THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/1   **CHEMISTRY 1**
                    (For Both School and Private Candidates)

Time: 3 Hours   **Tuesday November 02, 2004 p.m.**

Instructions

1. This paper consists of sections A, B and C.

2. Answer **all** questions in sections A and B, and **two (2)** questions from section C.

3. Each question carries 10 marks.

4. Electronic calculators are **not** allowed in the examination room.

5. Cellular phones are **not** allowed in the examination room.

6. Write your **Examination Number** on every page of your answer booklet(s).

7. The following constants may be used.

   Atomic masses: $H = 1, C = 12, O = 16, N = 14, Na = 23, S = 32.$

   Avogadro's Number 6.02×10^{23}

   GMV at STP $22.4 \ dm^3$

   1 Faraday   96,500 coulombs.

This paper consists of 8 printed pages.

SECTION A (20 marks)

Answer **all** questions in this section.

1. For each of the items (i) - (x) choose the correct answer from the given alternatives and write its letter beside the item number.

   (i)   Which of the following sets of laboratory apparatus contains direct measuring items?

        A   Crucible, Kipp's apparatus and volumetric flask

        B   Test tube, beaker and gas jar

        C   Thistle funnel, separating funnel and beaker

        D   Burette, pipette and measuring cylinder

        E   Volumetric flask, distillation flask and evaporating dish.

   (ii)   Chloride ions (Cl^-) differ from chlorine atoms in that the ions have one ----- than the atom.

        A   more proton

        B   less proton

        C   more electron

        D   less electron

        E   more neutron

   (iii) Hard water which is softened just by boiling contains dissolved

        A   calcium carbonate

        B   calcium chloride

        C   magnesium sulphate

        D   sodium carbonate

        E   calcium hydrogen carbonate.

   (iv) A wasp sting is alkaline. The solution to help ease the pain by neutralizing the alkali would be one with a pH of:

        A   5   B   7   C   8   D   10   E   13.

   (v)   Five separate 1 g samples of magnesium were placed in different beakers each containing 50 cm^3 of dilute sulphuric acid. The mixture which showed the fastest reaction rate at the start was the one containing magnesium

        A   block   B   granules   C   powder   D   ribbon   E   turnings.

   (vi) The compound CH_3CH_2Cl is named as

        A   carbon dichloride   B   methyl chloride   C   methylene chloride

        D   ethyl chloride   E   propyl chloride.

(vii) Which of the following actions would result into an increase in the temperature of the earth?

    A   Increase of distance from the sun
    B   Removal of water vapour from the atmosphere
    C   Increase of cloud cover
    D   Removal of noble gases from the atmosphere
    E   Increase of the carbon dioxide content of the atmosphere.

(viii) Denitrifying bacteria

    A   remove nitrogen from the atmosphere
    B   oxidize nitrogen of the atmosphere
    C   add nitrogen into the atmosphere
    D   fix nitrogen in the soil through plants
    E   add carbon dioxide into the atmosphere.

(ix) During the electrolysis of molten aluminium oxide, 3 Faradays were needed to deposit one mole of aluminium. The number of electrons of aluminium will be

    A 6.02×10^{23}
    B 1.806×10^{23}
    C 180.6×10^{23}
    D 18.06×10^{23}
    E 1806×10^{23}

(x) In plant nutrition nitrogen, phosphorus and potassium are classified as ----- nutrients or elements.

    A   micro   B   feeder   C   macro   D   trace   E   supplementary

2. Match the responses in **List B** with the words or phrases in **List A** by writing the letter of the correct response beside the item number.

