NAME………………………………………………………… INDEX NO……........…………….…...

SCHOOL…………………………………………………….. CANDIDATE'S SIGNATURE………...

DATE………...…………………………..

233/2
CHEMISTRY
(THEORY)
PAPER 2
JULY/AUGUST 2014
TIME: 2 HOURS

KURIA WEST SUB-COUNTY JOINT EXAMINATION - 2014

Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 2
(THEORY)
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

- Write your **name** and **index number** in the spaces provided **above**.
- **Sign** and write the **date** of examination in the spaces provided **above**.
- Answer **all** the questions in the spaces provided.
- Mathematics tables and electronic calculators may be used.
- All working **mus**t be clearly shown where necessary.

FOR EXAMINER'S USE ONLY:

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

*This paper consists of **12** printed pages.*
Candidates should check to ascertain that all the pages are printed
as indicated and that no questions are missing.

1. (a) The table **below** shows the ions of elements **W**, **X**, **Y**, **Z** and their electron arrangement. The letters do not represent the actual symbols of the element.

Ion	Electron configuration
W⁻	2, 8, 8
X²⁺	2, 8, 8
Y³⁺	2, 8
Z²⁻	2, 8

(i) Which **two** elements belong to the same period? Give a reason. (2mks)

_____

_____

_____

_____

(ii) In which group of the periodic table does Y belong? (1mk)

_____

(iii) Write the formula of the compound formed between **W** and **X**. (1mk)

_____

(iv) What type of bond is formed between **W** and **X**. Explain. (2mks)

_____

_____

_____

_____

(b) (i) What is a coordinate bond. (1mk)

_____

_____

_____

(ii) Draw a dot (•) cross (X) diagram to show bonding in the hydroxonium. H_3O^+ ion (H = 1, O = 8). (2mks)

Chemistry Paper 1   2

(c) Aluminium chloride and sodium chloride are both chlorides of period 3 elements.
Use this information to explain the following observations.

I   A solution of $AlCl_3$ in water turns blue litmus paper red while that of sodium chloride does hot. (1½mks)

_____

_____

_____

II The melting point of sodium chloride (801°C) is higher than that of $AlCl_3$ (180°C). (1½mks)

_____

_____

_____

2. (a) Use the standard electrode potentials for elements A, B, C, D and E given below to answer the questions that follow. The letters do not represent the actual symbols of the elements.

$$
\begin{array}{ll}
 & E^{\ominus} \text{ (volts)} \\
A^{2+}_{(aq)} + 2e^- \rightleftharpoons A_{(s)} & -2.90 \\
B^{2+}_{(aq)} + 2e^- \rightleftharpoons B_{(s)} & -2.38 \\
C^{+}_{(aq)} + e^- \rightleftharpoons \tfrac{1}{2}C_{2(g)} & 0.00 \\
D^{2+}_{(aq)} + 2e^- \rightleftharpoons D_{(s)} & +0.34 \\
\tfrac{1}{2}E_{(aq)} + e^- \rightleftharpoons E^- & +2.87
\end{array}
$$

(i)   Which element is likely to be hydrogen? Give a reason for your answer. (2mks)

_____

_____

(ii) Identify the strongest reducing agent. (1mk)

_____

(iii) In the space provided draw a labeled diagram of the electrochemical cell that would be obtained when half cells of element B and D are combined. (3mks)

Chemistry Paper 2   *3*

(iv) Calculate the E^Θ value of the electrochemical cell constructed in (iii) above. (2mks)

_____

_____

_____

_____

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

(i) Write the equation of the reaction occurring at the anode. (1mk)

(ii) Determine the change in mass of the cathode which occurred as a result of the electrolysis process. (Cu = 64, IF = 96500C). (3mks)

3. (a) A hydrocarbon contains 85% carbon. Its molecular mass is 68g.

(i) Determine its empirical and molecular formula. (C = 12, H = 1). (2mks)
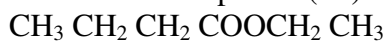
(ii)   Draw two positional isomers of the hydrocarbon.   (1mk)

(iii)   Write an equation for the reaction between one of the isomers with chlorine and name
        the products formed.   (2mks)
        Equation.

