Name: .... Class: .... Adm.No................

School: .... Date: ....

Sign:..

233/2
CHEMISTRY
Paper 2
JULY/AUGUST, 2018
Time: 2 hours

POST EVALUATION II E X A M I N A T I O N - 2018

Kenya Certificate to Secondary Education
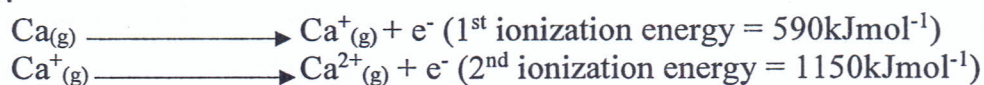
CHEMISTRY PAPER 2

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES
- *Write your name, admission number, date and school in the spaces provided.*
- *Answer **all** the questions in the spaces provided.*
- *All working must be clearly shown where necessary.*
- *Scientific calculators may be used.*

FOR EXAMINERS' USE ONLY

Questions	Maximum Score	Candidate's Score
1	12	
2	13	
3	9	
4	11	
5	12	
6	11	
7	12	
TOTAL	80	

1. a) Study the ionization energies of calcium given below and answer questions that follow.

$Ca_{(g)} \longrightarrow Ca^+_{(g)} + e^-$ (1st ionization energy = 590kJmol^{-1})
$Ca^+_{(g)} \longrightarrow Ca^{2+}_{(g)} + e^-$ (2nd ionization energy = 1150kJmol^{-1})

(i) Define the term ionization energy   (1 mark)

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(ii) Explain why the second ionization energy in calcium is almost double the first.
                                                                         (2 marks)

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b) Study the table below and use it to answer the questions

	Na	Al	Cl	NaCl	AlCl$_3$
M.P in °C	98	660	-101	801	-
B.P in °C	880	2460	-35	1413	-
Electrical conductivity	Good	Good	Does not	Good in solution or molten	Does not
Valency	1	3	1	-	-

(i) Explain why the melting point of NaCl is higher than that of aluminium chloride yet both are period 3 chlorides.   (2 marks)

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(ii) Other than the properties given in the table above, give two reasons why aluminium is used in making cooking pots.   (2 marks)

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c)i) State and explain the observation made when a blue litmus paper is dipped into a solution of aluminium chloride   (2 marks)

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ii) Using dots (•) and crosses (x) to represent electrons, show the bonding in sodium chloride.   (1 mark)

