KAMUKUNJI DISTRICT KCSE EVALUATION TEST
JULY 2014
CHEMISTRY THEORY
PAPER 2 (233/2)

TIME: 2 HOURS

NAME………………………………………………..SCHOOL……………………………

ADM NO. …………………………………   INDEX NO. …………………………

INSTRUCTIONS

- Answer all questions in the spaces provided.
- Mathematical tables and electronic calculators may be used.
- All working must be clearly shown where necessary.

For official use only

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

1. a) i) A student found a colorless liquid in the laboratory which he suspected to be water.
        Describe a chemical test he could have performed to confirm that the liquid was water. (2mks)

    ii) What other test could he have done to prove that the liquid is pure water?   (1mk)

    iii) Calculate the volume of hydrogen gas produced when 2.5g of calcium metal is reacted with
        Water at s.t.p. (molar gas volume at s.t.p. = 22.4 dm^3, Ca = 40).   (2mks)

    b) The diagram below shows how hydrogen reacts with copper (II) oxide. Study it and answer
    the questions that follow:
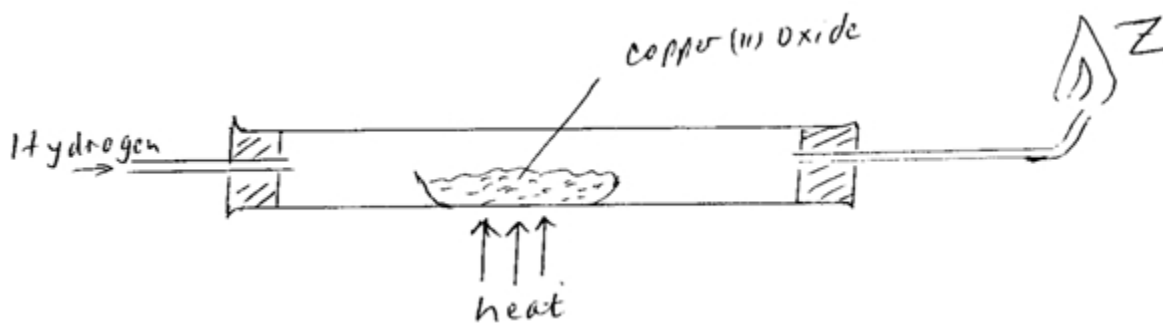
    i) Name a suitable substance that can be used to dry hydrogen gas.   (1mk)

    ii) State the two observations made in the combustion tube as the reaction proceeded.   (2mks)

iii) Write a chemical equation for the reaction taking place in the combustion tube. (1mk)

iv) Explain why it is necessary to pass hydrogen gas for some time through the apparatus before lighting the gas at point Z. (1mk)

v) Write a chemical equation for the reaction taking place to produce the flame at Z. (1mk)

vi) Name another metal oxide that reacts with hydrogen the same way as copper (II) oxide. (1mk)

2. a) The grid below represents part of the periodic table. Study it and answer the questions that follow.
   The letters do not represent the actual symbols of the elements.

i) Select the letter that represents an element that gains electrons most readily. (1mk)

ii) How does the atomic radius of E compare with that of F? Explain. (2mks)

iii) Which is more reactive A or J? Explain.   (2mks)

iv) Name the chemical family to which D and G belong.   (1mk)

v) Which letter represents the least reactive element? Give a reason for your answer.   (1mk)

b) Elements X and Y have atomic numbers 12 and 7 respectively.
i) Write the formula of the compound formed between X and Y.   (1mk)

ii) Use dots (.) and crossed (x) diagram to show bonding in the compound formed in b(i) above.
                                                                                 (2mks)

3. a) The set up below was used to carry out electrolysis of an aqueous solution of magnesium
   sulphate using carbon electrodes.
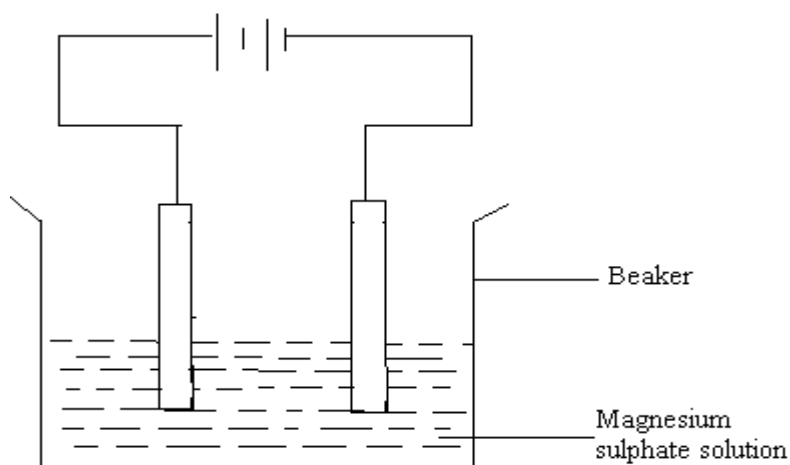
i) State and explain the observation made at the cathode. (2mks)