        Name _____

(b)   In an experiment an organic compound was reacted with absolute ethanol in the presence of
   concentrated sulphuric (VI) acid to form a compound whose formula is
        $CH_3 CH_2 CH_2 COOCH_2 CH_3$
        (i)   Name I   The type of reaction that took place.   (½mk)

                _____

                II   The name of the organic compounds to which the compound belonged.

                _____ (½mk)

        (ii)   Write the structural formula and give the systematic name of the acid used in the
                above experiment.   (1mk)

(c) Study the flow diagram **below** and answer the questions that follow.
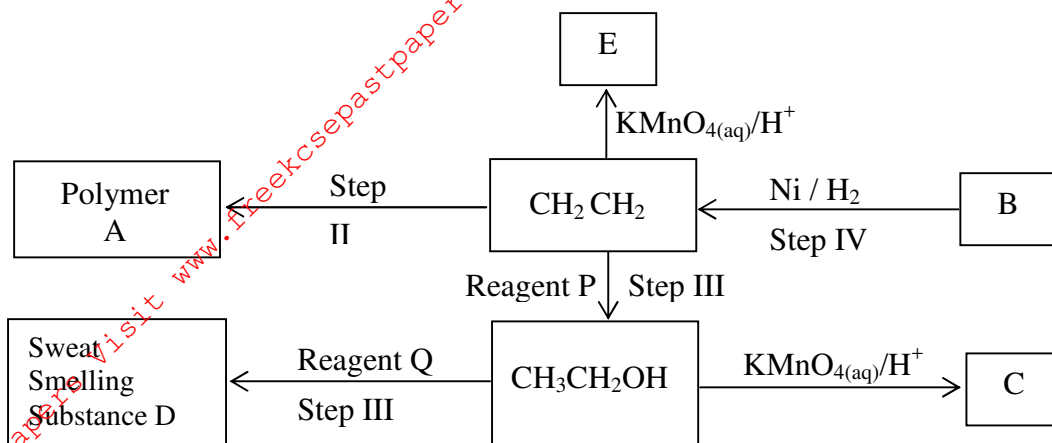
(i) Identify the following compounds.

B _____ (½mk)

C _____ (½mk)

A _____ (½mk)

E _____ (½mk)

(ii) Name the process in steps.

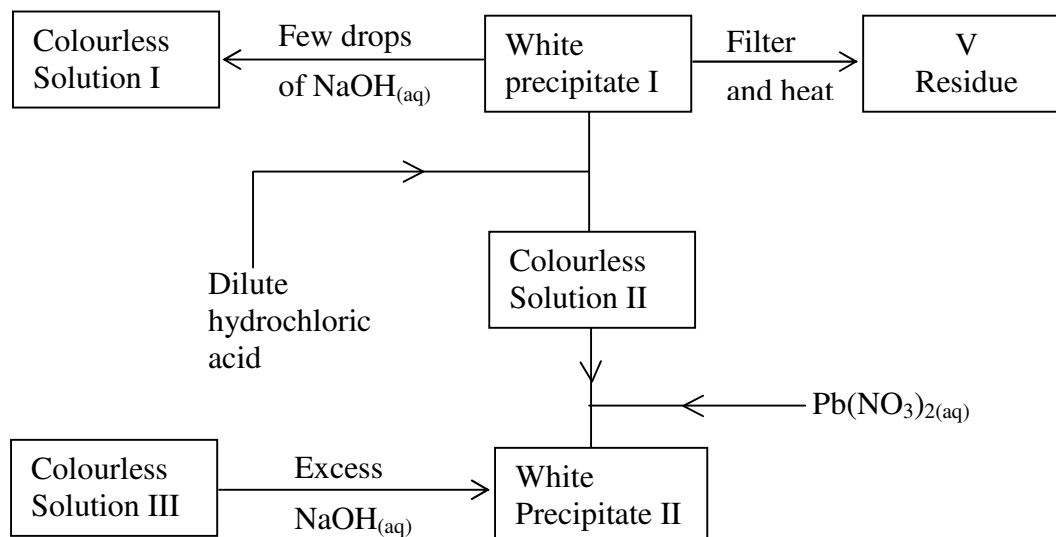**I** _____ (½mk)

II _____ (½mk)

IV _____ (½mk)

(iii) Reagent

P _____ (½mk)

Q _____ (½mk)

4. (a) Study the flow chart **below** and answer the questions that follow.