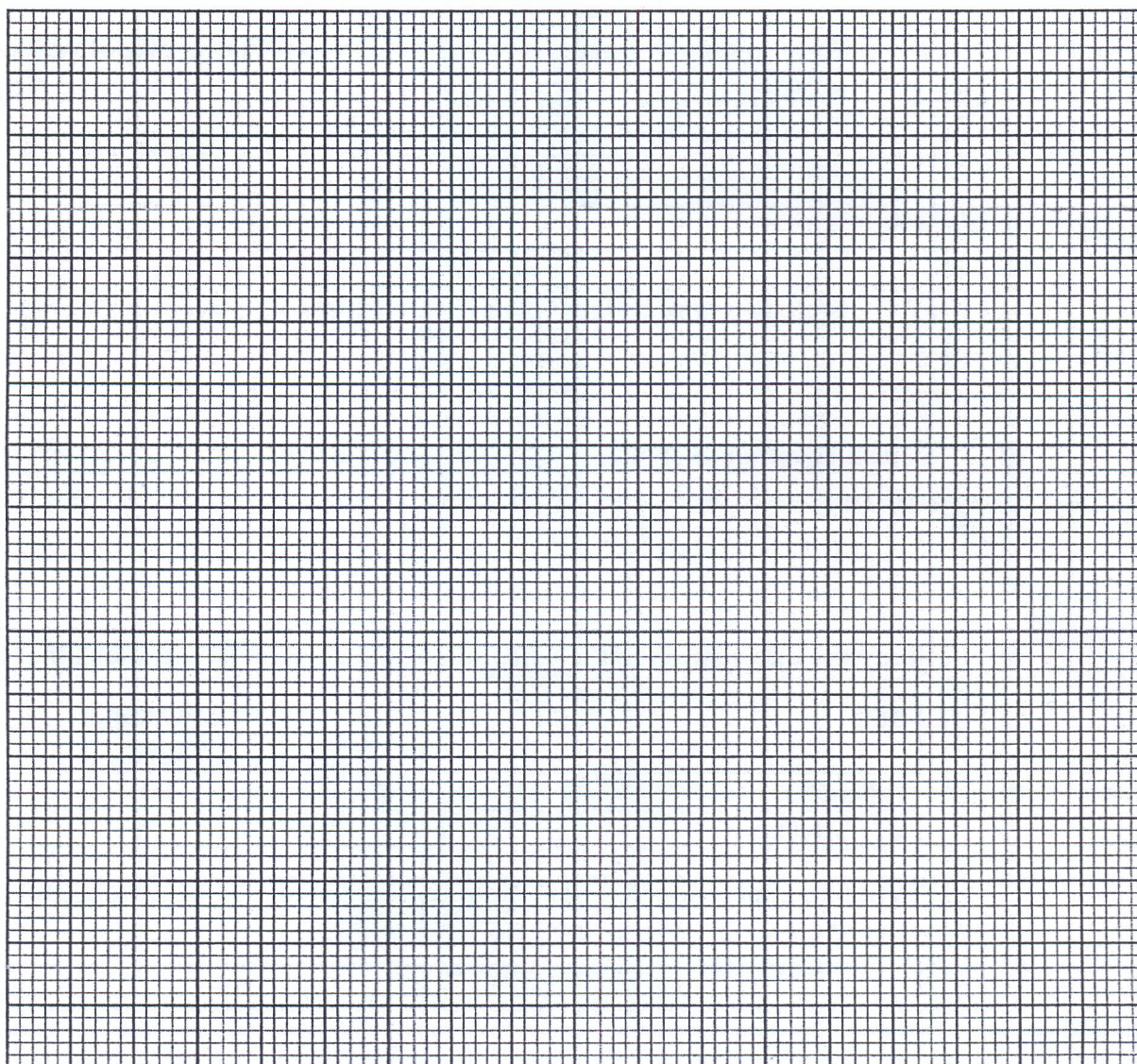iii)   Sodium and chlorine have the same valency. Compare their ionic radii   (2 marks)

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2.   a)   The table below gives the solubilities of ammonium phosphate at the stated temperatures.

Temp °C	10	18	26	34	42	50
Solubility g/100g of water	21	28	38.5	51	68.5	98

(i)   Plot a graph of solubility of ammonium phosphate against temperature.   (3 marks)

(ii)   Using the graph:

I   Determine the solubility of $(NH_4)_3PO_{4(aq)}$ at 17°C   (1 mark)

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II   Determine the molar concentration of $(NH_4)_3PO_{4(aq)}$ at 17°C   (2 marks)
             (N = 14, H = 1, P = 31, O = 16)

III   What mass of a saturated solution of $(NH_4)_3 PO_4$ in 50g of water will be present
         at 30°C   (2 marks)

IV   State two applications of solubility curves   (2 marks)

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iii)   Use an equation to explain how temporary water hardness is removed   (1 mark)

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iv)   Study the information in the table below and answer the questions that follow.

Salt	Solubility (g/100g of water at	
	45°C	60°C
i) Na_2CO_3	35	80
ii) $Pb(NO_3)_2$	77	101

A mixture containing 90g of sodium carbonate and 72g of Lead(II) nitrate in 100g of
water at 60°C was cooled to 45°C.
(i)   Identify the salt that crystalised out   (1 mark)

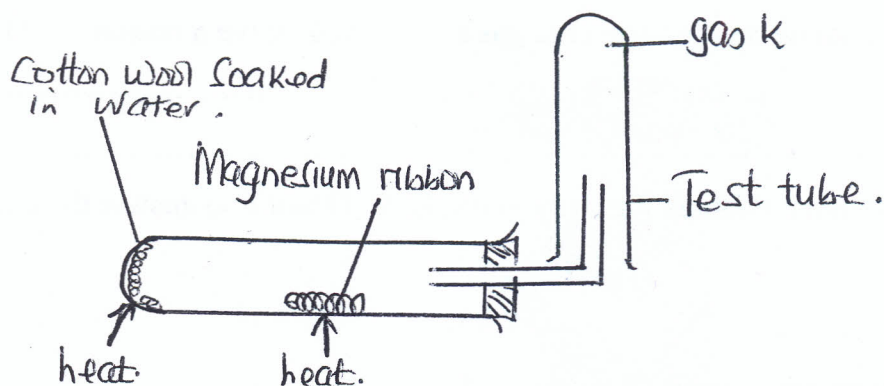..

