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

032/2 **CHEMISTRY 2**
ALTERNATIVE TO PRACTICAL
(For Both School and Private Candidates)

TIME: 2½ Hours ***Thursday morning 18/10/2007***

Instructions

1. This paper consists of **five (5)** questions.
2. Answer **all** questions.
3. All questions carry equal marks.
4. Qualitative analysis Guidance Pamphlets are allowed after a thorough check by the supervisor.
5. Electronic calculators are **not** allowed in the examination room.
6. Cellular phones are **not** allowed in the examination room.
7. Write your Examination Number on every page of your answer booklet(s).
8. The following constants may be used:

   Na = 23, C = 12, O = 16, H = 1, Cl = 35.5, K = 39, Ag = 108, Cu = 64.
   1 F = 96500 coulombs.
   GMV at s.t.p. = 22.4 dm^3.
   1 litre = 1 dm^3 = 1000 cm^3.

This paper consists of 5 printed pages.

1. (a) In each case state the reasons for installing in the laboratory the following:

(i) Fire extinguisher.

(ii) Fume chamber.

(iii) First aid kit.

(iv) Chemical balances.

(b) Study the grouped parts of the apparatus connection arranged as A, B and C shown in figure 1 below then answer the questions that follow.

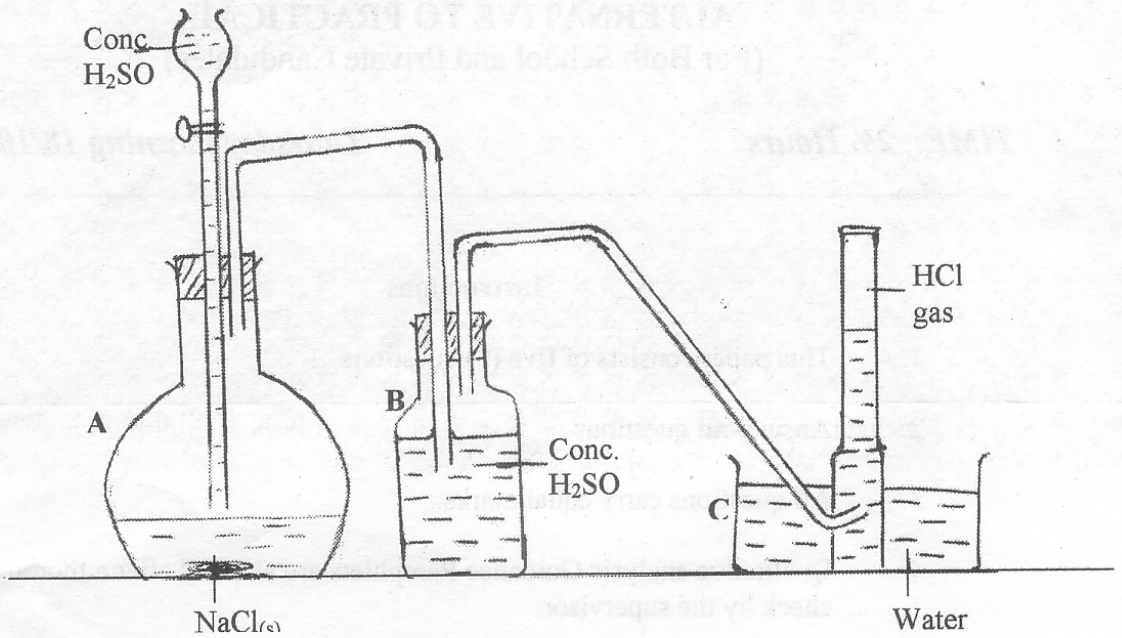

Fig. 1

(c) (i) Which group of arrangement of apparatus, **A**, **B** or **C** is not correct? Give reasons for your answer.

(ii) Draw the correct arrangement of apparatus for the collection of hydrogen chloride gas.

(iii) What is the function of concentrated sulphuric acid in the experiment?

2. In an experiment, 0.1 M HCl was titrated against hydrated sodium carbonate ($Na_2CO_3.xH_2O$) solution of concentration 14.3 g/dm^3. The volume of pipette used was 20 cm^3 and the burette readings were recorded as shown in table 1below.