ii) Write down an equation for the reaction that occurs at the anode. (1mk)

iii) What change occurred to the concentration of magnesium sulphate solution during the experiment? Explain. (2mks)

b) Iron (II) sulphate solution reacts with acidified hydrogen peroxide according to the ionic equation below:

$$2Fe^{2+}_{(aq)} + H_2O_{2(aq)} + 2H^+_{(aq)} \longrightarrow 2Fe^{3+}_{(aq)} + 2H_2O_{(l)}$$
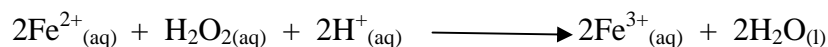
i) State the observation made during the reaction. (1mk)

ii) Using oxidation numbers, show that this is a redox reaction. (2mks)

c) Use the information below to answer the questions that follows:

$$Al^{3+}_{(aq)} + 3e^- \longrightarrow Al_{(s)} \quad E = -1.66v$$

$$Fe^{2+}_{(aq)} + 2e^- \longrightarrow Fe_{(s)} \quad E = -0.44v$$
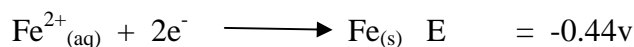
i) Calculate the e.m.f. of the cell formed by combining the two half-cells.   (1mk)

ii) Write the cell diagram for the cell.   (1mk)

iii) Why is it not advisable to keep a solution of iron (II) nitrate in a container made of aluminium?

(2mks)

d) Other than electroplating, give one application of electrolysis.   (1mk)

4. a) During the manufacture of hydrochloric acid, $50dm^3$ of hydrogen gas was burnt in $80dm^3$ chlorine.
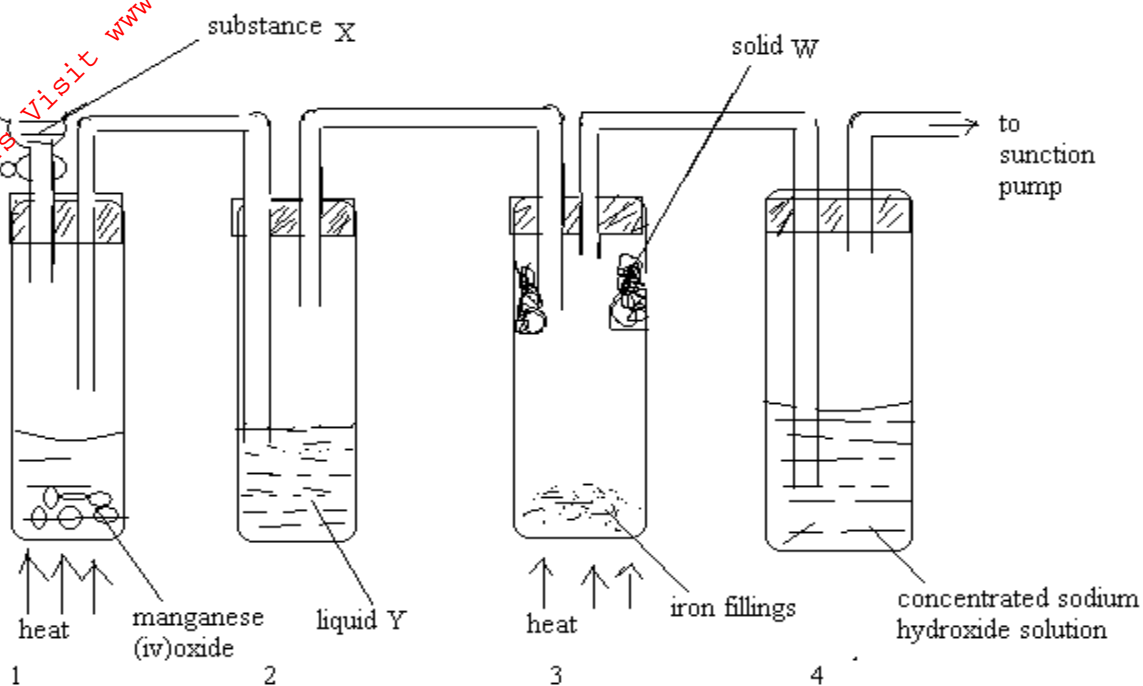   i) Write a chemical equation for the reaction between hydrogen and chlorine.   (1mk)