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(ii)   Calculate the mass of the salt that crystallised out   (1 mark)

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3.   A student set up the experiment below to collect gas K. The cotton wool was heated before heating the magnesium coil.

a)   Explain why it was necessary to heat the moist cotton wool before heating magnesium.
                                                                                                          (1 mark)

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b)   Identify gas K   (1 mark)

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c)   What property of gas K makes it to be collected as shown   (1 mark)

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d)   Write down the equation for the reaction in the combustion tube   (1 mark)

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e)   State the observation made in the combustion tube   (1 mark)

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f) Calculate the volume of gas K produced in the above experiment at RTP if 4g of magnesium was completely burnt.
(Molar volume of a gas at RTP is $24.0dm^3$; $Mg = 24$) (3 marks)

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g) A flame should not be brought closer to gas K collected. Give a reason (1 mark)

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4. Use the standard reduction potentials for elements A, B, C, D and F to answer the questions that follow.

$$E^{\ominus} \text{ volts}$$

$A^{2+}_{(aq)} + 2e \rightleftharpoons A_{(s)} - 2.90$

$B^{2+}_{(aq)} + 2e \rightleftharpoons B_{(s)} - 2.38$

$2C^{+}_{(aq)} + 2e \rightleftharpoons C_{2(g)} \; 0.00$

$D^{2+}_{(aq)} + 2e \rightleftharpoons D_{(s)} + 0.34$

$\frac{1}{2}F_{2(g)} + e \rightleftharpoons F^{-}_{(aq)} + 2.87$

a)i) Which element is likely to be hydrogen. Give a reason for your answer. (1 mark)

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ii) What is the $E^{\ominus}$ value for the strongest oxidizing agent (1 mark)

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iii) Draw a labelled diagram of the electrochemical cell that would be obtained when half cells of B and D are combined. (3 marks)

iv)   Calculate the emf of the electrochemical cell contracted in (iii) above   (1 mark)

b)   During the electrolysis of aqueous copper (II) sulphate using copper electrodes, a current of 0.2 Amperes was passed through the cell for 5 hours.

(i)   Write an ionic equation for the reaction that took place at the anode.   (1 mark)

(ii)   Determine the change in mass of the anode which occurred as a result of electrolysis process.

                    (Cu = 63.5, 1 Faraday = 96500 coulombs)   (3 marks)

