Name……………………………….Index No…………………………………

233/2
CHEMISTRY
PAPER 2
JULY/AUGUST – 2009
TIME: 2 HOURS

INTERZONAL

Kenya Certificate of secondary Education

1.   (a) Gaseous pollutants of air include: CO_2, NO_2 and excess CO_2
        (i)   Explain why each of these substances is regarded as a pollutant
                                                                (3 marks)

        (ii)   Write the formula of two other major gaseous pollutant (1 mark)

        (b) (i) Give two reasons why tetraethyl lead to be added to petrol (1 mark)

        (iii)   Give two reasons why tetraethyl lead used to be added to petrol (1
                  mark)

        (c) The scheme below shows some process that occurs naturally. Step 2 does
        not require a second substance
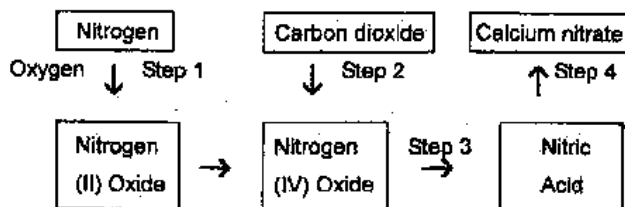
(i)   Name the reagents in

Step 3……………………………………………………….. (1 mark)

Step 4……………………………………………………….. (1 mark)

(ii)   Write an equation to represent a process by which carbon oxide

(a) added to the air   (1 mark)

(b) Removed from the air by living plants   (1 mark)

2.   The diagram below shows an arrangement used to electrolyze concentrated NaCL (brine) solution using inert electrodes and collects gaseous products
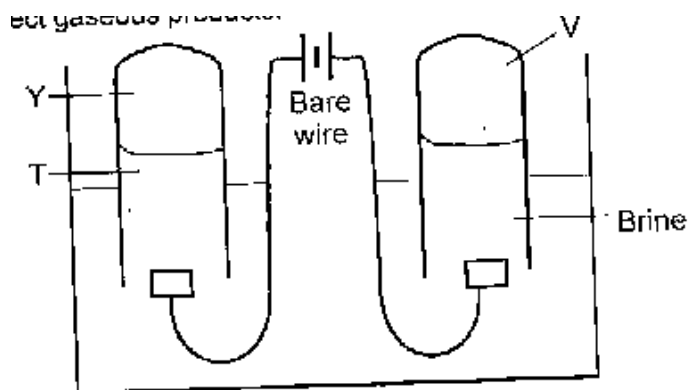
(i) Give two examples of inert electrodes   (1 mark)

(ii) Identify one   mistake in this arrangement andc state the problem it would cause   (1 mark)

(iii) Write an overall equation for the reaction   (1 mark)

(iv) Explain why the volume of gas V is less than of X   (1 mark)

(v) After some time, a gas G that is different from Y starts collecting in tube T. identify gas G and explain why it is formed instead of Y   (1 mark)

(vi) Show on the diagram the anode and cathode (1 mark)

(b) A student set up an electrochemical cell consisting of copper and AC half cell. The electrolysis in each cell contained 1M sulphate ions and the metals were thoroughly before use.

(i) Draw a labeled diagram to represent the electro chemical cell (1 mark)

(ii) Show on the diagram the direction of flow of
  (a) Electrodes (1 mark)

  (b) A cation at the point marked W (1 mark)

(iii) The standard electrode potential copper and aluminium half cells are +0.34V and -1.66V respectively.
Determine the electromotive force E^θ of the cell made up of the two half cells
(1 mark)

(iv) What is meant by standard electrode potential? (1 mark)

3. (a) A molecule of organic compound D, can be represented as follows:

Two molecules of D react with each other to form a compound E, whose simplified structure is shown below accompanied by water molecule

  (i) From this reaction, explain why an aqueous solution is expected to be neutral (1 mark)

(ii)   Give the structure of the polymer made by reacting n monomers
                                                    (1 mark)

(iii)   Name the process by which the polymer can be converted into
         monomers   (1 mark)

(b) (i) Write an equation to represent the process in which glucose $C_6H_{12}O_6$
         is converted into ethanol   (1 mark)

(ii)   Explain how this process maintains its temperature and yield
                                                     (2 marks)

(iii)   In what ways is ethanol similar to acids? Write an equation to support
         your answer   (2 marks)

(iv)   Explain how absolute ethanol can be obtained from the fermented
         mixture   (2 marks)

(v)   State two uses of ethanol   (1 mark)

4.   (a) (i) Write the formulae of ions responsible for hardness of H_2) (1 mark)

         (ii) Softening of hard water on industrial scale uses chemicals and not
         heating. Explain this   (1 mark)

(b)   In an experiment a student measured 10cm^3 samples of hard water transferred
        them into six identical test tubes labeled 1,2,3,4,5 and 6. she then added to each
        test tube, a different volume of 0.1M Na$_2$Co$_3$ solution and measured the heights of
        precipitate formed. The results obtained were shows below.

