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 **04 November 2002 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. Cellular phones are **not** allowed in the examination room.
4. Electronic calculators are **not** allowed in the examination room.
5. Write your Examination Number on every page of your answer booklet(s).
6. In your calculations you may use the following constants:

Atomic masses: H = 1, C = 12, O = 16, Na = 23
N = 14, Mg = 24, Cl = 35.5, Ca = 40
S = 32, Mn = 55.

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 among the given alternatives and write its letter beside the item number.

(i) Separation of the constituents of a mixture by fractional distillation is possible because the constituents in the mixture differ in their

A vapourizing points B freezing points C melting points
D boiling points E sublimation points.

(ii) If element M of Group I combines with element X of Group VI the formula of the compound formed is

A X_2M B MX_6 C MX_2 D X_3M E M_2X.

(iii) In an industrial process ethene may be made from ethane. Ethane is fed into pre-heated furnace and mixed with steam at 800 °C. The type of reaction involved in the process of converting ethane to ethene is called

A cracking B double decomposition C sublimation D distillation
E chain decomposition.

(iv) During chemical reactions, bonds are broken and others are formed. If the total energy required to break the bonds is higher than the energy required to form the new bonds, the reaction will be termed as

A exothermic B endothermic C polymerisation D hydrogenation
E neutralisation.

(v) One disadvantage of hard water is that it

A causes the corrosion of water pipes

B causes increased tooth decay

C requires more soap for washing

D contains minerals which are harmful

E boils above 300 °C.

(vi) An example of a salt which is insoluble in water but can dissolve by warming is

A sodium chloride B lead chloride C calcium carbonate
D silver chloride E copper carbonate.

(vii) Ammonia is manufactured by

A Le Black Process B Hess Process C Contact Process
D Kuhlman Process E Habers Process

(viii) Equivalent weight of an element is the mass liberated by

A 1 coulomb of electricity B 96500 coulombs of electricity C 2 Faradays

D 9650 coulombs of electricity E electrolytic process.

(ix) In the periodic table, ionization energy

A decreases towards the right hand side

B increases down the group

C increases towards the right hand side

D decreases down the group

E follows the diagonal relationship

(x) The loss in mass when 100 g of calcium carbonate is strongly heated to constant mass is

A 100 g B 56 g C 54 g D 48 g E 44 g

2. Match the items in list A with the responses in list B by writing the letter of the correct response in list B beside the item number in list A.

List A

i. Hygroscopic substance
ii. Oxygen
iii. Nickel
iv. Basicity of an acid
v. 80 g
vi. Solvent
vii. Mercury
viii. Air
ix. A coordinate bond
x. Dehydration

List B

A a liquid non metal
B sublimes
C one atom donates a pair of electrons to be shared in a chemical bond
D a dissolved substance
E a gaseous mixture
F a substance which dissolves a solute
G catalyst used in the hydrogenation of oils
H concentrated sulphuric acid
I relights a glowing wooden splint
J a compound
K a liquid metal
L removal of water from a compound

M each atom donates electrons to be shared
N concentrated nitric acid.
O the mass of oxygen in 90 g of water
P addition of water
Q the number of moles of acid
R explodes in air with a "pop" sound
S the weight of oxygen is 80 g of water
T the number of hydrogen ions produced per molecule of acid.

SECTION B (60 marks)

Answer **ALL** questions in this section.

3. Diamond and graphite are two allotropes of carbon.

(a) (i) State two similarities and four differences of these allotropes. (2 marks)

(ii) How can we experimentally prove that diamond and graphite are the allotropic forms of carbon? (2 marks)

(b) 200 cm^3 of ethene were mixed with 60 cm^3 of oxygen gas and the mixture was exploded to complete reaction.

Write the balanced equation to represent the reaction. (3 marks)

(c) If excess ethene was exploded in only 60 cm^3 of oxygen, what volume of CO_2 measured at STP would be formed? What volume of ethene would be consumed? (3 marks)

4. (a) Distinguish between an endothermic and an exothermic reaction. (2 marks)

(b) (i) Draw a simple straight line graph of the energy profile diagram for an endothermic reaction.