5.   Study the flow chart below and use it to answer questions that follow.
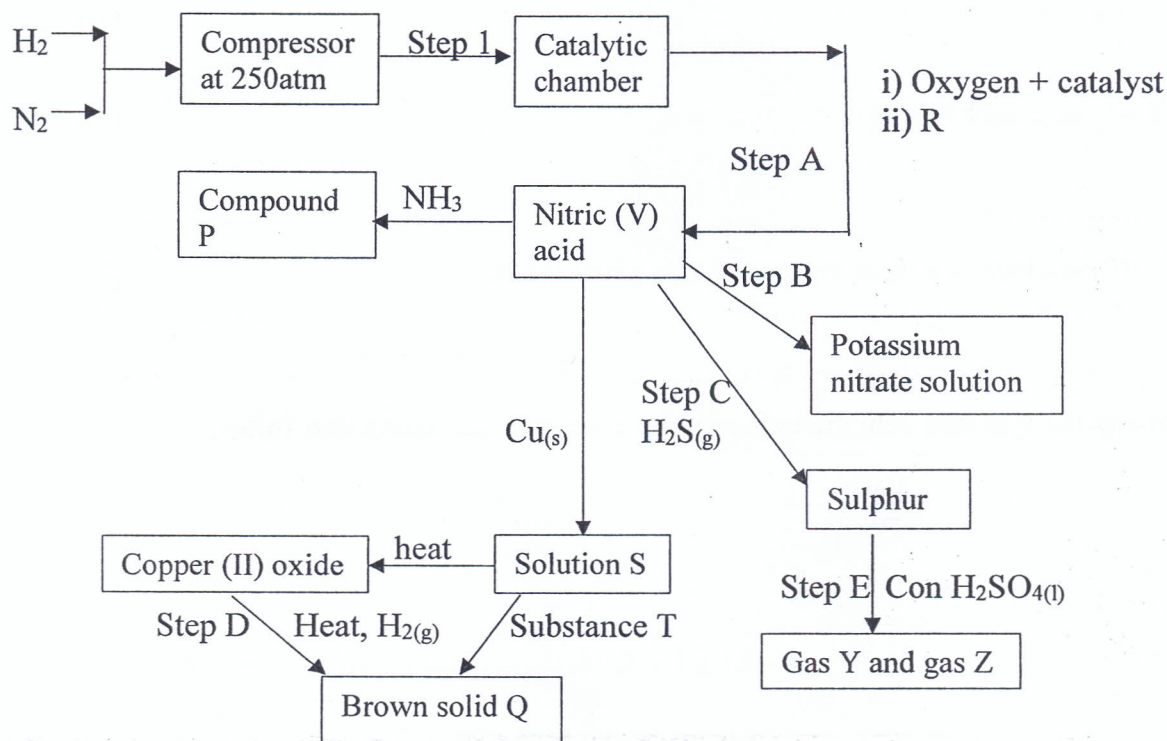
a)i)   State the optimum condition of temperature required in step I   (1 mark)

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ii)   Name the catalyst used in
        I   The catalytic chamber   (1 mark)

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        II   Step A   (1 mark)

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b)i)   Identify R   (1 mark)

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ii)   Write two balanced chemical equations taking place in step A.   (2 marks)

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c)   Identify the process taking place in
(i)   Step B   (1 mark)

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ii)   Step E   - (1 mark)

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d)   Explain how the reaction in step C occurs.   (1 mark)

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e)   Give the possible identity of substance T   (1 mark)

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f)   Write the formula of compound P and give one of its uses.   (2 marks)

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6.   a)   Study the reaction scheme below and answer the questions that follow.

C_6H_{14}

Step 1

C_4H_{10} C_2H_6 ← Step II C_2H_4 — Step V → Polymer W

$2Cl_2$

Step III ↓ UV light   Step IV

CH_3CH_2OH Step VI → CH_3COOH
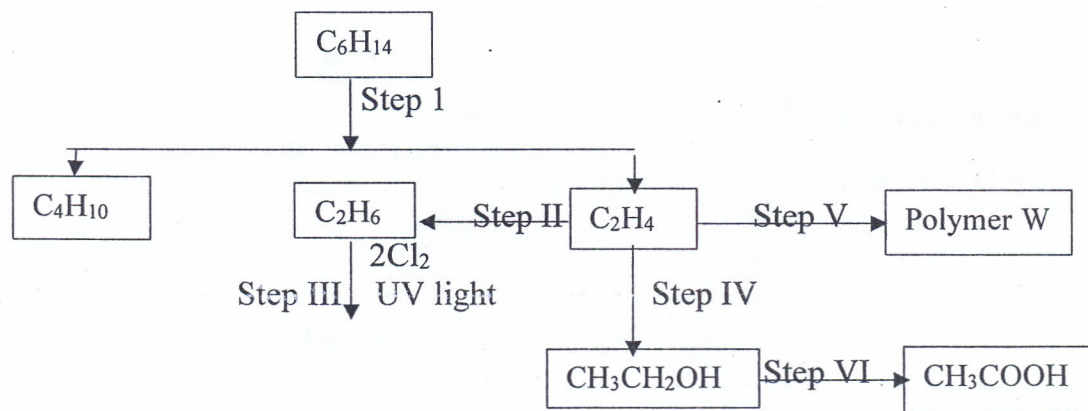
(i) Name the process in I)Step I   (1 mark)
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                                  I) Step (VI)   (1 mark)
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ii) State the homologous series to which the compound C_4H_{10} belongs   (1 mark)
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iii) State the reagent and the condition used in step IV   (1 mark)
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iv) Write an equation for the reaction in step III   (1 mark)
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v) Give one industrial application of the process in step II   (1 mark)
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vi) Draw the structure of a repeat unit in polymer W   (1 mark)

b)   Give the IUPAC names of;
     (i) CH_3CCH (1 mark)
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     (ii) $HCOOH$ (1 mark)

