Time 1Hour 30 min

1. The flow diagram below shows the processes of purification of an aluminium ore and extraction of aluminium from it.
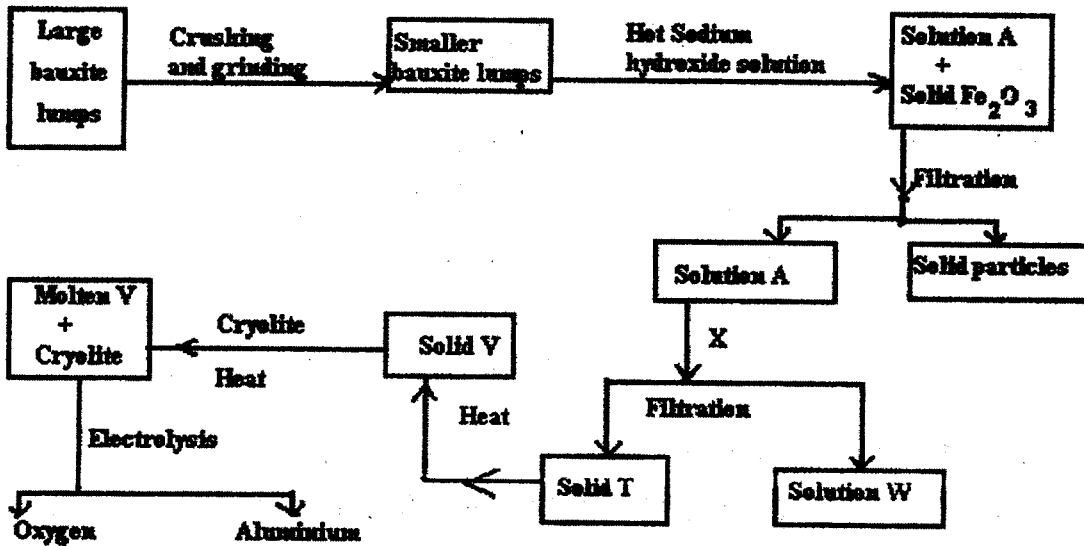
a) State why bauxite is first crushed and ground into smaller
   particles?   (1mk)

b) Only aluminium oxide and silicon (IV) oxide dissolves chemically in the hot
   concentrated sodium hydroxide to form solution A, Iron (III) oxide does not.
What property make aluminium oxide and silicon (IV) oxide react with sodium
   hydroxide solution?

I.   Silicon (IV)oxide.   (1mk)

II.   Aluminium oxide.   (1mk)

c) Write ionic equation for the reaction between sodium hydroxide solution and

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I.   Silicon (IV) oxide.   (1mk)

II.   Aluminium oxide.   (1mk)

III.   I. Identify solid T   (1mk)

d)   Name substance X that could be used to precipitate out solid T from solution Q.   (1mk)

e)   Write equation for the formation of solid V from solid T.   (1mk)

f)   Why is cryolite added to substance V?   (1mk)

g)   Write half equation for the formation of aluminium at the cathode during electrolysis   (1mk)

h)   Give one advantage of locating aluminium extraction plant near the

    I.   Source of hydroelectricity   (1mk)

    II.   Aluminium deposits or sea port.   (1mk)

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i) Explain why an alloy of aluminium, instead of aluminium is used in overhead electric power cables. (1mk)

j) State two uses of aluminium. (2mks)

2. One cm³ of dilute sulphuric (vi) acid was added to four test tubes containing cation as shown below.

A   B   C   D

Ba^{2+} Zn^{2+} Pb^{2+} Mg^{2+}
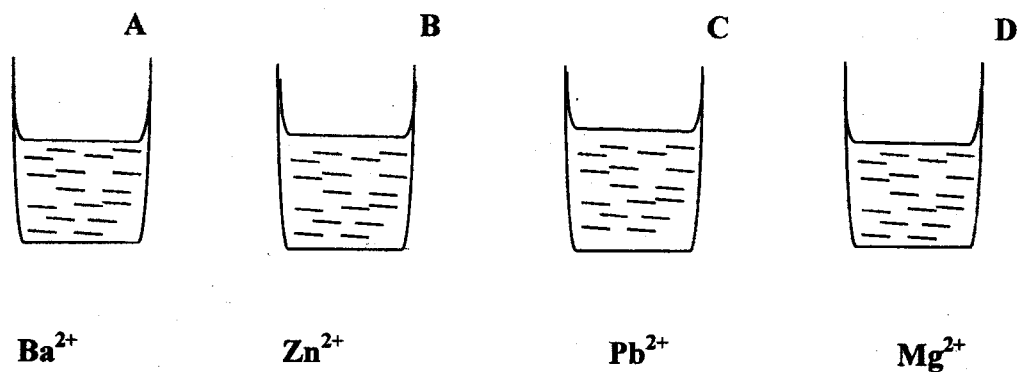
(a) (i)   In which **two** test tubes was a white precipitate formed. (2mks)

(ii) Write the ionic equation for the formation of the precipitates formed. (2mks)

(b) When a few drops of soap solution are added into the contents of test tube D, a white substance is formed on the sides of the test tube.

(i) Name the white substance. (1mk)

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(ii)Three samples of water were collected from three districts labeled A, B, and C. Some soap solution was added to equal volumes of each water samples and the soap volumes required to form lather before and after boiling the samples were as recorded in the table below.

Sample of water from district	A	B	C
Volume of soap solution before boiling	20	5	11
Volume of soap solution after boiling	20	5	5

(a) From which district is the water sample likely to be soft? Explain.   (2mks)

(b) Which district has temporary hard water? Explain.   (2mks)

(c) Give **three** other methods other than boiling that can be used to remove Hardness in water   (3mks)

(d) State two dis advantages and one advantage of hard water.

Disadvantages   (2mks)

i)

ii)

Advantage   (1mks)

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3) a) give the meaning of the following terms

i) Acid. (1mk)

ii) Strong acid. (1mk)

b) A solution of hydrogen chloride in water turns blue litmus red while a solution of the same gas in methylbenzene has no effect on blue litmus. Explain this observation. (2mks)

c) In the preparation of magnesium carbonate, magnesium was burnt in air and the product M collected. Dilute sulphuric (VI) acid was then added and the mixture filtered and cooled. Sodium carbonate was added to the filtrate and the contents filtered. The residue was then washed and dried to give a white powder.

(a) Give the name of product M. (1mk)

(b) Write the chemical equation for the formation of the product. (1mk)

(c) (i) Name the filtrate collected after sodium carbonate was added. (1mk)

(ii) Write down the chemical formula of the white powder. (1mk)

(d) Write a chemical equation for the reaction between product in (a) and the acid. (1mk)

(e) Write an ionic equation to show the formation of the white powder. (1mk)

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(f) Write an equation to show what happens when the white powder is strongly heated. (1mk)

4. a) give the meaning of the following terms

(i) Exothermic reaction. (2mks)

(ii) Latent heat of fusion. (2mks)

b) The thermochemical equation for dissolution of sodium hydroxide is given below.

$NaOH_{(s)} + water \longrightarrow NaOH_{(aq)}$; $H = -42kJmol^{-1}$
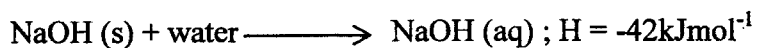
(i)   Is this an endothermic or an exothermic process? Give a reason. (2mks)

(ii) Represent this process in an energy level diagram below. (3mks)