    ii) Which gas was in excess and by how much?   (2mks)

    iii) What is the source of hydrogen used during the manufacture?   (1mk)

    iv) A solution of hydrogen chloride gas in water turns blue litmus red while a solution of hydrogen chloride gas in methyl benzene has no effect. Explain.   (2mks)

b) The set up below was used to prepare and study the reaction of chlorine gas. Study it and answer the questions that follow:

i) Give the role of manganese (IV) oxide in the first boiling tube.   (1mk)

ii) Identify substances X and Y.   (2mks)

   X –

   Y –

iii) Write a chemical equation for the reaction in boiling tube 3.   (1mk)

iv) What is the role of concentrated sodium hydroxide solution in tube 4?   (1mk)

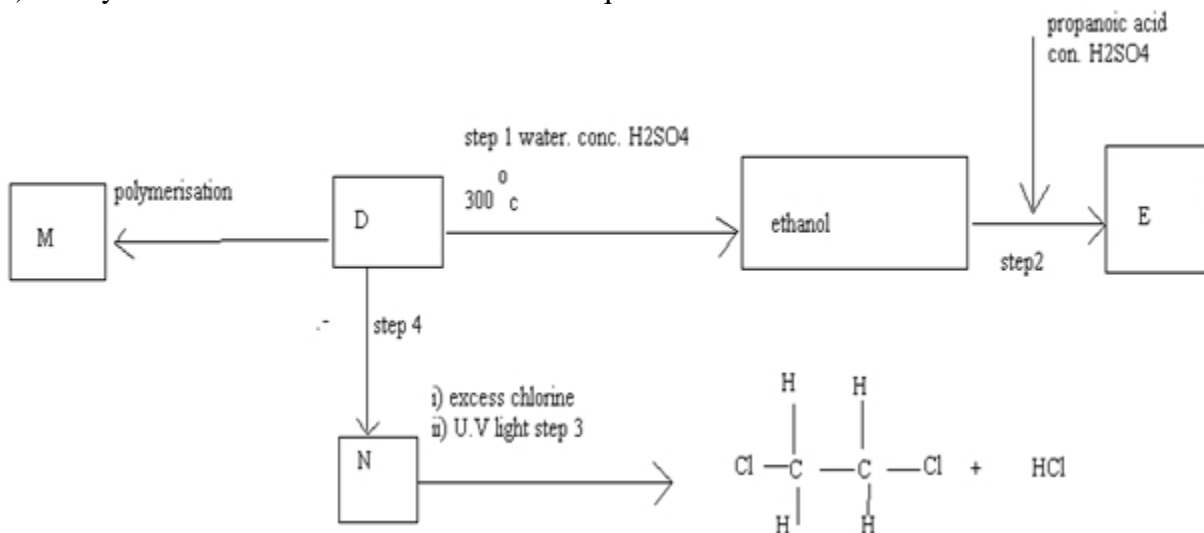v) Explain why solid W is collected as shown in the set up.   (1mk)

5. a) Draw the structural formula of:

i) 2-bromopropane   (1mk)

ii) 2,3 dimethybut-l-ene.   (1mk)

iii) propanoic acid   (1mk)

b) Study the flow chart below and answer the questions that follow:

i) Name compounds   (2mks)