Test tube	1	2	3	4	5	6
Volume of 0.1MNa_2Co_3	2	4	6	8	10	12
Height of precipitate	3.0	6.0	9.0	12.0	14.0	14.0

(i) Plot a graph of height of ppt (y axis) against volume of 0.1M Na_2Co_3 added

(3 marks)

(ii) Determine the minimum vol of 0.1M Na_2 Co_3 required to soften $10cm^3$ of the hard H_2O (1 mark)

(iii) Calculate the number of moles per litre of the divalent ions responsible for hardness of H_2O (2 marks)

(c) When the experiment in (b) was repeated with boiled samples of H_2O it was found that 5.0 cm^3 of 0.1M Na_2CO_3 was just enough to soften $20cm^3$ of water
(i) Explain this observation

(ii) Calculate the mass of anhydrous Na_2Co_3 needed to soften $1000dm^3$ of water before boiling (Na = 23, C=12, O= 16) (2 marks

5. (a) Nitrogen (IV) Oxide undergoes self- addition reaction in which a dynamic chemical equilibrium is reached
Reaction (i) $N_2O_{(g)} \rightarrow NO_{2(g)}$ $N_2O_{4(g)}$ $\Delta H = 34Kjmol^{-1}$

(i) What is meant by dynamic chemical equilibrium? (1 mark)

State the enthalpy change for the reaction represented below

$\frac{1}{2} N_2O(g) \rightarrow NO_{2(g)} -$ Reaction (ii)

(ii) State and explain how each of the following would affect the position of equilibrium in reaction (i)

(I) Increase in temperature   (1 mark)

(II) A decrease in pressure   (1 mark)

(b) (i) Use this information for the reaction

$CH_2 = CH_{2(g)} + HCL_{(g)} \rightarrow CH_3 CH_2CL$

Enthalpy of formation of ethane $(CH_2 = CH_2) = + 52.3$

Enthalpy of formation of HCL $= 65.0$ kjmol^{-1}

Enthalpy of formation of $CH_3 CH_2 CL = 1039$ kjmol^{-1}

(ii) Represent on the energy axes provided below, the energy change for the reaction between ethane and hydrogen chloride   (1 mark)

(iii) State the values of temperatures and pressure that are referred to as standard states when considering enthalpies   (1 mark)

Energy

Rxn Progress
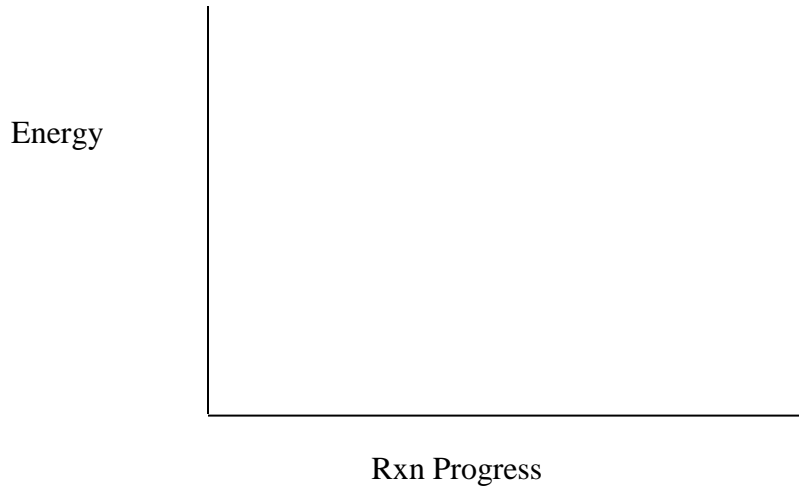
6.   Iron is the most widely used metal, especially in the   construction of mechanical structures. It exists in four main   ores from which it can be extracted.
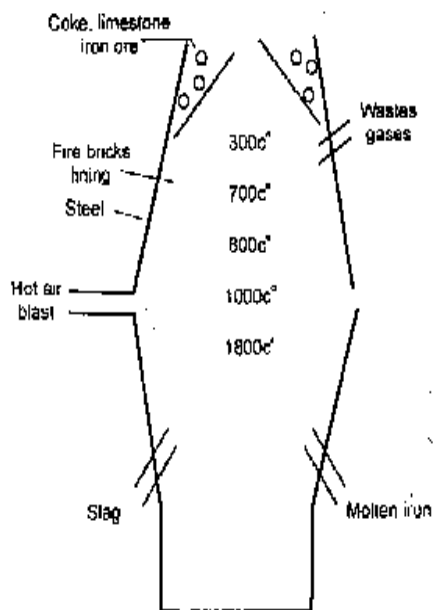
(a) (i) Give the names and formulae of any three main of iron   (2 marks)

