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# GCSE CHEMISTRY

Topic Paper: 4.1, 4.3 and 10.1 Extraction of metals  
Part 1

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Time allowed: 35 minutes

## Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

## 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.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.



**30 Marks**

**Q1.** Metals are extracted from their ores.

Many copper ores contain only 2% of copper compounds.

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

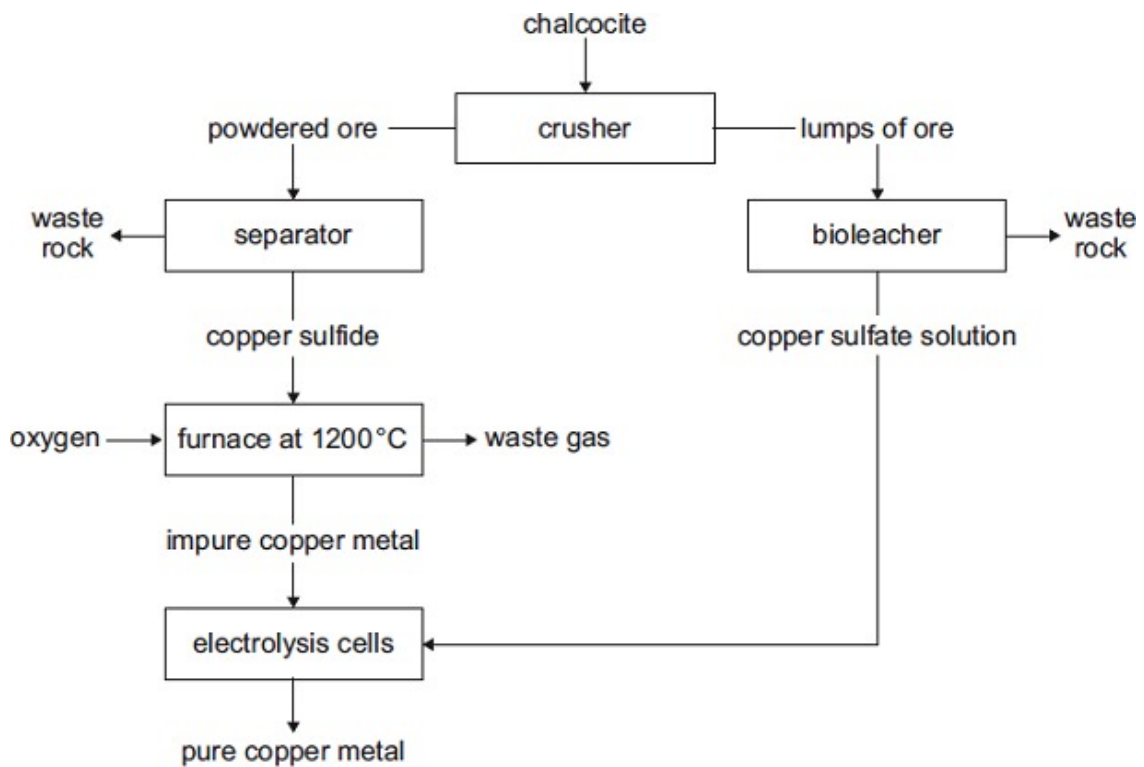
Suggest **two** reasons why.

.....  
.....  
.....  
.....

(2)

(b) Chalcocite, an ore of copper, contains copper sulfide.

The flow diagram shows how copper metal is extracted from chalcocite.



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

.....  
.....

(1)



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

.....  
.....  
.....  
.....

(2)

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

.....  
.....

(1)

- (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.

.....  
.....  
.....  
.....

(2)

- (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)

(Total 9 marks)



- Q2.** Cans for food and drinks are made from steel or aluminium.  
The main metal in steel is iron.



By Sun Ladder (Own work) [CC-BY-SA-3.0 or GFDL],  
via Wikimedia Commons

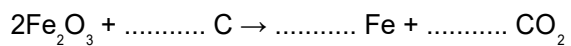
- (a) Iron is extracted by heating a mixture of iron oxide and carbon in a blast furnace.

- (i) Name this type of reaction.

.....

