THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

NOVEMBER 1997

032/2

CHEMISTRY PAPER 2

ALTERNATIVE TO PRACTICAL

(For both School and Private Candidates)

TIME: 3.00 Hours.

INSTRUCTIONS TO CANDIDATES

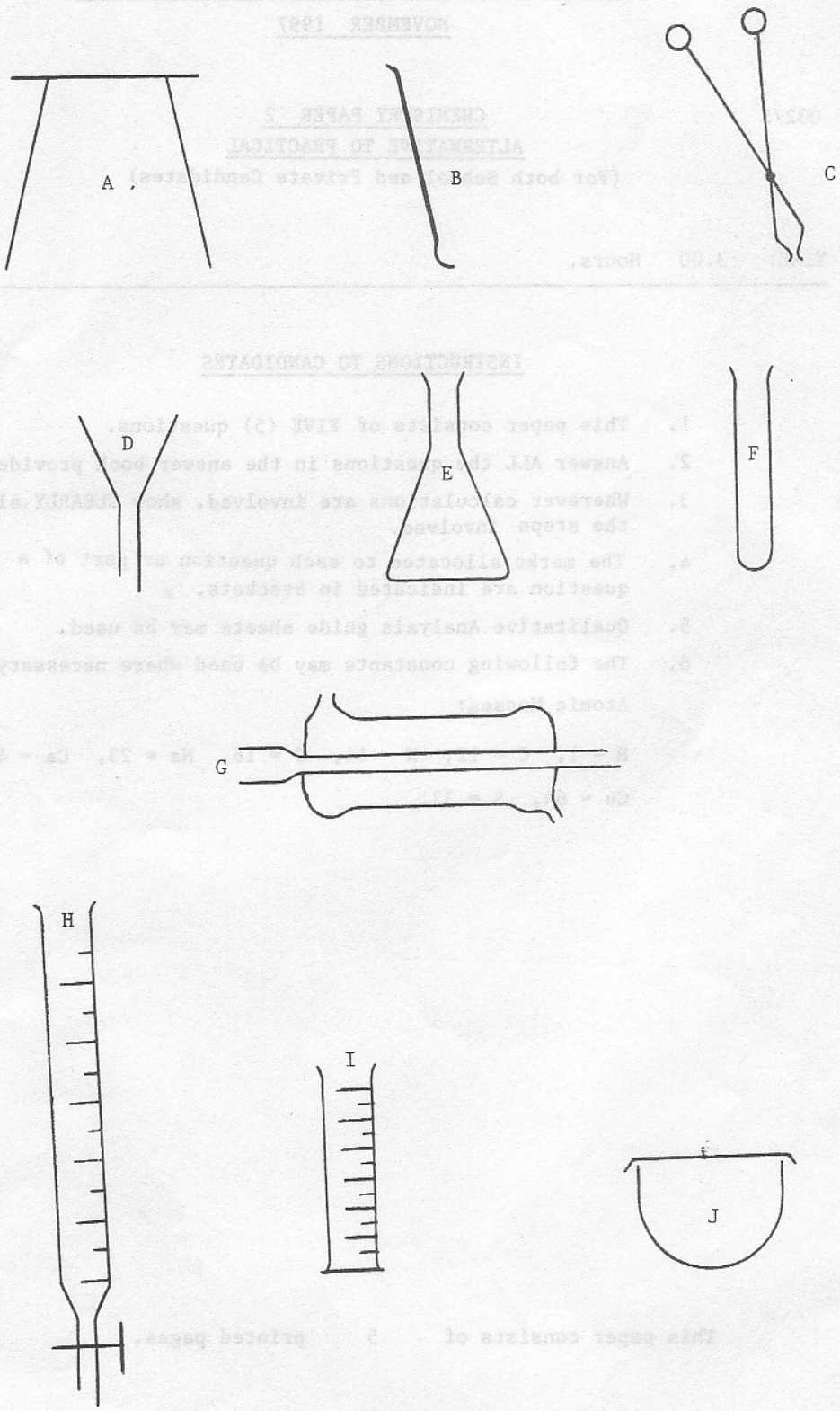
1. This paper consists of FIVE (5) questions.
2. Answer ALL the questions in the answer book provided.
3. Wherever calculations are involved, show CLEARLY all the steps involved.
4. The marks allocated to each question or part of a question are indicated in brackets.
5. Qualitative Analysis guide sheets may be used.
6. The following constants may be used where necessary.

Atomic Masses:

H = 1, C = 12, N = 14, O = 16, Na = 23, Ca = 40, Cu = 64, S = 32.

This paper consists of 5 printed pages.

1. (a) Give the name of each of the pieces of apparatus labelled A, B, C, D, E, F, G, H, I, J.



1. Cont.

(b) Give at least one use of the apparatus labelled, C, D; H, I and J.

(10 marks)

2. (a) Define the following terms:

(i) a standard solution

(ii) a 1.0 molar solution

(iii) Molarity.

