KCSE 2023 TOP PREDICTION MASTER CYCLE 9

Name ……………………………………… Index Number……………….……/………………..

Signature ………………………………….. Date …………………/……..………/…………

INSTRUCTIONS TO CANDIDATES

1. Write your name and index no in the spaces provided above.
2. Sign and write the date of exam in the spaces provided above.
3. Answer all the questions in the spaces provided after each.
4. Mathematical tables and silent electronic calculators may be used.
5. All working must be clearly shown where necessary.
6. This paper consists of 12 printed pages. Candidates should check to ensure that all pages are printed as indicated and that no questions are missing.
7. All answers should be written in English.

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1	11	
2	14	
3	10	
4	10	
5	12	
6	13	
7	11	
Total	**80**	

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

The letters do not represent the actual symbols of the elements.

Elements	Electronic configuration	Ionization energy kJmol⁻¹
P	2:1	519
C	2:8:1	494
R	2:8:8:1	418

(i) What is the general name given to the group which elements P, C and R belong? (1mark)

………

(ii) What is meant by ionization energy? (2marks)

………

(iii) Explain why element P has the highest ionization energy. (2marks)

………

(iv) (a) When a piece of element "C" is placed on water, it melts and hissing sound is produced as it moves on the surface of the water. Explain these observations. (2marks)

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……….………………………………………………………………………………………………………

(b) Distinguish between a strong and a weak base. Give an example of each. (3marks)

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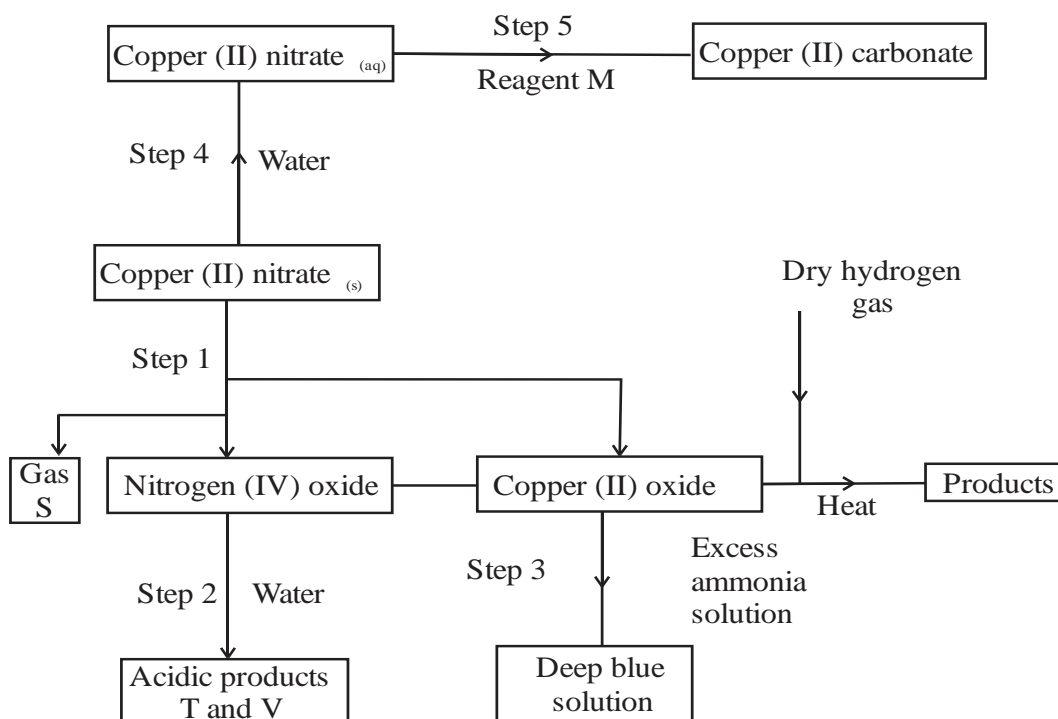**www.kenyaeducators.co.ke or Contact 0724333200/0768321553/0795491185**

2. The flow chart below shows some reactions starting with copper (II) nitrate. Study it and answer questions that follow.

a) State the condition necessary in step 1. (1mark)

. ...

   i.   Identify (1mark)
      Reagent **M**

    ....

