

THE UNITED REPUBLIC OF TANZANIA  
NATIONAL EXAMINATIONS COUNCIL  
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION  
NOVEMBER 1995

032/2

CHEMISTRY PAPER 2  
ALTERNATIVE TO PRACTICAL

(For Both School and Private Candidates)

TIME: 3 Hours

---

1. This paper consists of sections A, B and C.
2. Answer ALL questions in each section.
3. Wherever calculations are involved, show clearly all the steps required.
4. Remember to write your Examination Number on every page of your answer book provided.
5. The marks intended for each question are indicated in brackets.

This paper consists of 7 printed pages.

SECTION A

Answer ALL questions in this section.

1. Name and state the use of each of the following apparatus.



(a)



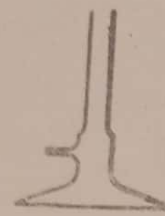
(b)



(c)



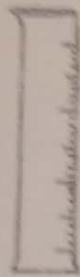
(d)



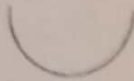
(e)



(f)



(g)



(h)



(i)

(13½ marks)

3. The table below shows experimental results obtained from the electrolysis of copper (II) sulphate ( $\text{CuSO}_4$ ).

| Time (in Min) | Mass of cathode (g) | Increase in Mass of Cathode(g) |
|---------------|---------------------|--------------------------------|
| 0             | 11.60               | 0.00                           |
| 10            | 12.05               | 0.45                           |
| 20            | 12.50               | 0.45                           |
| 30            | 12.95               | ---                            |
| 40            | 13.40               | ---                            |
| 50            | 13.60               | ---                            |
| 60            | 13.60               | ---                            |

- Complete the table by filling in the four blanks in the third column.
  - Plot a graph of mass of cathode(g) against time (min). From your graph, record the
    - mass (in grams) of cathode after 40 minutes.
    - time (in minutes) for the mass of cathode to reach 1g.
  - Explain why your graph between 50 minutes and 60 minutes assumes that shape. ( 15 marks )
3. Electrolysis of dilute sulphuric acid ( $\text{H}_2\text{SO}_4\text{aq}$ ) can be easily carried out in the laboratory.
- Draw a well labelled diagram to represent this electrolysis
  - Write balanced ionic equations which take place during the electrolysis of dilute sulphuric acid using platinum electrodes at the
    - Cathode
    - Anode
  - Name the main product formed at
    - Cathode
    - Anode.

( 14 marks )

SECTION B

Answer All questions in this section.

1. The information given below was derived from a qualitative analysis experiment. Record this information in a tabular form under the heading: Experiments, observations and inferences. You are required to identify each piece of information given below and record it under its relevant heading.

A green powder A on heating it strongly, gave a black powder B and a colourless, odourless gas which turned lime water milky. From its appearance, it was suggested that the green powder A was a copper or iron salt. It was also suggested that the colourless and odourless gas was carbon dioxide suggesting that the green powder A was a carbonate.

On addition of dilute sulphuric acid to the black powder B, a blue solution C was observed suggesting that the resulting blue solution C was copper sulphate. This confirms the presence of copper in the original green powder A. It also suggests that the black powder B was copper oxide which reacted with dilute sulphuric acid to give the blue solution.

When dilute sulphuric acid was added to the original green powder A, an odourless, colourless gas which turned lime water milky was evolved giving a blue solution C in the reaction mixture. This confirms that the green powder A was a carbonate.

On addition of Barium chloride solution to the blue solution C, a white precipitate of barium sulphate was formed. This confirms that the blue solution was copper sulphate.

From this general information, it was concluded that the green powder A was  $\text{CuCO}_3$ , the black powder B was  $\text{CuO}$ , the blue solution C was  $\text{CuSO}_4$  and the gas was  $\text{CO}_2$ .

( 14½ marks )

5. Qualitative analysis experiments were carried out on sample 0 in order to identify one cation and one anion in the sample. The experiments and observations were recorded as shown in the table below. Complete the table by filling in the Inferences column.

| EXPERIMENT                                                                                     | OBSERVATIONS                                                                                            | INFERENCES |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------|
| Sample 0 was heated                                                                            | Choking, colourless, acidic fumes which turned $K_2Cr_2O_7$ solution green was evolved.                 |            |
| Sample 0 dissolved in distilled water                                                          | Sample 0 dissolved completely.                                                                          |            |
| Solution of 0 + sodium hydroxide solution.                                                     | Pale green precipitate which turned brown on exposure to air and insoluble in excess NaOH was observed. |            |
| Solution of sample 0 + lead acetate solution followed by potassium ferricyanide solution.      | A white precipitate followed by a dark-blue solution or precipitate was formed.                         |            |
| Solution of sample 0 + acidified potassium permanganate followed by sodium hydroxide solution. | The potassium permanganate was decolourised followed by the formation of a reddish brown precipitate.   |            |

CONCLUSION: The cation in sample 0 was .....  
and the anion was .....

( 14 marks )

### SECTION C

Answer ALL questions in this section.

6. In a class experiment, titration of 0.1M sulphuric acid ( $H_2SO_4$ ) and sodium hydroxide (NaOH) gave the following results:

The volume of pipette used was  $20\text{cm}^3$ .

|                 | PILOT | 1     | 2     | 3     |
|-----------------|-------|-------|-------|-------|
| Final reading   |       |       |       |       |
| Initial reading | 1.00  | 21.50 | 0.00  | 21.00 |
| Titre           | 20.50 | 20.40 | 21.00 | 20.50 |

- Complete the above table by filling in the value of the final reading in each column.
- Calculate the mean titre of this experiment.
- Write a balanced chemical equation that took place to reach the end-point in this class experiment.
- Calculate the molarity of sodium hydroxide used in the above titration.

( 14 marks )

7. Kambo was supplied with two beakers, one containing 0.10M sodium hydroxide solution ( $\text{NaOH(aq)}$ ) and the other containing acetic acid solution ( $\text{C}_2\text{H}_4\text{O}_2\text{(aq)}$ ). He was asked to perform a titration experiment in order to find the molarity of the acetic acid.

Kambo's procedure followed the following steps.

- 1<sup>st</sup>: He took the base solution and poured into the burette.
- 2<sup>nd</sup>: He measured accurately  $20\text{cm}^3$  of the acetic acid using a measuring cylinder and poured it into a conical flask.
- 3<sup>rd</sup>: He then added a few drops of methyl orange indicator into the conical flask containing the acid.
- 4<sup>th</sup>: Then he started his titrations.

His titration results showed that  $20\text{cm}^2$  of acetic acid required  $2\text{cm}^3$  of the 0.1M sodium hydroxide.

In calculating the molarity of the acetic acid solution he used the following formula.

$$\text{Molarity of acetic acid} = \frac{\text{Volume of Acid} \times \text{Volume of NaOH}}{\text{Molarity of NaOH}}$$

- Identify four (4) main mistakes which Kambo made in his titration and for each mistake, suggest the correct procedure Kambo should have followed.

- 7 -

(b) Is the formula used by Kambo to calculate the molarity of acetic acid correct or incorrect?

If incorrect, explain why and hence suggest the correct formula for the calculation of the acetic acid given.

( 15 marks )

---