(1)

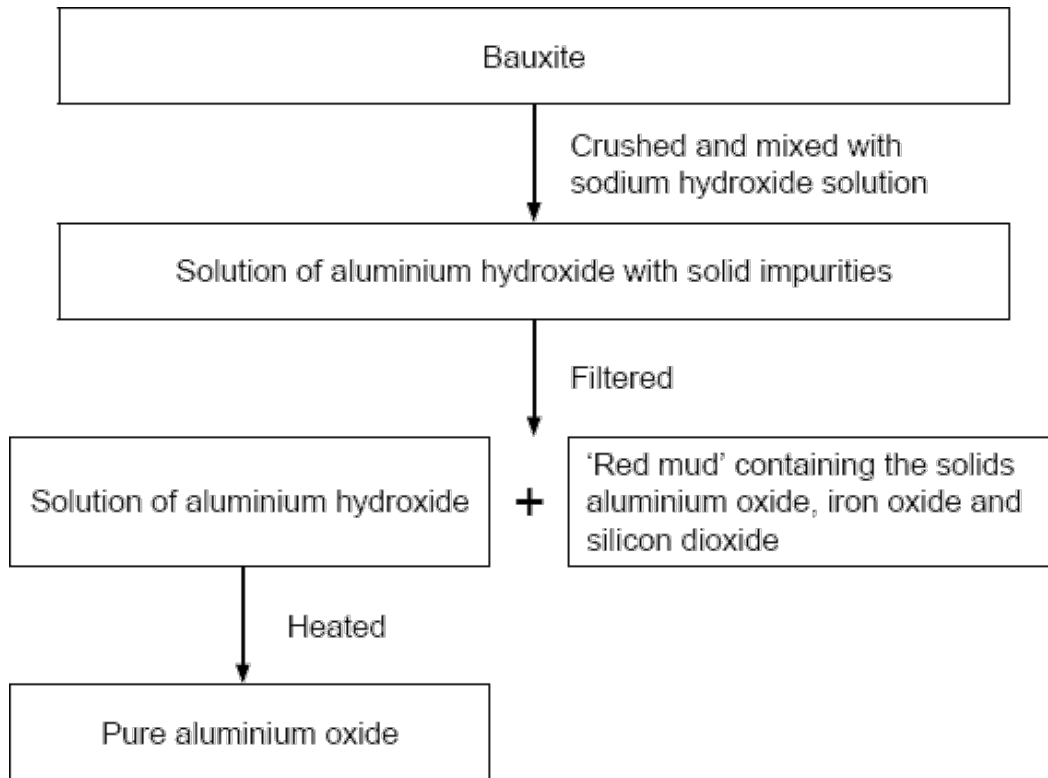
- (ii) Balance the symbol equation for this reaction.



(1)



- (b) Aluminium ore, bauxite, contains aluminium oxide, iron oxide and silicon dioxide. Aluminium is extracted by electrolysis of aluminium oxide.



The 'red mud' which is dumped in very large ponds contains:

Name of solid	Percentage (%)
Aluminium oxide	10
Iron oxide	65
Silicon dioxide	25

- (i) 100 tonnes of bauxite produced 50 tonnes of pure aluminium oxide and 50 tonnes of 'red mud'.

What percentage of aluminium oxide did the bauxite contain?

.....

Answer = ..... %

(1)

- (ii) Apart from the solids shown in the table, name **one** other substance that would be in the 'red mud'.

.....

(1)



- (iii) The purification of the aluminium oxide is usually done near to the bauxite quarries.  
Suggest **one** reason why.

.....

(1)

- (c) Aluminium is used to make many things including cans.

During one year in the USA:  
100 billion aluminium cans were sold  
55 billion aluminium cans were recycled.

Give **one** environmental impact of recycling aluminium cans and **one** ethical or social impact of recycling aluminium cans.

Environmental .....

.....