Residue **V** was yellow when hot and white when cold.

(i) Identify

I   White precipitate **L** (1mk)

_____

II   Solution **II**. (1mk)

_____

III   Residue **V**. (1mk)

_____

(ii) Write an ionic equation for the reaction of solution **II** with $Pb(NO_3)_{2(aq)}$. (1mk)

(iii) Write observations that would be made when ammonia solution is added drop wise till in excess to the colourless solution II. (1mk)

_____

_____

_____

(b) The diagram **below** represents a set-up for large scale manufacture of hydrochloric acid. Study it and answer the questions that follow:
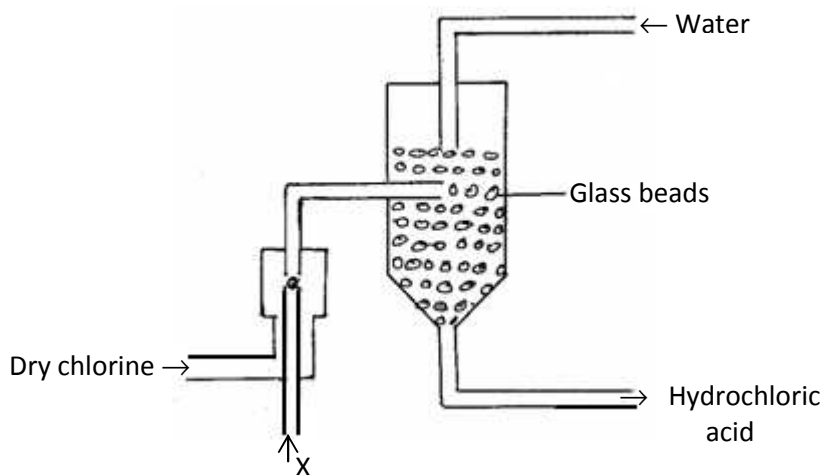
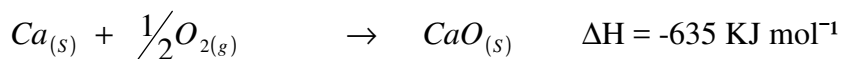(i) Name substance **X**. (1mk)

_____

(ii) What is the purpose of glass beads? (1mk)

_____

_____

(iii)   Give **one** source of substance X used in the above process.   (1mk)

_____

_____

_____

(iv)   Give **two** use of hydrochloric acid.   (2mks)

_____

_____

_____

_____

5.   (a)   Use the information below to answer the questions that follow.

$$Ca_{(s)} + \frac{1}{2}O_{2(g)} \rightarrow CaO_{(s)} \qquad \Delta H = -635 \text{ KJ mol}^{-1}$$

$$Ca_{(s)} + O_{2(g)} \rightarrow CaO_{2(g)} \qquad \Delta H = -394 \text{ KJ mol}^{-1}$$

$$Ca_{(s)} + e_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow CaCO_{3(s)} \qquad \Delta H = -1207 \text{ KJ mol}^{-1}$$

Calculate the enthalpy change for the reaction.
$$CaO_{(s)} + CO_{2(g)} \rightarrow CaCO_{3(s)} \qquad \qquad \text{(3mks)}$$

(b)   State **one** factor that should be considered when choosing a fuel for cooking.   (1mk)

_____

_____

_____

(c)   The following data was obtained during an experiment to determine the molar heat of combustion of ethanol.

|	
Volume of water used	= 500cm³
Initial temperature of water	= 25°C
Final temperature of water	= 44.5°C
Mass of ethanol + lamp before burning	= 121.5g
Mass of ethanol + lamp after burning	= 120.0g

Chemistry Paper 2   8

Calculate the
(i)   heat evolved during the experiment (density of water = 1g/cm³, specific heat capacity of water = $4.2 Jg^{-1}K^{1}$).   (1mk)