    Gas **S** (1mark)

    ....

    Acidic products (2marks)

     T...

     V...

   ii.   Write the formula of the complex ion formed in step 3. (1mark)

    ....

iii.   Write the equations for the reaction in,   (2marks)
  Step 1

  ....

  Step 2

  ....

iv.   Write an ionic equation for that occurs in step 5.   (1mark)

  ....

v.   State any **one** observation made in STEP 1,   (1mark)

  …………..

3.   a) State **two** types of polymerization.   (2marks)

  ....

  ....

  b) Name the compound with the formula below:

  $CH_3CH_2CH_2ONa$ (1mark)

  ....

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c) Study the scheme below and use it to answer the questions that follow:-

i. Name the following compounds:- (2marks)
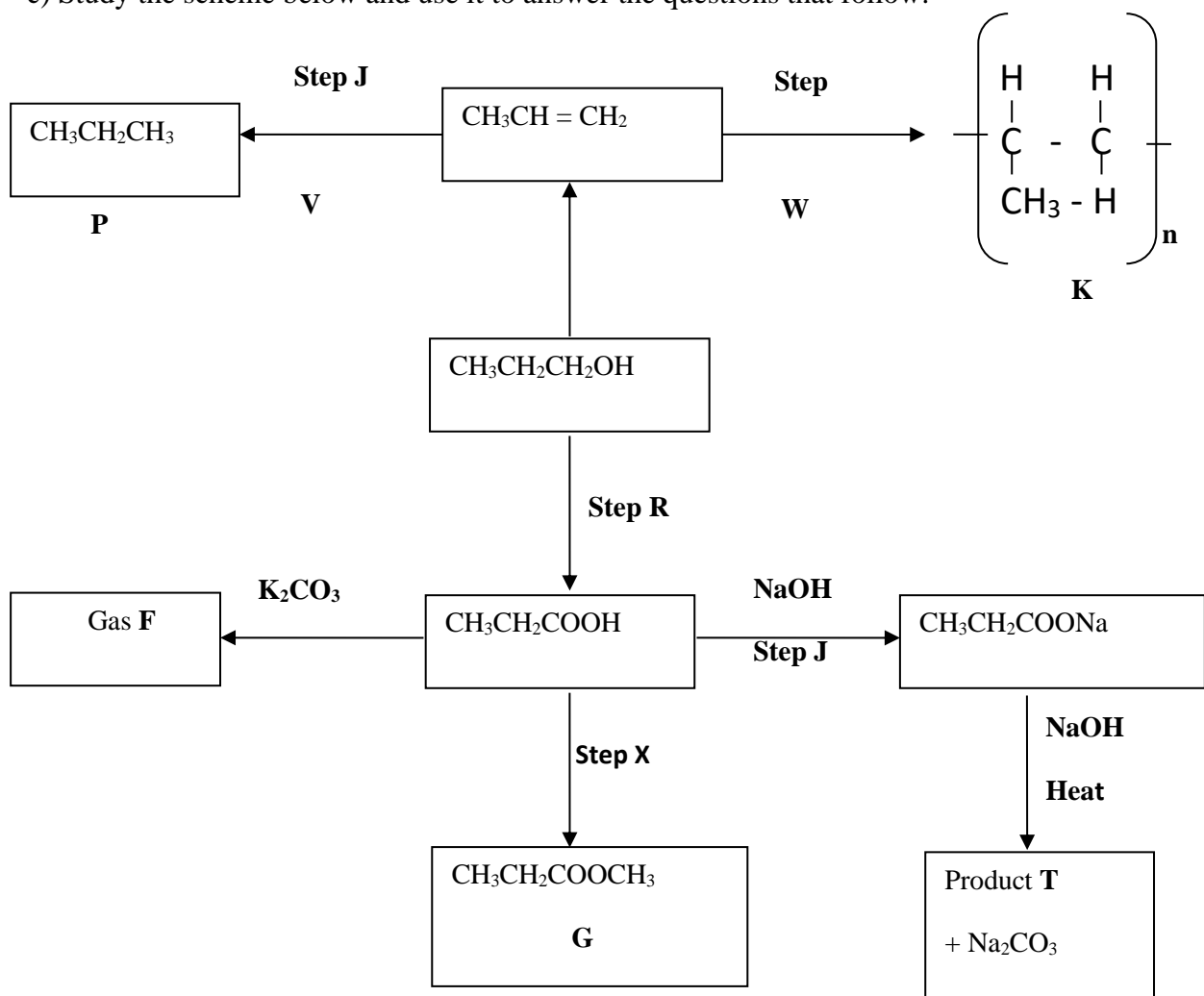
I. Product **T** ………………………………. II. **K** ……………………………………….

