

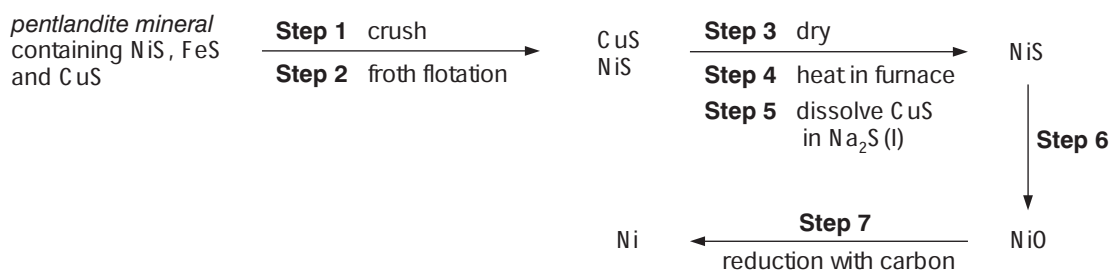
'FROM MINERALS TO ELEMENTS' TEST

60 marks (1 hour)

- 1 Bromine can be made from a concentrated solution of bromide ions (derived from sea water) by passing chlorine through the solution.
- What would you expect to **see** as the reaction takes place? Explain your answer. (2 marks)
 - Give the oxidation state of bromine in:
 - bromide ions; (1 mark)
 - bromine molecules. (1 mark)
 - Explain, in terms of electron transfer, why turning bromide ions into bromine molecules is called oxidation. (1 mark)
 - Write a half-equation for this process. (1 mark)
 - Suggest how the chlorine used in the extraction of bromine from sea water is manufactured. (2 marks)
 - Write the overall equation, with state symbols, for the reaction of chlorine gas with aqueous bromide ions. (3 marks)
 - When the reaction in **d ii** is complete, some aqueous silver nitrate is added.
 - What would you expect to **see**? (2 marks)
 - Write an ionic equation, with state symbols, to explain your observation. (3 marks)
 - State **two** safety precautions needed when handling bromine industrially. (2 marks)
 - The maximum amount of bromine that will dissolve in 100 cm³ water at 25 °C is 1.8 g. Calculate the concentration of Br₂ in this solution in mol dm⁻³. (A_r: Br, 80) (3 marks)
 - State **one** large-scale use of bromine or of one of its compounds. (1 mark)

[TOTAL: 22 MARKS]

- 2 The flow diagram below shows how nickel can be manufactured.

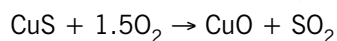


- What effect does froth flotation have on the crushed mineral? (1 mark)
 - Suggest how step **6** is carried out. (2 marks)
 - Suggest a possible environmental problem associated with:
 - step **2**; (1 mark)
 - step **6**. (1 mark)
- Copper and nickel compounds often have similar reactions.
 - In which block of the Periodic Table are copper and nickel both found? (1 mark)
 - At which step in the process shown above are copper and nickel separated? (1 mark)
- The waste material from the mine will contain silica, SiO₂. Carbon dioxide has a similar formula, yet its properties are very different from those of silica. Describe the structures of SiO₂ and CO₂, and explain how these structures lead to differences in properties. (5 marks)

[TOTAL: 12 MARKS]

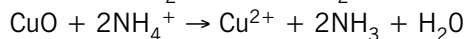
3 This question is about making copper from its ore in the laboratory. The stages are:

I Roasting the ore

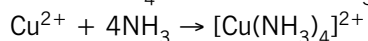


Equation 3.1

II Leaching out the copper



Equation 3.2



Equation 3.3

III Filtering

IV Acidifying the solution remaining

V Displacing the copper using zinc

a Complete the electronic configurations for:

copper $1s^2 2s^2 \dots$ (1 mark)

Cu^{2+} ions $1s^2 2s^2 \dots$ (1 mark)

sulphur $1s^2 2s^2 \dots$ (1 mark)

b Draw a labelled diagram of the apparatus you would use for vacuum filtration in stage III.

(3 marks)

c From **Equations 3.1, 3.2 and 3.3**, pick:

i a redox reaction. Copy out the equation and under **each** of the atoms write its oxidation state.

(6 marks)

ii an acid-base reaction. Give the number of the equation and identify the acid in the reaction.

Why is this an acid? (3 marks)

d The concentration of the ammonia solution used in **Equation 3.3** can be checked by titration with hydrochloric acid of known molar concentration. A measured volume of ammonia solution is placed in a flask (using a pipette) and the hydrochloric acid solution is run in from a burette.

i Give **three** other vital instructions that would be necessary for someone to carry out the above titration to obtain an *accurate* value for the amount of acid needed. (3 marks)

ii 25.0 cm^3 of ammonia solution required 21.3 cm^3 of 1.00 mol dm^{-3} hydrochloric acid for complete reaction. Calculate the concentration of the ammonia solution in mol dm^{-3} . (3 marks)

e Copper sulphide has a structure similar to that of sodium chloride. Draw a three-dimensional sketch of the structure of CuS , labelling the ions. (2 marks)

f Copper ions are said to be *hydrated* in aqueous solution. Draw a fully labelled diagram to illustrate this. (3 marks)

[TOTAL: 26 MARKS]

(Adapted from OCR Chemistry (Salters), Module 1, question 3, Jan 1996)