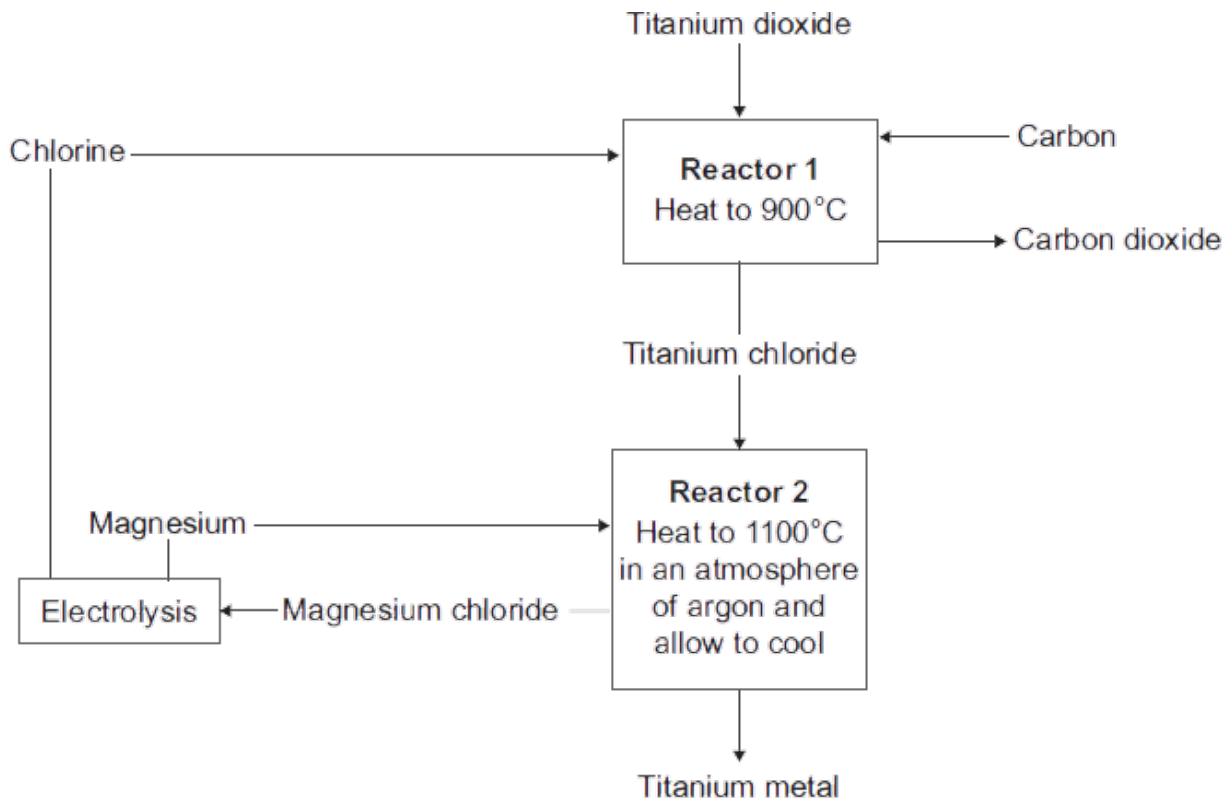
Ethical or social .....

.....

(2)

(Total 7 marks)

- Q3.** Rutile is an ore of titanium. Rutile contains titanium dioxide.  
The flow chart shows how titanium metal is extracted from titanium dioxide.





(a) Titanium is much more expensive than iron.

Give **one** reason why.

.....  
.....

(1)

(b) Name the only waste product shown on the flow chart.

.....

(1)

(c) Describe the example of recycling shown on the flow chart.

.....  
.....  
.....  
.....

(2)

(d) The air is removed from **Reactor 2**. An atmosphere of argon is used for the reaction between titanium chloride and magnesium metal.

Explain why.

.....  
.....  
.....  
.....

(2)

(e) Titanium metal is produced by reacting titanium chloride with magnesium.

950 kg of titanium chloride was mixed with 240 kg of magnesium metal. The mixture was heated and produced 950 kg of magnesium chloride.

Calculate the mass of titanium metal produced.