LIST A		LIST B
(i) Potassium and sodium	A	A method for separating dyes
(ii) Lead oxide	B	Stored under water
(iii) To put off flammable liquid fire	C	A compound in which all ionizable hydrogen have been replaced
(iv) Pollution H		
(v) Chromatography	D	A catalyst in the contact process
(vi) Ferrous sulphate	E	Is reddish brown when hot and yellow when cold
(vii) Electrovalent bond C	F	A catalyst in the Harbers' process
(viii) Normal salt	G	Is yellow when hot and white when cold
(ix) Vanadium (V) oxide	H	The act of making air, water and soil unfit for use
(x) Molar solution Q	I	A compound in which part of ionisable hydrogen have been replaced
	J	Use sand and carbon dioxide

	LIST A		LIST B
		K	Stored under kerosene
		L	Each atom donates electrons to be shared
		M	Sublimes when heated
		N	Turned reddish brown on the surface when exposed to air
		O	A solution of known concentration
		P	Use water and carbon dioxide
		Q	A solution that contain one mole of a solute in one dm^3
		R	Add vapour into the atmosphere
		S	Is formed between opposite charged ions
		T	Is a method used for separating two liquids with different boiling points

SECTION B (60 marks)

Answer **all** questions in this section.

3. (a)   Write ionic equations for the following:

   (i)   Laboratory preparation of ammonia gas and hydrogen chloride.

   (ii)   Precipitation of barium sulphate from barium chloride and sodium sulphate; and silver chloride from a soluble chloride.

   (iii)   Neutralization of a strong acid and a strong alkali.

   (b)   Consider the following elements of group seven in the order in which they appear in their group in the periodic table.
   F, C , Br and I.

   (i)   Which element is the most electronegative?

   (ii)   Name the least electronegative element.

   (iii)   Which element has the largest atom?

   (iv)   Write the electronic configuration of the chlorine atom.

   (c)   Define electronegativity.

4. (a)   Sodium, magnesium, zinc, copper and silver are five metals which appear in this order in the activity series; sodium being the most reactive and silver the least reactive. Which one of these metals is

   (i)   likely to tarnish most rapidly when exposed to air

   (ii)   most likely to be found free in nature

   (iii)   least likely to react with steam?

   (b)   Two of the metals in 4 (a) above are usually extracted by electrolysis of their molten chlorides.

   Name the **two (2)** metals and give one reason of using this method.

(c) (i)   Name the positive and negative electrodes of an electrolytic cell.
     (ii)   To which electrode will sodium ions in an aqueous dilute solution of sodium chloride migrate during electrolysis?
     (iii) What other ions will migrate to the electrode stated in 4.(c)(ii)?
     (iv)   Which ions will be discharged at the electrode stated in 4.(c)(ii)? Give reasons for your answer.

5.   In the reactions below, state whether the substances underlined are undergoing oxidation or reduction.

     (a) (i) $\underline{S} + O_2 \rightarrow SO_2$
          (ii) $H_2\underline{S} + C_2 \rightarrow 2HC + S$
          (iii) $Mn\,O_2 + 4H\underline{C} \rightarrow Mn\,C_2 + 2H_2O + C_2$
          (iv) $\underline{Cu^{2+}} + 2e \rightarrow Cu$

     (b) (i)   Write the electronic configurations of the elements with atomic numbers 11, 15 and 18.
          (ii)   Which element is the most reactive and which is the least reactive?

     (c) Draw a large electronic diagram for a compound formed when elements with atomic numbers 12 and 9 combine.

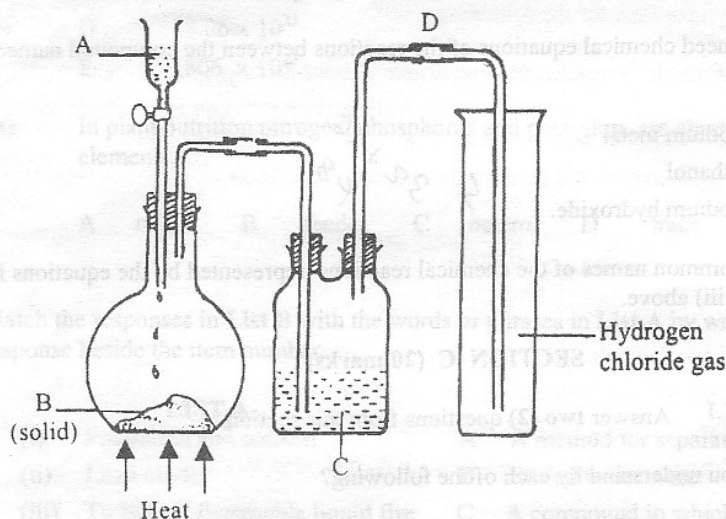6.   Figure 1 below represents the laboratory preparation of hydrogen chloride gas.

