate and iron(II) sulfate.

Complete the equation for this reaction.

You should balance the equation.

[2 marks]

$$CuFeS_2 + _____ \rightarrow CuSO_4 + FeSO_4$$

0 5 . 2 Calculate the percentage by mass of copper in $CuFeS_2$

Relative atomic masses (A_r): S = 32 Fe = 56 Cu = 63.5

[3 marks]

Percentage by mass = _____ %

0 5 . 3 Describe a test to show the presence of copper(II) ions in a solution of copper(II) sulfate.

Give the result of the test.

[2 marks]

Test _____

Result _____

4.10.1.4 Alternative methods of extracting metals (HT only)

Question 05 · continued

0 5 . 4 Copper can be extracted from low-grade ores by bioleaching.

Describe what is meant by bioleaching.

[2 marks]

9

Turn over for the next question