(ii) Name the main impurity in the ores   (1 mark)

(iii) Differentiate between an ore and a mineral   (1 mark)

(b)   For most metal, the ore is first grouped into powder, followed by froath floatation. Explain hwy grinding is necessary   (1 mark)

(c)   The diagram below represents the blast furnace for the extraction of iron.

Coke. limestone
iron ore

Fire bricks
hning
Steel

Hot air
blast

300c°

700c°

800c°

1000c°

1800c°

Wastes
gases

Slag

Molten iron

(i) Explain the function of hot blast, giving an equation for the reaction at 1800^0C. (1 mark)

(ii) Name two reducing agents in the blasts furnace (1 mark)

(iii) Write an equation to show how the gaseous reducing agent is obtained (1 mark)

(iv) Limestone decomposes at about 700^0C. Explain how product for decomposition of limestone are used in the extraction process. Write equations to support your answer (2 marks)

(v) Taking any one ore of iron, show how it is reduced to the metal
Give an equation (1 mark)

(vi) State two properties of iron that make it possible to separate it from the slag (1 mark)

(vii) Name the components of the gaseous wastes and show how some of them can be reused in the furnace (2 marks)
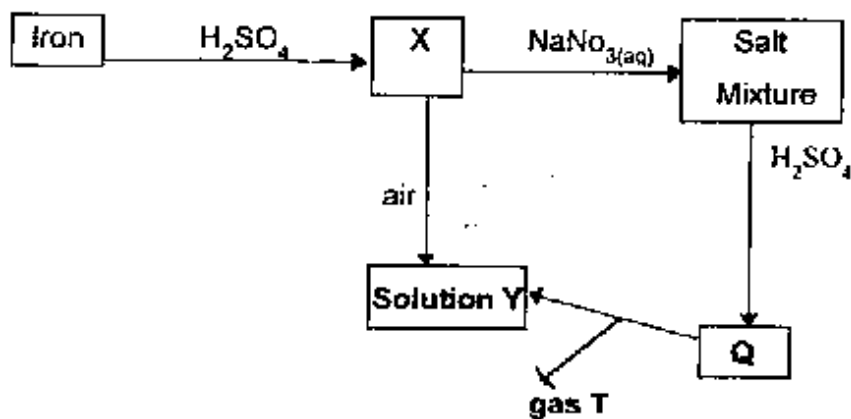
7.   (a) Marble chips weighing 5.0g required $30cm^3$ of 2 .M $HCL_{(aq)}$ to react with all the calcium carbonate in it. (ca = 40, O = 16, C = 12)
(i) Write a balanced formula equation for the reaction   (1 mark)

(ii) How many moles of HCL were used   (2 marks)

(iii) Calculate the percentage of calcium, carbonate in the chips   (2 mark)]

(b) Study the diagram below then answer the questions that follows:

(i)   Name the family of compounds to which P belongs   (1 mark)

(ii)   Give the structural formulae of the compound which react with each to form P   (1 mark)

(iii)   Give the formulae of two coloured ions found in Y   (1 mark)

(iv)   Name gas T and explain how it is released from mixture Q (1 mark)

(v)   Describe giving the expected observation how gas T can be identified
                                                                    (1 mark)

(vi)   Explain the effect of air on substance X   (1 mark)

(c) Describe briefly giving relevant equation how you would carry out the following
conversions
(i) Fe^{3+} to Fe^{2+} (2 marks)

(ii) CrO_4^{2-} to $Cr_2O_7^{21}$ (2 marks)