Fig. 1

(a) Name the parts labelled A, B, C, and D.

(b) (i)   Do you think the gas can be collected over water? Give reasons for your answer.
     (ii)   Explain the test for the gas.
     (iii) What is the function of liquid C?
     (iv)   Name the method used to collect the gas.
     (v)   Write a balanced chemical equation for the reaction taking place during the preparation of hydrogen chloride gas.

(c)   Write chemical equations of the reaction between

    (i)   Ammonia gas and hydrogen chloride gas.

    (ii)   Hydrogen chloride gas and water.

7. (a)   Define the term mole.

    (b)   What would be the molarity of the solution if 46 g of sodium hydroxide (NaOH) were dissolved in 2000 cm^3 of the solution?

    (c)   8.50 g of a sample of iron required just 75 cm^3 of 3.00 M HC to dissolve it and give a neutral solution. Calculate the percentage purity of the sample of iron.

    (d)   5.00 cm^3 of sulphuric acid solution from an automobile battery required 17.48 cm^3 of 1.95 M NaOH solution to neutralize the acid. Determine the concentration of the battery acid in

    (i)   mole dm^{-3}

    (ii)   gram dm^{-3}.

8. (a)   Chemical analysis shows that the empirical formula of a compound is CH_2O and its relative molar mass is 60.

    (i)   Calculate its molecular formula.

    (ii)   Name the compound formed and write its open structural formula.

    (b)   Write balanced chemical equations of the reactions between the compound named in 8 (a) (ii) above and

    (i)   Sodium metal

    (ii)   Ethanol

    (iii) Sodium hydroxide.

    (c)   State the common names of the chemical reactions represented by the equations in 8 (b)(ii) and   8 (b)(iii) above.

SECTION C (20 marks)

Answer **two (2)** questions from this section.

9. (a)   What do you understand by each of the following?

    (i)   Soil reaction

    (ii)   Liming.

    (b) (i)   Differentiate active acidity from potential acidity.

        (ii)   What is a fertile soil?

        (iii) State **four (4)** factors that affect soil fertility.

    (c) (i)   Name **four (4)** nitrogenous fertilizers.

        (ii)   What is manure?

        (iii) Name **four (4)** types of organic manure.

10. A piece of mable chipps (calcium carbonate) was placed in a beaker containing an excess of dilute hydrochloric acid standing on a direct reading balance. The mass of the beaker and its contents was recorded after every 2 minutes as shown in the table below:

Time (minute)	0	2	4	6	8	10	12
Mass (g)	126.44	126.31	126.19	126.09	126.03	126.00	126.00

(a) Why was there a loss of mass?

(b) Write the equation for the reaction.

(c) State **three (3)** different ways in which the reaction could have been made more rapid.

(d) Why did the mass remain constant after 10 minutes?

(e) Write the name and the formula of the two ions remaining in the final solution.

(f) The solution was then evaporated to dryness in the same beaker and the mass of the beaker and the remaining solid was 97.63 g. Next day the mass was 98.63 g. Explain what had occurred to cause the change and name the phenomena.