E –

M –

ii) Give the reagents and conditions required for step 4.   (1mk)
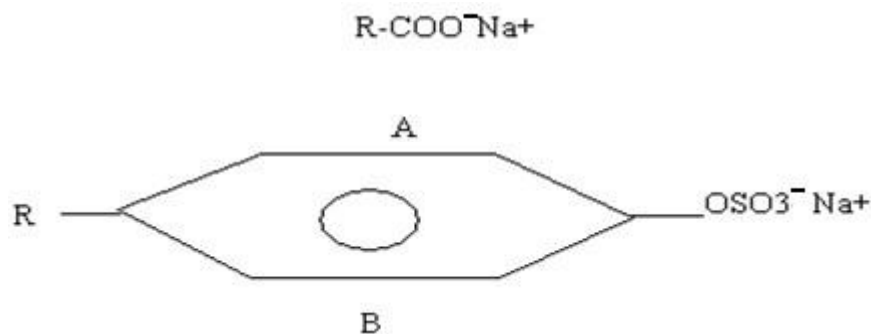
iii) Give one disadvantage of M.   (1mk)

iv) State the type of reaction that takes place in: (2mks)

Step 2

Step 3

c) The structure below represents two cleaning agents A and B. Which cleaning agent would be suitable for washing in water containing magnesium sulphate? Give a reason.
(2mks)

$R-COO^-Na^+$

A

R ———< >——— $OSO3^- Na^+$

B

6. a) An experiment was done using magnesium ribbon and dilute hydrochloric acid of different concentrations. The time needed to produce $50cm^3$ of the gas for every experiment was recorded in the table below:

| Concentration of HCl (aq) in moldm^{-3}	2.0	1.75	1.50	1.25	1.00	0.75	0.50	0.25
Time in sec	8.8	10.0	11.7	13.5	17.5	22.7	35.5	70.0
Rate =								

i) Complete the table above. (2mks)

ii) Plot a graph of rate. ($\frac{1}{time}$) against concentration. on the grid provided. (3mks)

ii) Determine from your graph the concentration needed to produce 50cm3 of hydrogen gas when time is 15 seconds. (1mk)

b) Apart from concentration, state two other factors that may affect the rate of a chemical reaction. (2mks)

c) Equilibrium exists between chromate and dichromate ions as shown below:

$$2CrO_4^{2-}{}_{(aq)} + 2H^+{}_{(aq)} \longrightarrow Cr_2O_7^{2-}{}_{(aq)} + 2H_2O_{(l)}$$
(yellow)   (orange)
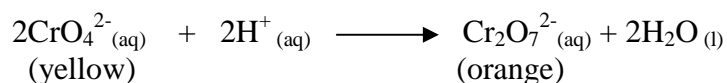
i)   Calculate the oxidation number of chromium (Cr) in both of the above ions. (2mks)

CrO_4^{2-}

$Cr_2O_7^{2-}$

ii)   State and explain the observations made when sodium hydroxide solution is added to the above mixture.   (2mks)

7.   a) The diagram shows a set up used in extraction of aluminium metal. Study it and answer the questions that follow:

Aluminium outlet   Steel tank   Molten Aluminium
                                                        + Cryolite
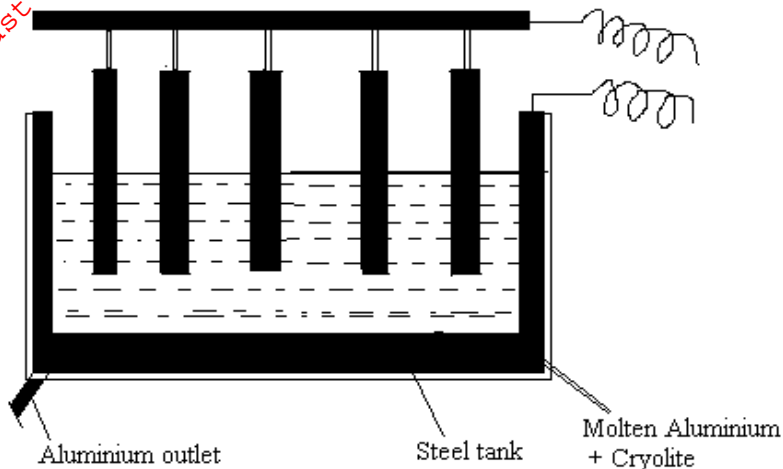
i) Name the main ore from which aluminium is extracted.   (1mk)

ii) Name any two impurities found in the ore.   (2mks)

iii) State the role of cryolite added to aluminium oxide.   (1mk)

iv) Label on the diagram the anode and cathode.   (1mk)

v) Give the reason why the carbon anode has to be replaced from time to time.   (1mk)

b) Calculate the mass of aluminium that would be deposited at the cathode when a steady current of 7.5 amperes flows for 3 hours through the molten aluminium oxide (Al_2O_3). (1 Faraday = 96500C, $Al = 27$)   (3mks)

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