_____

_____

_____

(ii)   molar heat of combustion of ethanol (C = 12, O = 16, H = 1).   (2mks)

_____

_____

_____

_____

(d)   Write the thermo equation for the complete combustion of ethanol.   (1mk)

(e)   At 298K and one atmosphere pressure, graphite changes into diamond according to the equation.

$$C_{(graphite)} \rightarrow C_{(diamond)} \qquad \Delta H = +2.9 \text{ KJ/mol}$$
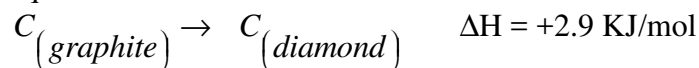
In the space provided, sketch a simple energy level diagram for the above change. (2mks)

6.   (a)   At 25°C 50g of substance X were added to 100g of water to make a saturated solution. What is meant a saturated solution?   (1mk)

_____

_____

_____

(b)   The table **below** gives the solubilities of substance X at different temperatures.

Temperature °C	14	24	33	40	46	52
Solubility g/100g H_2O	24	36	50	62	72	90

(i)   Plot a graph of the solubility of substance X (vertical axis) against temperature. (3mks)
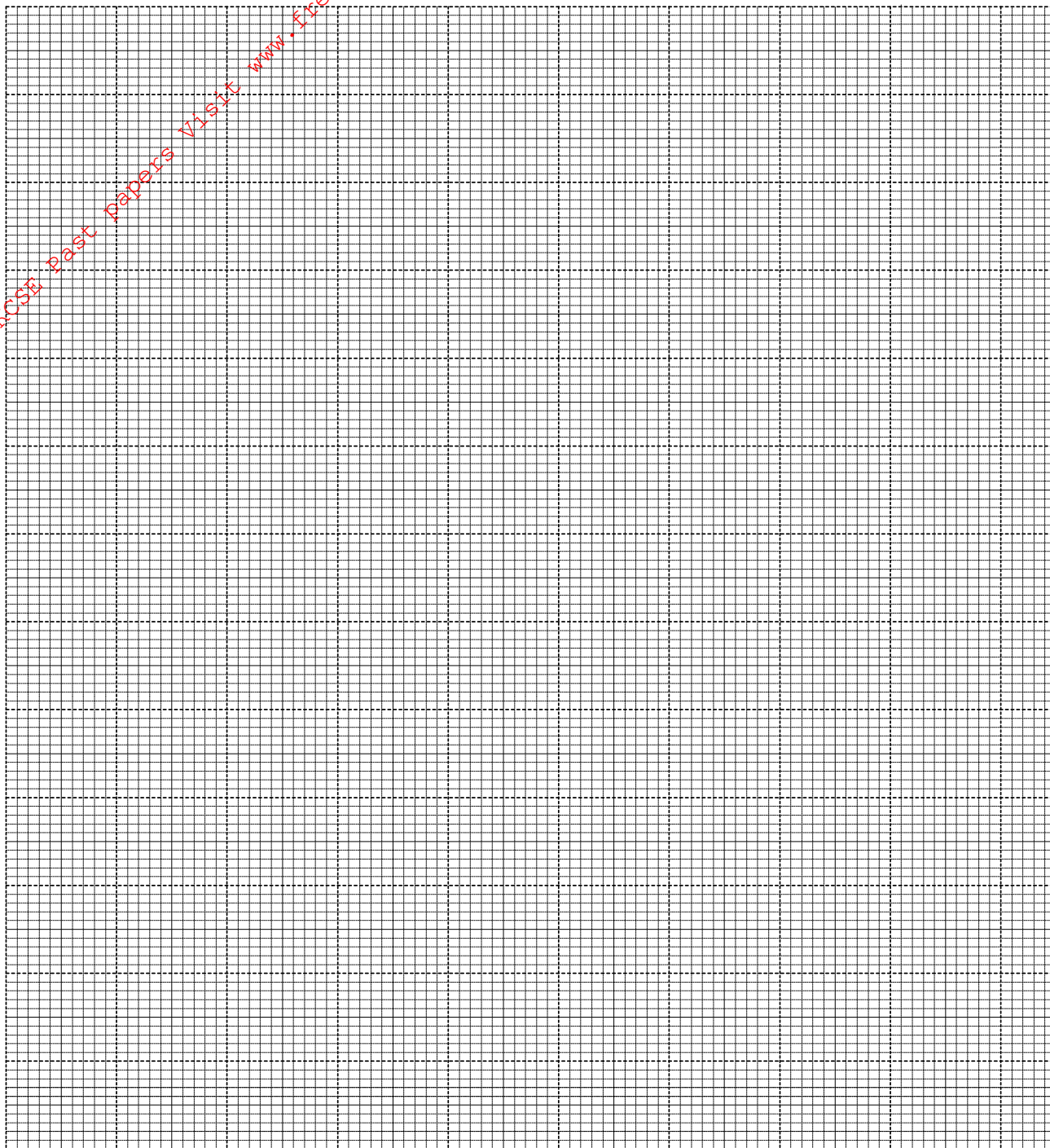
(ii)   Using the graph.
       I   determine the solubility of substance X at 20°C.   (2mks)