ii. State **one** common physical property of substance **G**. (1mark)

....

iii. State the type of reaction that occurred in step **J.** (1mark)

....

iv. Give **one** use of substance **K.** (1mark)

....

v. Write an equation for the combustion of compound **P**. (1mark)

....

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vi.   Describe how compounds CH_3CH_2COOH and $CH_3CH_2CH_2OH$ can be distinguished chemically.
(2marks)

....

....

....

vii.   If a polymer **K** has relative molecular mass of 12,600, calculate the value of **n** (H=1 C =12)
(2marks)

....

....

....

4. The diagram below shows the extraction of sodium metal using the downs cell. Study it answer the questions that follow.
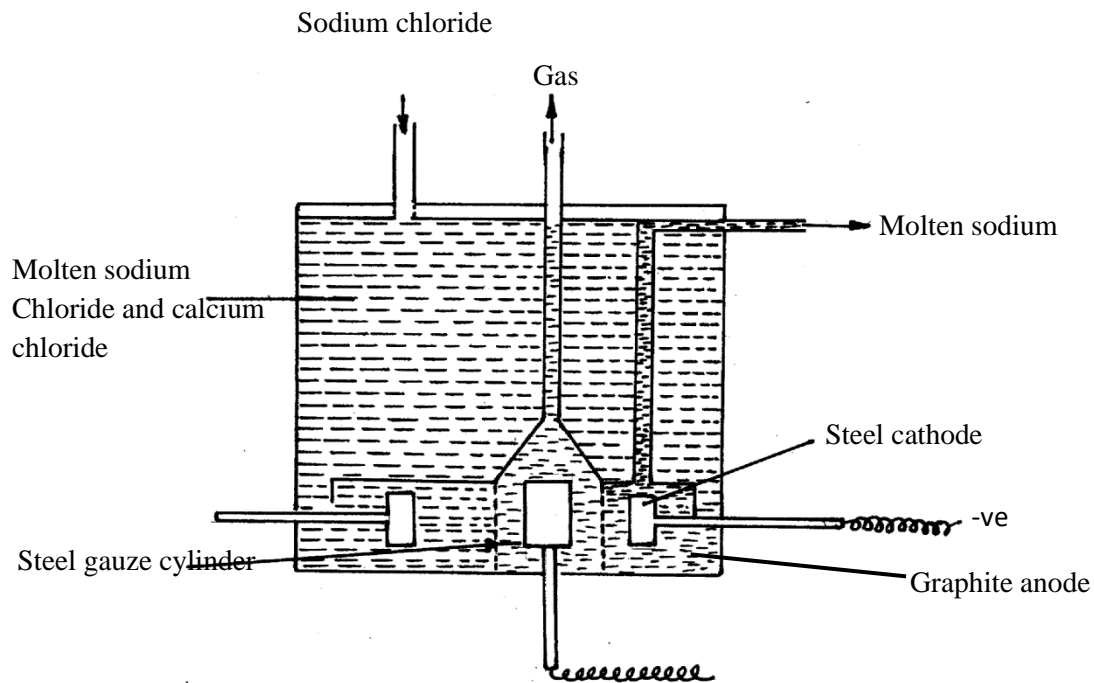
i.   Explain why in this process the sodium chloride is mixed with calcium chloride. (2marks)