(b) Copy and complete the table below:

Name of Indicator	COLOUR OF INDICATOR	
	IN ACIDIC SOLUTIONS	IN ALKALINE SOLUTIONS
Menthyl Orange		
Phenolphthalein		
Litmus		

(c) Samples of sodium hydroxide solution of unknown concentration were titrated against 0.2M ethanoic acid, and the results are as tabulated below:

Volume of pipette used = $10cm^3$

Burette readings cm^3	PILOT	1	2	3
FINAL READING	21.50	45.05	30.00	40.00
INITIAL READING	1.00	25.00	10.05	20.00
TITRE VALUE				

(i) Find the average volume of the acid used.

(ii) If the chemical equation of the reaction is

$$NaOH_{(aq)} + CH_3COOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$$

calculate the molarity of the sodium hydroxide solution and its concentration in gdm^{-3}.

(iii) Name the most suitable indicator for this reaction.

(iv) If the indicator you named in (iii) above was used, what would be the colour change at the end point of the titration?

(10 marks)

3. (a) State the Faradays 1st and 2nd laws of electrolysis.

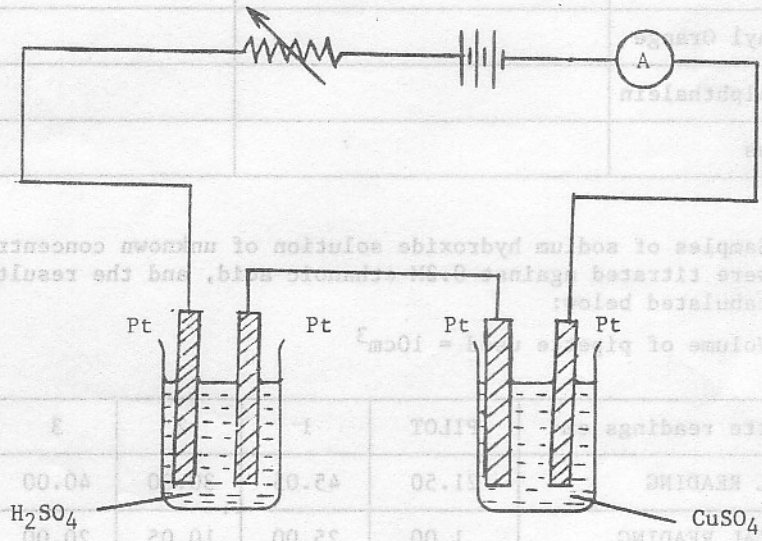
(b) Two voltameters were connected in series as seen in the diagram below. One of the voltameters contained dilute sulphuric acid and the other contained dilute copper (II) sulphate solution. Platinum electrodes were used in both voltameters.

(i) What mass of copper would have been liberated by the time $125cm^3$ of hydrogen gas measured at STP had been collected from one of the electrodes?

(ii) Write balanced equations for all the reactions which took place in the copper (II) sulphate voltameter.

(iii) Explain the colour changes which would be observed if the electrolysis was allowed to continue to completion.

(10 marks)



4. Five grams of calcium carbonate were mixed with $250cm^3$ of 0.125M HCl solution. The carbon dioxide evolved was collected, measured and corrected to STP. Measurements were taken after every twenty minutes, and the results are given in the table below.

TIME (minutes)	VOLUME OF CO_2 (cm^3)
0	0
20	180
40	250
60	310
80	340
100	350
120	350

4. Cont.

(a) In this experiment calcium carbonate was present in excess. What mass of this substance was consumed in the process?

(b) Draw a graph to show how the evolution of carbon dioxide varied with time.

(c) After how many minutes was all the acid completely finished?

(10 marks)

5. The table below shows the experiments and the observations for the qualitative analysis of an unknown sample, X, which contains one anion and one cation. Complete the table and identify the anion, the cation and the compound X.

	EXPERIMENT	OBSERVATION	INFERENCE
(i)	Appearance of sample X.	White crystalline	
(ii)	A sample of solid X was heated in a test tube.	White vapours were formed and these condensed on the cooler parts of the test tube.	
(iii)	Three drops of dilute NaOH solution were added to solid sample X, warmed, and the gas given off was tested.	The gas given off formed white dense fumes with gaseous hydrogen chloride.	
(iv)	To a portion of solid X in a dry test tube, conc. H_2SO_4 was added, the mixture was warmed and the gas given off was tested.	The gas given off formed white dense fumes with gaseous ammonia.	
(v)	To another portion of solid X in a test tube, M_nO_2 and and conc. H_2SO_4 were added and the mixture was slightly warmed. The gas given off was passed over wet litmus paper.	The yellowish-green gas given off bleached the wet litmus paper.	
(vi)	To an aqueous solution of substance X, aqueous silver nitrate was added, followed by excess aqueous ammonia solution with shaking.	The white precipitates formed dissolved in the aqueous ammonia solution.	

Anion = ----------

Cation = ----------

Compound X = ----------

(10 marks)