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c)   When an organic compound A is reacted with potassium hydrogen carbonate,
     effervescence is observed. A reacts with ethanol to form a compound whose structure
     is shown below.

$$CH_3CH_2CH_2 \overset{O}{\overset{\|}{C}}\text{-O-}CH_2CH_3$$
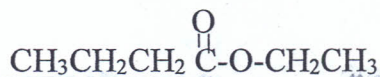
     i)   Write the molecular formula of compound A   (1 mark)
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ii)   What is the name of the group of compounds to which Z belongs?   (1 mark)

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7.   a)   Sodium - 20 *is* a radioisotope and decays by beta emission as shown in the equation
below.

$$^{20}_{11}Na \longrightarrow ^{a}_{b}X + ^{0}_{-1}e$$
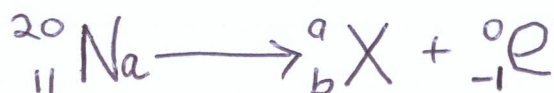
(i)   Define the term radioisotope   (1 mark)

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ii)   Find the values of a and b   (1 mark)

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iii)   Identify the actual symbol of X   (1 mark)

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b)   The half-life of sodium-20 is 0.3 seconds. P grammes of sodium 20 decays to 6
grammes in 0.9 seconds.
(i)   Calculate the initial mass P of the radioisotope   (2 marks)

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ii)   With reference to sodium-20, give one use of the radioactive isotope   (1 mark)

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c)   The extraction of sodium from its ore takes place in a Downs cell. Below is a
simplified diagram for the extraction.
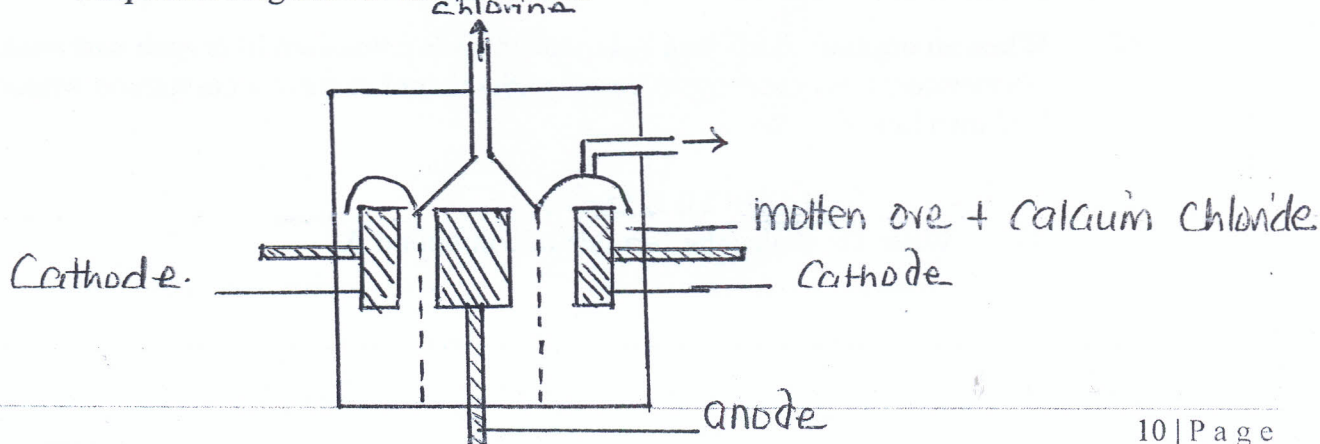
(i)   Name the ore from which sodium is extracted.   (1 mark)

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ii)   Explain why in this process the ore is mixed with calcium chloride   (2 marks)

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iii)   Write ionic equations for the reactions which place at;   (2 marks)
        Cathode

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        Anode

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iv)   Why is sodium used in nuclear reactors?   (1 mark)

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