…………………………………………..…………………………………………………………………

…..……

ii.   Why is the anode made of graphite and not steel?   (1mark)

…………………………………………..…………………………………………………………………

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iii. State **two** properties of sodium metal that make it possible for it to be collected as shown in the diagram. (2marks)

…………………………………..……………………………………………………………………

…..…………………………………………….……………………………………………………..

iv. What is the function of the steel gauze cylinder? (1mark)

…………………………………..……………………………………………………………………

…..……………………………………….……………………………………………………………

v. Write ionic equations for the reactions which take place at: (2mks)

Cathode……………………………………………………… ………………………………

Anode……………………………………………………………………………………………….

vi. Give **one** industrial use of sodium metal. (1mark)

…………………………………..……………………………………………………………………

…..……………………………………………………………………………………………………

b) Explain why the sodium metal is kept stored under kerosene. (1mark)

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5. Below is a simplified diagram for the manufacture of sulphuric (VI) acid in large scale.

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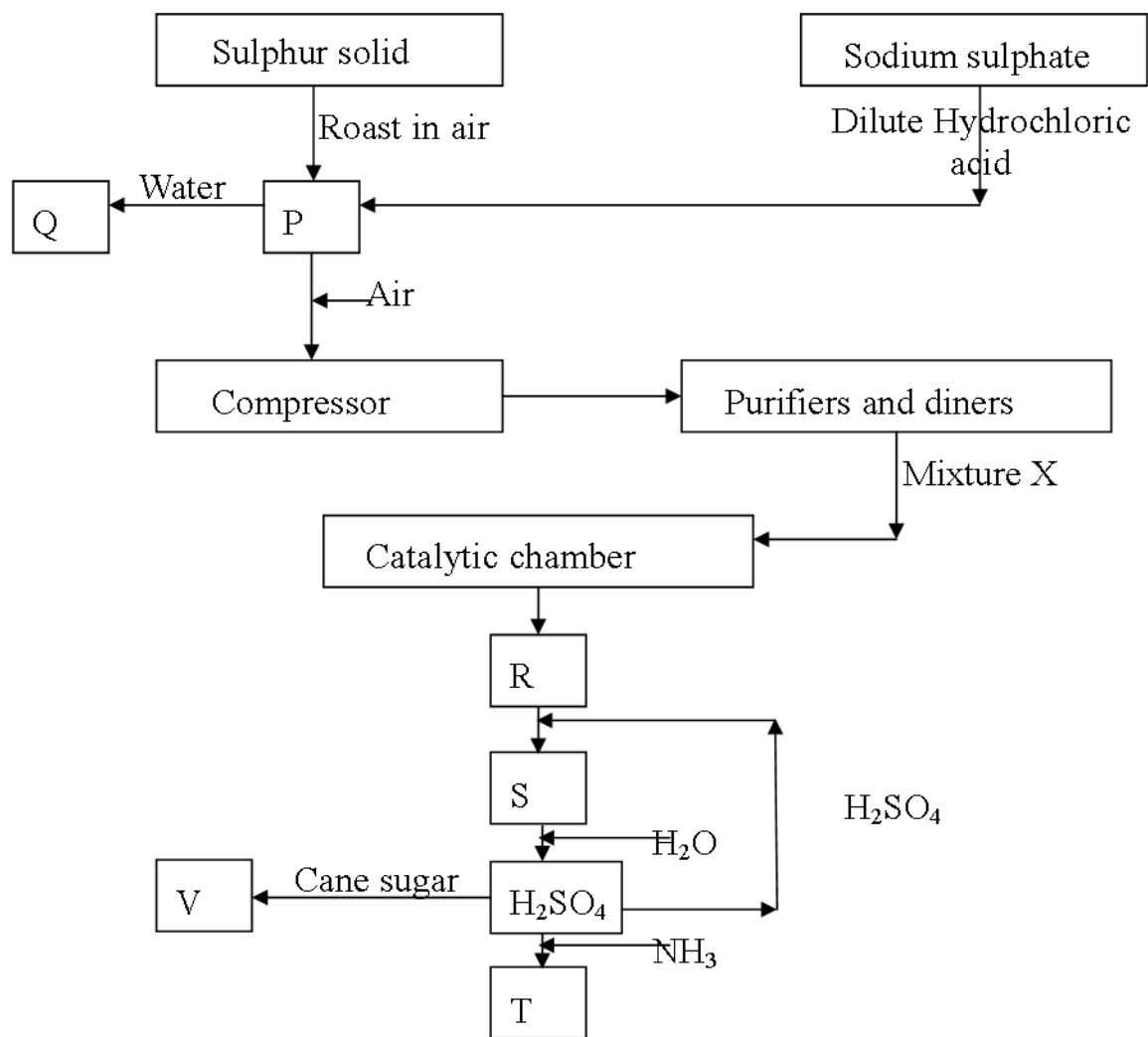
a) Name the substances **P, Q, R, S, T** and **V** (3marks)