(ii) Draw a similar graph of an exothermic reaction. (4 marks)

(c) Name the types of reaction represented by each of the following chemical phenomena:

(i) $2\,KClO_{3(s)} \xrightarrow[MnO_2]{\Delta} 2\,KCl_{(s)} + 3O_{2(g)}$

(ii) $Fe_{(s)} + S_{(s)} \xrightarrow{\Delta} Fe\,S_{(s)}$

(iii) $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow AgCl_{(s)} + NaNo_{3(aq)}$

(iv) $NH_4Cl_{(s)} \overset{\Delta}{\rightleftharpoons} NH_{3(g)} + HCl_{(g)}$ (4 marks)

5. (a) Define the following terms:

(i) Electrolyte

(ii) Cation. (3 marks)

(b) What is meant by isotropy? (4 marks)

(c) Give four differences between electrovalent compounds and covalent compounds. (3 marks)

6. Study the part of the periodic table below and then answer the questions that follow.

Note that the letters are not the official symbols for the elements concerned, they have been used for the purpose of this question only.

Groups

	I	II	III	IV	V	VI	VII	O
1								
2		U		V		W	X	
3	T					Z		Y
4								

(a) Name and write the chemical symbols for elements with the letters

U, V, W, X, Y and Z. (3 marks)

(b) Write down the electronic configuration for the elements V, X and Z. (2 marks)

(c) Give the names of three elements found in period 2. (5 marks)

7. (a) Differentiate between the following, giving an example in each case:

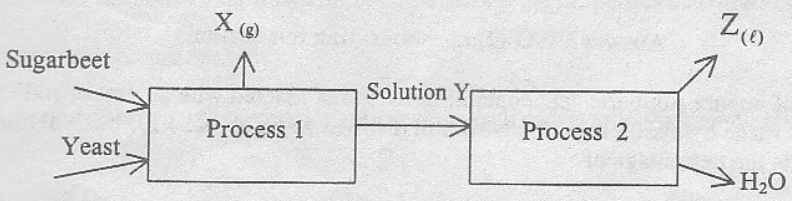
(i) Solute and solvent

(ii) Deliquescence and efflorescence

(iii) Miscible liquids and immiscible liquids

(iv) An element and a molecule. (2 marks)

(b) Study carefully the flow chart below and then answer the questions which follow:



(i) Name processes 1 and 2.

(ii) Identify gas X and solution Y.

(iii) A newspaper article wrote about **'drivers of the future fuelling their cars with sugar beet instead of petrol'**. What do you think was meant by the article? (5 marks)

(c) The following experiments were carried out on metals A, B, C and D.

Metals B, C and D reacted with dilute acid. Oxides of B and C were reduced on heating with carbon. When B and C were made at the electrodes in a voltaic cell, electricity flowed from B $\longrightarrow$ C.

(i) What does the experiment tell you about the reactivities of the metals?

(ii) Arrange the metals in the order of decreasing reactivity.

(iii) What is the position of carbon and hydrogen in this series? (3 marks)

8. (a) Define the following terms:

(i) Empirical formula

(ii) Molecular formula. (2 marks)

(b) Determine the empirical formula of a substance that has the following composition by mass: 49.5 % Manganese and 50.5 % oxygen. (3 marks)

(c) Complete and balance the following equations:

(i) $Mg_3N_2 + 6H_2O \longrightarrow$

(ii) $2NH_3 + CuO \longrightarrow$

(iii) $NH_3 + Cl_2 \longrightarrow$

(iv) $NH_3 + O_2 \xrightarrow[800\ ^oC]{Pt}$

(v) $MgCl_{2(aq)} + AgNO_{3(aq)} \longrightarrow Mg(NO_3)_2 + AgCl$ (5 marks)

SECTION C (20 marks)

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

9. (a) 25 cm^3 of impure sulphuric acid containing 5.2 g/dm^3 reacted with 25 cm^3 of sodium hydroxide solution made by dissolving 4.0 g NaOH in distilled water to make 1.0 litre solution. Calculate the percentage of

(i) purity of the acid

(ii) impurity of the acid. (4 marks)

(b) The following reaction can take place in living organisms:

$$X + O_{2(g)} \longrightarrow CO_{2(g)} + H_2O_{(\ell)}$$

(i) What name is given to this reaction?