Burette readings

Experiment	Pilot	1	2
Final reading (cm^3)	22.00	40.90	21.95
Initial reading (cm^3)	01.00	21.00	02.00
Titre volume (cm^3)			

Table 1

(a) Complete the table by filling in the values of titre volume in each column.

(b) Calculate the mean titre volume.

(c) Write a balanced chemical equation for the reaction, which took place during the titration of sodium carbonate solution and hydrochloric acid.

(d) Calculate the

(i) molarity of sodium carbonate.

(ii) concentration in g/dm^3 of sodium carbonate.

(iii) number of water of crystallization, x in $Na_2CO_3.xH_2O$.

3. The diagram in figure 2 below represents the electrolysis of dilute sulphuric acid.

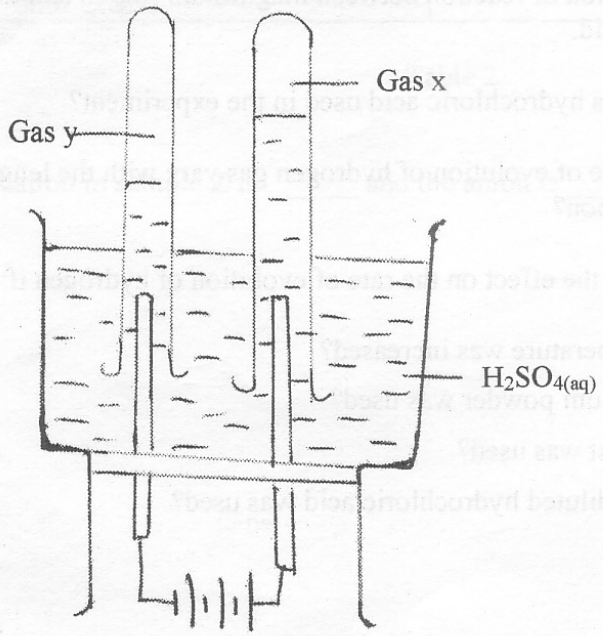

Fig. 2

(a) Name gases x and y.

(b) Write the equations of discharging reactions, which took place at the

(i) anode. (ii) cathode.

(c) What is the name of the apparatus used in the experiment of the electrolysis of dilute sulphuric acid represented by the diagram in figure 2 above?

(d) An electric current was passed through two voltameters connected in series whose electrolytes were calcium chloride and copper (II) sulphate solutions respectively. Carbon rods were used as electrodes in both voltameters. Calculate the mass of copper produced if 2.5 litres of chlorine were produced at s.t.p.

4. The study of the rate of evolution of hydrogen from magnesium ribbon of uniform width with excess dilute hydrochloric acid was done in a certain school laboratory. The results obtained were recorded as shown in the table below.

Length of magnesium ribbon in (cm)	1.0	2.0	3.0	4.0	5.0	6.0	7.0
Rate of evolution of hydrogen in (cm^3)/min	1.1	2.0	2.9	3.8	4.8	5.6	6.6

(a) Write the equation of reaction between magnesium ribbon and dilute hydrochloric acid.

(b) Why was excess hydrochloric acid used in the experiment?

(c) How did the rate of evolution of hydrogen gas vary with the length of magnesium ribbon?

(d) What would be the effect on the rate of evolution of hydrogen if:

(i) the temperature was increased?

(ii) magnesium powder was used?

(iii) a catalyst was used?

(iv) a more diluted hydrochloric acid was used?

5. Use the information given under the experiment and inference columns in table 2 below to complete the observation column.

Experiment	Observation	Inferences
(a) Appearance of sample **Z**.		Probably Fe^{2+} or Cu^{2+} present.
(b) To a portion of solid **Z** in a test tube, concentrated sulphuric acid was added and the gas given off was tested.		Cl^- present.
(c) To another portion of **Z** in a test tube, MnO_2 was added followed by concentrated H_2SO_3. The gas evolved was passed over moist litmus paper.		Cl^- confirmed.
(d) Sample **Z** was dissolved in distilled water.		Soluble salts of Cu^{2+} suspected.
(e) Excess sodium hydroxide solution was added to the solution of sample **Z** and heated.		Residue is CuO thus Cu^{2+} is present.
(f) Ammonium hydroxide solution was added to a solution of **Z** until excess.		Cu^{2+} confirmed.

Table 2

Conclusion

The cation in sample **Z** is _____ and the anion is _____.