P…………………………………………...   **S**……………………………………………

Q…………………………………………   **T**………………………………………...

R………………………………………..   **V**……………………………………………

b)

i. What is the use of the compressor? (1mark)

………………………………………………………………………………………………………

………………………………………………………………………………………………………

ii. Name **two** impurities removed in purification chamber? (1mark)

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....

....

c)

    i)   State **two** conditions for the formation of **R** other than the catalyst.   (1mark)

        ....

        ....

    ii)   Write the chemical formula of the commonly used catalyst in the catalytic chamber. (1mark)

        ....

        ....

    iii)   Write an equation for the reaction in the catalytic chamber.   (1mark)

        ....

d)   Describe a chemical test to confirm the presence of **P**.   (1mark)

    ....

    ....

e)   One of the uses of sulphuric (VI) acid is 'pickling' metals. What does the term 'pickling' mean?

                                                                           (1mark)

    ....

    ....

f)   The following diagram represents the method of preparing sulphur (1V) oxide solution.

$SO_{2(g)}$ → Inverted funnel — Water
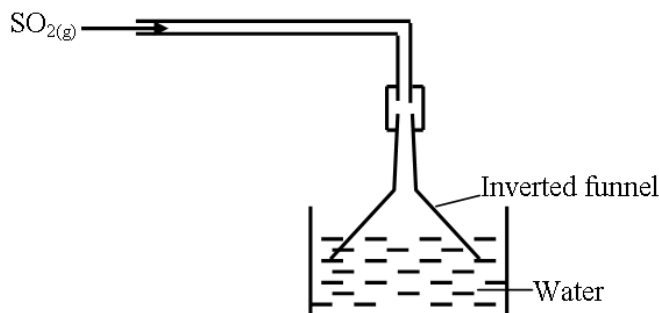
    i.   Why is an inverted funnel used?   (1mark)

        ....

        ....

        Explain the observation made when moist litmus paper is dipped in a gas jar containing

        sulphur (IV) oxide gas.   (1mark)

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……

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g) State and explain what would be observed if concentrated sulphuric (VI) acid is added to canesugar leading to formation of substance Q. (2marks)

……………………………………………………………………………………………………….

……………………………………………………………………………………………………….

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6.The following results were obtained in an experiment to determine the heat of neutralization of $50cm^3$ of 2M HCl and $50cm^3$ of 2M NaOH.