11. Figure 2 represents an experiment in which Faraday's second law was illustrated by connecting in series three cells containing water to which a very little amount of dilute sulphuric acid, copper sulphate solution and silver nitrate solution had been added. A current of 1 A was passed through the solution for 2 seconds.
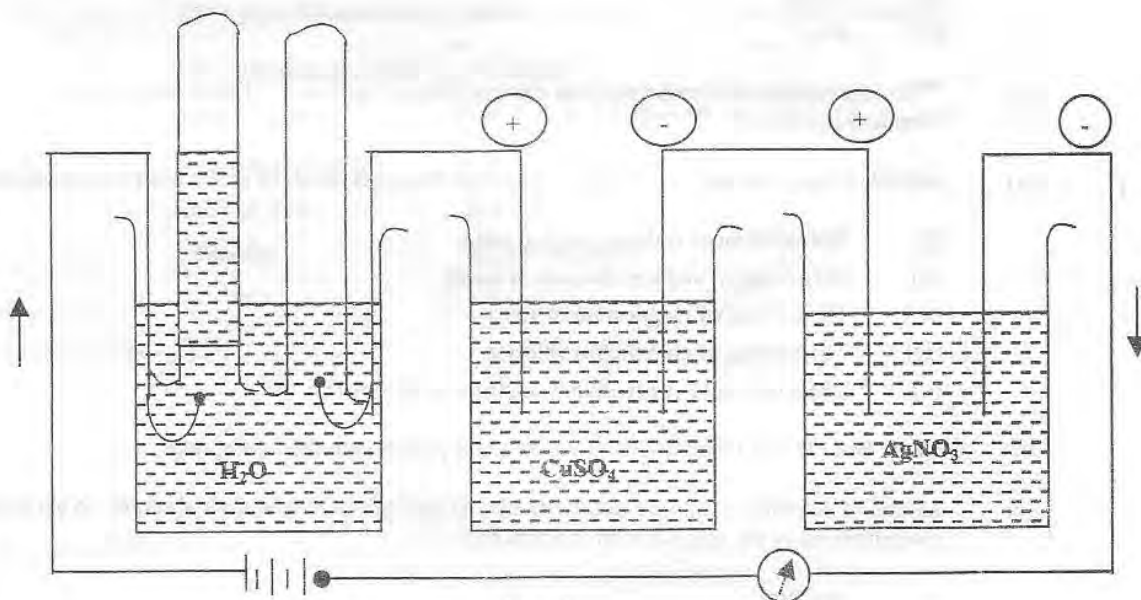

Fig. 2

The volumes and hence weights of hydrogen and oxygen liberated were calculated. The weight of copper and silver formed by the electrolysis of copper sulphate and silver nitrate solutions was also measured.

The results of the experiment are tabulated below:

Element		Current I	Time t(s)	Mass of element deposited in g	Quantity of electricity	Electrochemical equivalent
1.	Hydrogen	1.00	2	2.0892×10^{-5}		
2.	Oxygen	1.00	2	1.658×10^{-4}		
3.	Copper	1.00	2	6.587×10^{-4}		
4.	Silver	1.00	2	2.236×10^{-3}		

(a) Complete the table above by calculating the

   (i) quantity of electricity passed in experiments 1, 2, 3 and 4.
   (ii) electrochemical equivalent of the elements in 1, 2, 3 and 4.

(b) If the Faraday constant is given as 96,500 C, calculate the chemical equivalents of

   (i) hydrogen
   (ii) oxygen
   (iii) copper
   (iv) silver.

(c) What relationship is there between an electrochemical equivalent of an element and its chemical equivalent?

12. (a) Indicate clearly whether a chemical or physical change is involved in the following processes.

   (i) The addition of sodium metal to water.
   (ii) Dissolving of sodium chloride in water.
   (iii) The heating of magnesium in air.
   (iv) The heating of ammonium chloride.
   (v) The addition of concentrated sulphuric acid to water.

(b) Name **two (2)** non-metallic oxides which cause pollution to the atmosphere.

(c) 25 cm^3 of sulphuric acid were neutralized by 27 cm^3 of 0.1 M sodium hydroxide. What is the concentration of the acid solution in terms of

   (i) mol/dm^3
   (ii) g/dm^3?