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 **6 November 2000 A.M.**

Instructions.

1. This paper consists of sections A, B and C.
2. Answer ALL the questions in sections A and B and THREE (3) questions, including question number 6 from section C.
3. The marks allocated for each question, or part of it, are indicated in parantheses.
4. Write your Examination Number on every page of your answer booklet(s).
5. Whenever necessary the following constants may be used.

(a) Atomic masses:

H = 1, C = 12, N = 14, O = 16, S = 32, Ca = 40.

(b) 1 Faraday = 96500 C.

This paper consists of 6 printed pages.

SECTION A (15 Marks).

This section consists of fifteen multiple - choice items. Answer ALL the items.

1. Choose the letter corresponding to the correct alternative and write it in the answer booklet provided.

(i) A gas at 273° C under a pressure of 1600 mmHg occupies a volume of 190 cm^3. What is the volume of the gas at STP?

A. 200 cm^3
B. 350 cm^3
C. 400 cm^3
D. 200 dm^3

(ii) What volume of 0.2 M H_2SO_4 will be required to neutralize completely 25.0 cm^3 of 0.05 M KOH?

A. 0.626 cm^3
B. 6.125 cm^3
C. 6.315 cm^3
D. 3.125 cm^3

(iii) Which of the following statements does NOT support the fact that "water is a compound"?

A. The hydrogen and oxygen in water can not be separated by physical means.
B. The physical and chemical properties are quite different from those of the consitituents.
C. Hydrogen can be separated from water at boiling point of water.
D. The formation of water is always accompanied by the production of heat, light and sound.

(iv) If element X is one of the elements found in the periodic table which are called "alkali earth metals", then element X is likely to be found in

A. group II
B. group I
C. group IV
D. group VII

(v) Which of the following sets of compounds is NOT an example of a homologous series?

A. Ethene, methane and acetylene
B. Propene, butene and ethene
C. Methanol, ethanol and propanol
D. Formic acid, acetic acid and propanoic acid

(vi) Anti – acid drugs which are used to control excess stomach acidity are actal, eno's, andrews' liver salt and other commercial names. Chemically these anti- drugs contain a substance which neutralize the acid; one of these substances is sodium hydrogen carbonate. Below is a balanced chemical equation of the action of the substance on hydrochloric acid:

A. $NaHCO_{3\,(aq)} + 2HCl_{\,(aq)} \rightarrow NaCl_{\,(aq)} + 2CO_{2(g)} + H_2O_{\,(l)}$
B. $2NaHCO_{3(aq)} + HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + 2CO_{2(g)} + H_2O_{(l)}$
C. $NaHCO_{3(aq)} + HCl_{(aq)} \rightarrow NaCl_{\,(aq)} + CO_{2(g)} + H_2O_{(l)}$
D. $2NaHCO_{3(aq)} + 2HCl_{\,(aq)} \rightarrow 3NaCl_{\,(aq)} + 3CO_{2(g)} + 2H_2O_{(l)}$

(vii) Why is carbon dioxide used in fire extinguishers?

A. It is denser than air
B. It turns lime water milky
C. It does not support burning
D. It is colourless and odourless

(viii) Cutting down trees without planting others is bad for animals because

A. it spoils nice shade
B. it makes the earth look ugly
C. the amount of carbondioxide in air will become less
D. the amount of oxygen in air will become less

(ix) The discharge of cations during electrolysis is

A. oxidation
B. reduction
C. neither oxidation nor reduction
D. both oxidation and reduction

(x) Diamond and graphite differ because

A. graphite is an impure carbon
B. carbon has a different vacancy in the two forms
C. the atoms in diamond are larger than those in graphite
D. carbon atoms are differently arranged

(xi) Which of the following list of chemical species have the same number of electrons.

A. Na^+, Mg^{2+}, Be^{2+} and Li
B. O^{2-}, F^-, Ne and Na
C. Cl^-, He, Be and O^{2-}
D. K^+, Ca^{2+}, Cl^- and Ar

(xi) If Anna wants to electroplate a spoon with copper by using copper sulphate solution, she should arrange the electrodes in the following way

A. Spoon as anode and copper as cathode
B. Spoon as cathode and copper as anode
C. Spoon as anode and carbon as cathode
D. Spoon as cathode and copper sulphate as anode

(xiii) Which of the following nitrates will not evolve nitrogen dioxide when heated?

A. Potassium nitrate
B. Silver nitrate
C. Mercuric nitrate
D. Lead nitrate

(xiv) The quantity of electricity needed to deposit 1 mole of aluminium in the electrolysis of aluminium sulphate is

A. 96500 coloumbs
B. 289500 coloumbs
C. 386000 coloumbs
D. 193000 coloumbs

(xv) The chemical equation $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$ represents an example of

A. polymerization
B. addition reaction
C. substitution reaction
D. esterification reaction

SECTION B (40 Marks)

Answer ALL questions in this section.

2. (a) State Avogadro's law (2 marks)
(b) Define the term mole (2 marks)
(c) Solid calcium carbonate ($CaCO_3$) reacts with excess nitric acid (HNO_3) liberating carbon dioxide gas to form soluble calcium nitrate and water. Calculate the amount of nitric acid needed to dissolve 5 g of calcium carbonate. (6 marks)

3. (a) State Faraday's laws of electrolysis. (4 marks)
(b) An element X has a relative atomic mass of 88. When a current of 0.5 amperes was passed through fused chloride of X for 32 minutes and 10 seconds, 0.44 g of X were deposited at the cathode.