_____

_____

_____

_____

II   determine the mass of substance X that remained undissolved given that 90g of substance X were added to 100cm³ of water and warmed to 35°C.   (2mks)

_____

_____

_____

_____

III   Calculate the molarity of the solution at 30°C. (Relative formula mass of X = 122.5).
                                                                                        (3mks)

(c)   In an experiment, soap solution was added to three separate samples of water. The table **below** shows volumes of soap solution required is form lather with 1000cm³ of each sample of water before and after boiling.

	Sample		
Volume of soap before water is boiled (cm³)	25.0	5.0	10.0
Volume of soap after water is boiled (cm³	25.0	5.0	5.0

(i)   Which water was likely to be soft? Explain.   (2mks)

_____

_____

_____

(ii)   Explain the change in volume of soap solution used in sample III.   (1mk)

_____

_____

_____

7.   Aluminium is extracted using the electrolytic cell represented by the diagram **below**.
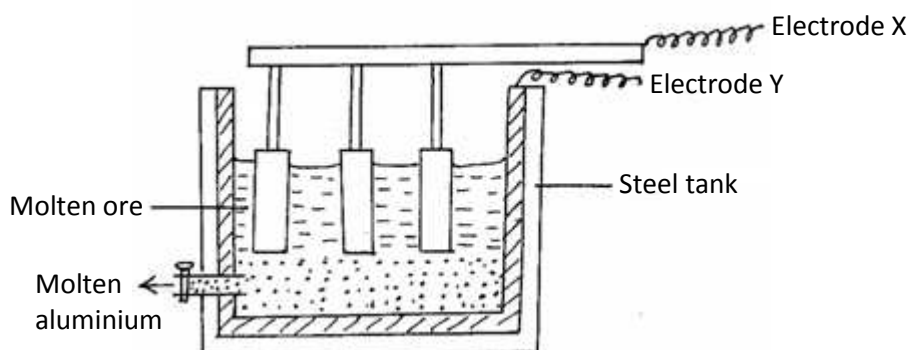
(a)   Why is aluminium extracted by electrolytic method?   (1mk)

_____

_____

_____

(b)   Name the electrodes labeled.

X _____ (½mk)

Y _____ (½mk)

(c)   The chief ore from which aluminium is extracted is bauxite.
     (i)   Name **two** main impurities present in bauxite.   (2mks)

_____

_____

     (ii)   Aluminium oxide is the main component in bauxite with a melting point of 2015°C
        but electrolysis of molten aluminium oxide is carried out at 800°C. Explain how this
        is achieved.   (2mks)

_____

_____

_____

(d)   Write the equations for the reaction taking place at the anode.   (1mk)

(e)   One of the electrodes is replaced periodically. Which one and why?   (2mks)

_____

_____

_____

_____

(f)   Duralumin (an alloy of copper, aluminium and magnesium) is preferred to pure aluminium
     in the construction of aeroplane bodies. Give **one** property of duralumin that is considered.
                                                                                       (1mk)

_____

_____

_____