Mass of plastic cup	=	45.1g
Initial temperature of acid	=	27.0°C
Initial temperature of Alkali	=	23.0°C
Mass of Plastic cup + NaOH + HCl	=	145.1g
Temp. of the mixture of HCl + NaOH	=	38.5°C.

a) Define molar heat of neutralisation. (1mark)

……….……

……

b) Write an ionic equation for the neutralisation of HCl and NaOH. (1mark)

……….……

……

a) Calculate:

i. The amount of heat produced during the experiment. (*Specific heat capacity of solution = 4.2kJ/kg/K and density of solution = 1g/cm³*). (2marks)

……….……

……

……

ii. The molar heat of neutralisation for this reaction. (2marks)

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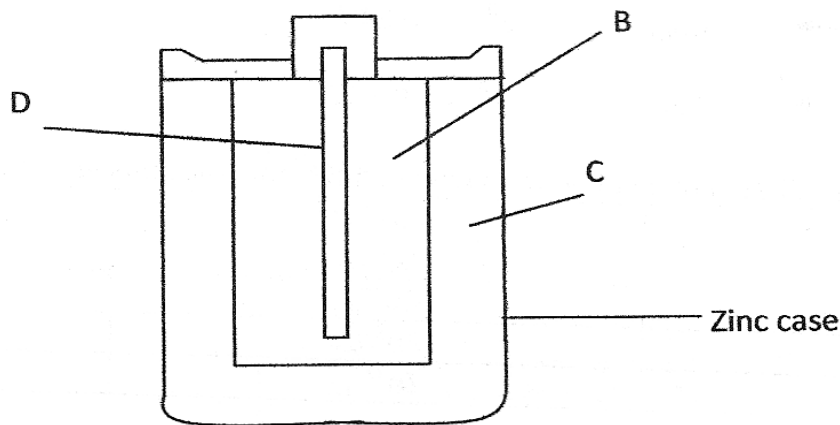……..……………
………

b) Explain why the molar heat of neutralisation of sodium hydroxide and ethanoic acid of equal volume and molarity would be less than the value obtained in c (ii) above. (2 marks)

………..……………
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………………………………………………………………………………………………………..……………………
…….

e)   Draw an energy level diagram for the neutralisation reaction in (c) above. (2 marks)

7. The figure below shows parts of Le'Clanche cell (dry cell).

(a) Name:
(i)   Substance D (1mark)
…….
(ii) Mixture B (1mark)
…….
(iii) Electrolyte C (1mark)
…….
(b) In the cell, the electrolyte is a paste. Explain. (1mark)

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....

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(c) The following reaction occurs when the cell is in use.

$$Zn_{(s)} + 2NH_4^+{}_{(aq)} \xrightarrow{\quad MnO_2 \quad} Zn^{2+}{}_{(aq)} + 2NH_{3(aq)} + H_2O_{(l)}$$

Given that:

$$Zn^{2+}{}_{(aq)} + 2e^- \xrightarrow{\quad MnO_2 \quad} Zn(s) \qquad\qquad E^\Phi = \textbf{-0.76V}$$

$$2NH_4^+{}_{(aq)} + 2e^- \longrightarrow 2NH_{3(g)} + H_2O_{(l)} \qquad\qquad E^\Phi = \textbf{+0.74V}$$
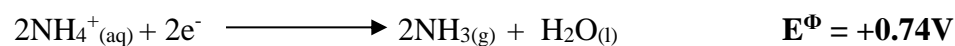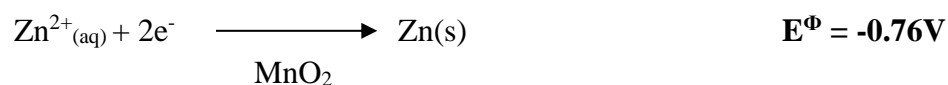
Calculate the e.m.f. of the cell.   (1mark)

(d) Use the standard electrode potentials given below to answer the questions that follow.