(i) Calculate the number of Faradays needed to liberate one mole of X.
(ii) Write the formula of the X ion.
(iii) Write the formula of the hydroxide of X. (6 marks)

4. (a) Differentiate between SATURATED and UNSATURATED hydrocarbons. (2 marks)

(b) When a solution of sucrose is **fermented** by yeast, ethanol is formed. This ethanol can be isolated from the liquid by **fractional distillaction**.

(i) Explain the meaning of the two terms bolded
(ii) What is the purpose of the yeast?
(iii) Write down the structural formula of ethanol and give its name under the IUPAC system.
(iv) Give the balanced chemical equations when

- ethanol reacts with sodium metal.
- ethanol reacts with concentrated sulphuric acid at 180° C.

Note: Name the products in each reaction. (8 marks)

5. (a) The following list of elements is arranged in order of an ACTIVITY SERIES.
Na, Ca, Mg, Zn, Fe, H, Cu, Hg.

From these elements, name

(i) a metal which reacts with cold water
(ii) a metal which burns in steam but does not react with cold water
(iii) any other element which reacts when heated in steam
(iv) an element which has oxide which decomposes on heating
(v) those elements which do not displace hydrogen from dilute hydrochloric acid. (6 marks)

(b) Write balanced chemical equation when
(i) a named metal in (a) (i) above reacts with cold water.
(ii) an oxide of the named element in (a) (iv) above is heated. (4 marks)

SECTION C (45 Marks)

Answer question number 6 and any other TWO (2) questions from this section.

6. (a) Name four (4) forms of organic manures which are commonly available in Tanzania. (4 marks)
(b) In what ways does the addition of organic manures affect the condition of the soil? (6 marks)
(c) (i) State three (3) types of mineral fertilizers which are commonly used in Tanzania.
(ii) Indicate the nutrient element provided by each of the mineral fertilizers stated in c(i) above. (5 marks)

7. (a) Define the following terms:

(i) Exothermic reaction
(ii) Endothermic reaction. (4 marks)

(b) State Le Chatellier's principle. (3 marks)

(c) The equation for the dissociation of calcium carbonate is

$$CaCO_3 \rightleftharpoons CaO + CO_2 \qquad \Delta H = +175.5\ kJmol^{-1}$$

What will be the effect on the proportion of calcium carbonate in the equilibrium mixture if

(i) the temperature is increased
(ii) the pressure is increased?

What is the necessary condition for manufacturing calcium oxide from calcium carbonate in large scale? (8 marks)

8. (a) By naming the reagents, stating the conditions whenever possible and writing a balanced equation for each, describe how ethene could be converted into

(i) ethane
(ii) chloroethane
(iii) 1,2 - dibromoethane
(iv) ethanol. (12 marks)

(b) Give the balanced equations showing how the following substances may be obtained:
(i) An acid from an alcohol
(ii) An ester from an acid. (3 marks)

9. (a) State:

(i) Charles' law
(ii) Boyle's law of gases. (6 marks)

(b) Write the equation of state of an ideal gas. (2 marks)

(c) A gas occupies 90 cm^3 at 11°C and 550 mmHg. At what temperature will it have a volume of 80 cm^3 if the pressure is adjusted to 750 mmHg? (7 marks)

10. Study carefully the figure below and then answer the questions which follow:

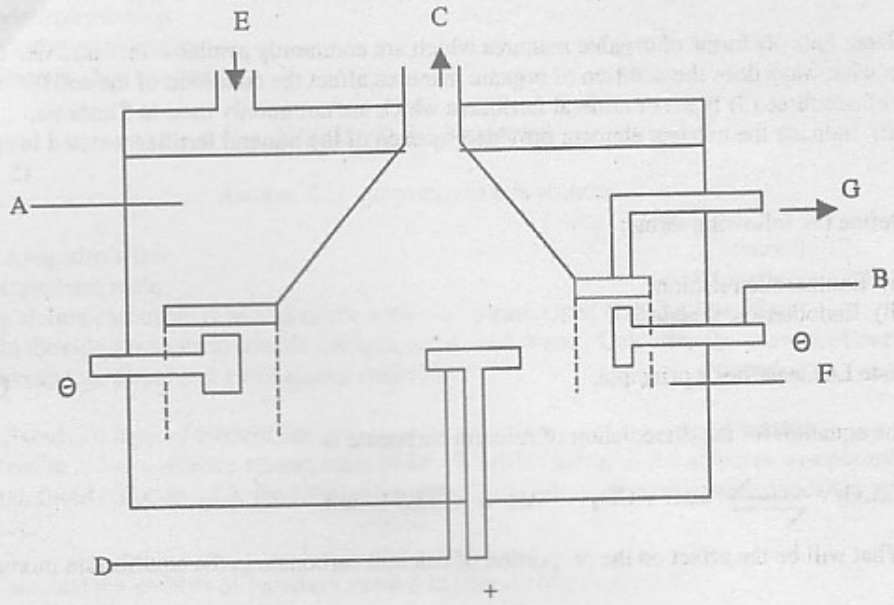

Figure 1

(a) Name the apparatus. (1½ marks)

(b) What is the element obtained by using the apparatus in figure 1. (1 mark)

(c) State what the letters A, B, C, D, E, F and G represent. (10 marks)

(d) Name the ore used in this process. (1½ marks)

(e) Is the element in (b) a metal or non-metal? (1 mark)