(ii) Why is this reaction important to animals? (3 marks)

(c) The following is a table of electron arrangements:

ELEMENT	ELECTRON ARRANGEMENT
A	2:8:5
B	2:8:8
C	2:2
D	2:8:8:1
E	2:7

(i) What kind of bonding is there between the atoms in each of these elements?

(ii) What type of bonding exists between atoms of A and E?

(iii) What type of bonding occurs when an atom of hydrogen combines with bromine and with an atom of sodium.

(iv) Sketch the appearance of the resulting molecules in 9 (c) (iii) above. (3 marks)

10. (a) Write down the balanced equations for the manufacture of sulpher dioxide (SO_2) from

(i) sulphur

(ii) hydrogen sulphide

(iii) a sulphide ore. (3 marks)

(b) Write down a balanced chemical equation for the combustion of sulphur dioxide. (4 marks)

(c) State two important commercial uses of sulphuric acid. (3 marks)

11. (a) What do you understand by soil fertility? (3 marks)

(b) Give reasons why a fertile soil is not necessarily productive. (2 marks)

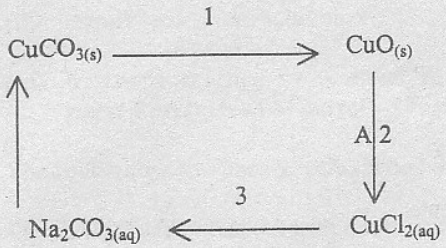
(c) List four nitrogenous straight fertilizers and describe the properties of two of them.

(Describe two properties only). (5 marks)

12. (a) With the aid of an equation/equations show how each of the following conversions can be brought about:

Calcium oxide → calcium hydroxide → calcium nitrate → calcium carbonate.
(3 marks)

(b) The reaction cycle for malachite ($CuCO_3$) is shown below.



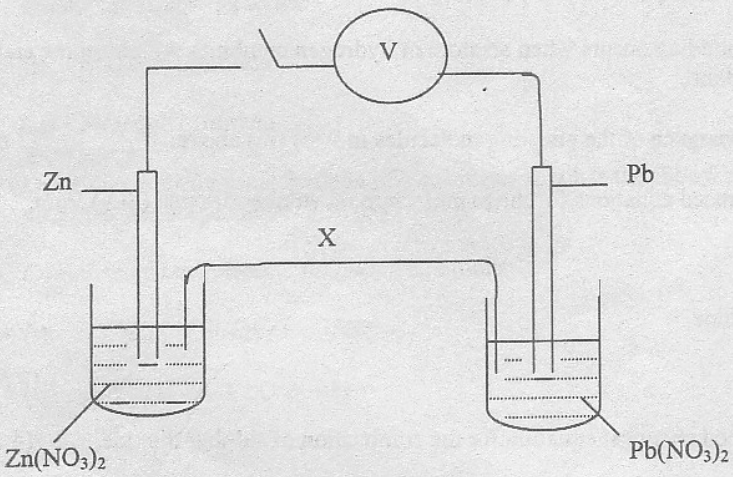
(i) How would step 1 be brought about?

(ii) Name reagent A in step 2.

(iii) What kind of reaction is involved in step 2?

(iv) Write down a balanced equation for step 1 and step 2. (3 marks)

(c) A pupil set up the cell shown in the drawing below.



(i) What does X represent?

(ii) What is the function of X?

(iii) What is the direction of flow of electricity in the circuit? (4 marks)