Half reactions	Electrode potential, E^θ (V)
$D^+{}_{(aq)} + e^- \longrightarrow D_{(s)}$	+ 0.80
$E^{2+}{}_{(aq)} + 2e^- \longrightarrow E_{(s)}$	+ 0.34
$F^{2+}{}_{(aq)} + 2e^- \longrightarrow F_{(s)}$	-0.13
$G^{2+}{}_{(aq)} + 2e^- \longrightarrow G_{(s)}$	-0.76

(i) Construct an electrochemical cell that will produce the lowest emf.   (3 marks)

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(ii) Calculate the emf of the cell constructed in (i) above. (1 mark)

8. a) Iron is obtained from haematite using a blast furnace shown below. Study it and answer the questions that follow.

Raw materials (Haematite)

230^0 C
470^0C
Y 1790^0C Y

Hot air

Slag

Hot Air

Molten iron
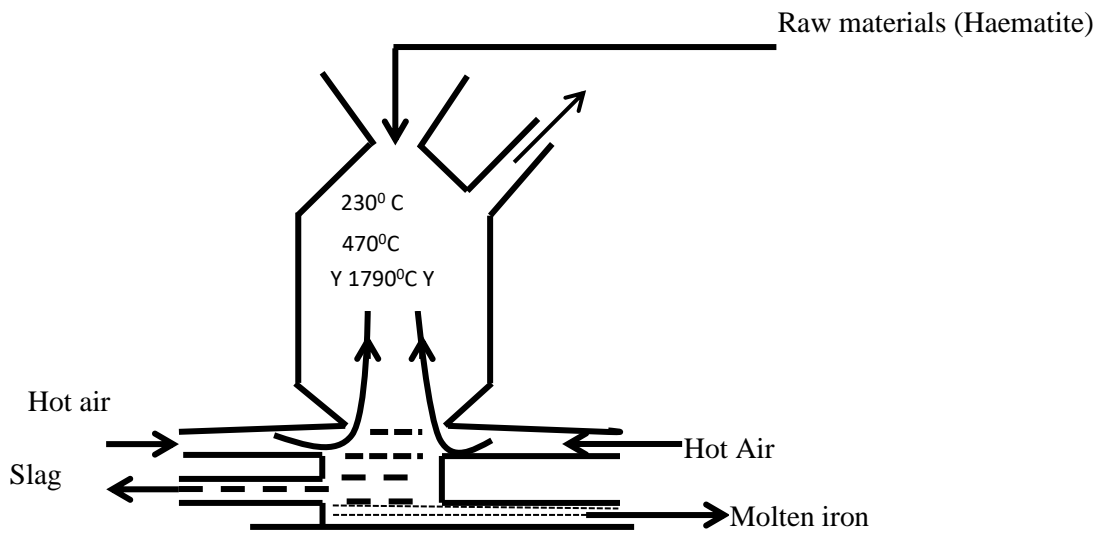
i) Four raw materials are required for the production of iron. Three of these are haematite, hot air and coke. Give the name of the fourth raw material and its use. (1 mark)

I Name………………………………………………………………………………………….

II Use………………………………………………………………………………………….

ii) Name another Iron ore other than the one shown in the blast furnace. (1 mark)

………………………………………………………………………………………………………

………………………………………………………………………………………………………

iii) State one physical property of slag other than density that allows it to be separated from molten Iron as shown in the figure. (1 mark)

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iv) Iron from the blast furnace contains about 5% carbon.
   I. Describe how the carbon content is reduced. (1 mark)

   ……

   ……

   ………………………………………………………………………………………………………

   II. Why is it necessary to reduce the carbon content? (1 mark)

   ……

   ………………………………………………………………………………………………………

v) Explain why temperature in the region marked Y is higher than that of the incoming hot air (1 mark)

   ……

   ……

   ………………………………………………………………………………………………………

vi) Describe the process which led to the formation of iron in the blast furnace (3 mark)

   ……

   ……

   ……

   ……

   ……

   ……

   ………………………………………………………………………………………………………

vii) Give a reason why the melting point of the Iron obtained from the blast furnace is 1200^0C while that of pure iron is 1535^0C (1 mark)

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viii) One of the components of the waste gases is Nitrogen (IV) oxide. Describe the adverse effects it has on the environment. (2 marks)

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