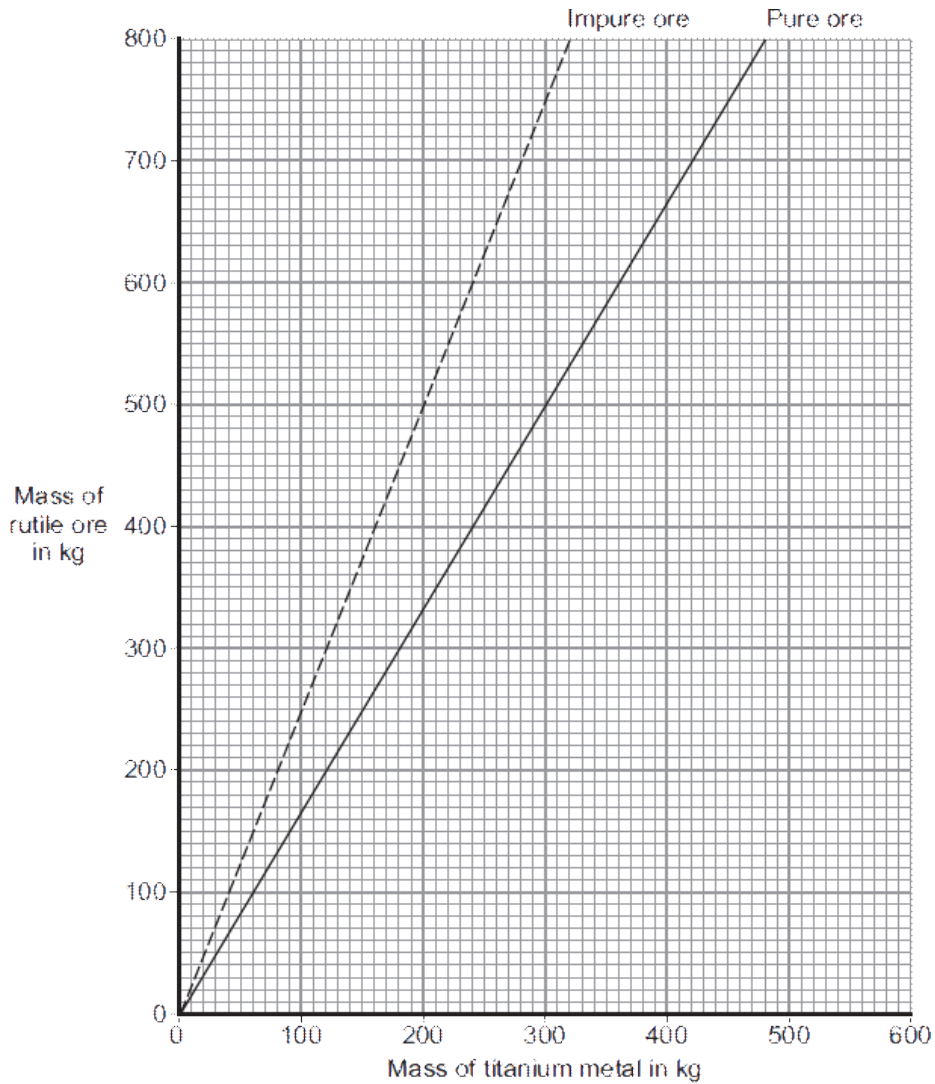
.....

Mass = ..... kg

(1)



- (f) The graph shows the mass of titanium metal produced from a pure rutile ore and from an impure rutile ore.



The difference between the two lines represents the amount of waste rock in the impure ore.

300 kg of titanium metal was produced from the impure ore.

Calculate the mass of waste rock in the impure ore.

.....

Mass = ..... kg

(1)  
(Total 8 marks)





**Q4.** The table gives information about some metals.

Name of the metal	Cost of one tonne of the metal in December 2003 (£)	Percentage of the metal in the crust of the earth (%)
Aluminium	883	8.2
Platinum	16720000	0.0000001
Iron	216	4.1
Gold	8236800	0.0000001

(a) Use information in the table to suggest why gold and platinum are very expensive metals.

.....  
.....

(1)

(b) Aluminium and iron are made by *reduction* of their ores.

(i) Name the element that is removed from the ores when they are *reduced*.

.....

(1)

(ii) Use the reactivity series on the Data Sheet to suggest a metal that would reduce aluminium ore.

.....

(1)

(c) Aluminium is made by the reduction of molten aluminium ore, using a very large amount of electricity.

(i) How is iron ore reduced in a blast furnace to make iron?

.....  
.....  
.....  
.....

(2)

(ii) Suggest why aluminium is more expensive than iron.

.....  
.....

(1)

**(Total 6 marks)**