1408/315
SCIENCE LABORATORY PRACTICE
(PRACTICAL)
June/July 2010
Time: 4 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

SCIENCE LABORATORY TECHNOLOGY CRAFT

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(PRACTICAL)

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INSTRUCTIONS TO CANDIDATES

You should have the following for this examination.

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

1. (a) You are provided with the following:

7 pieces of connecting wires;
4 crocodile clips;
1 voltmeter, Range (0 - 3.0V);
1 milliameter - Range (0 - 100MA);
4 resistors each 56.0Ω, 0.5 watts (carbon film);
2 cells (each 1.5V);
1 resistance wire mounted on a graduated wooden plank at least 50cm long (Nickel Chrome 36 SWg).

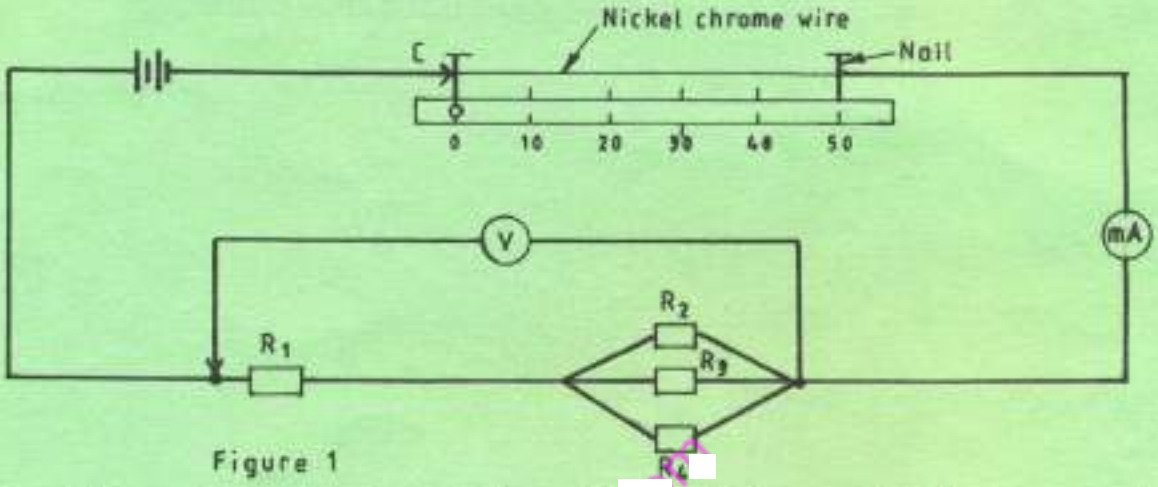

Figure 1

(b) Connect the circuit as shown in Figure 1 above with the crocodile clip C, at start of graduated wooden scale.

(c) Record the length in cm, potential difference in volts and current in milliamperes (MA).

(d) Repeat the reading in (c) above at length 10cm, 20cm, 30cm, 40c, and 50cm along the resistance wire.

(e) Tabulate your results in table f.

(f) Data Table

Length in cm	0	10	20	30	40	50
Voltage in volts						
Current in MA						

(12 marks)

(g) Plot a graph of potential difference in volts against current in milliamperes.

(9 marks)

(h) Determine the gradient (g) of the graph in volts per ampere. (4 marks)

(i) Calculate:

(i) $R_{x1} = g - R_1$ (1 mark)

(ii) R_{x2} from $\frac{1}{R_{x2}} = \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$ (3 marks)

(iii) R_{x3} from $R_{x3} = R_{x2} + R_1$ (1 mark)

(j) State the expected relationship between R_{x3} and g. (1 mark)

(k) State the physical properties represented by:

(i) g; (1 mark)

(ii) R_{x1}. (1 mark)

2. (a) You are provided with:

- Analar grade sodium carbonate powder;
- Dilute hydrochloric acid;
- Ammonia solution;
- Methyl orange indicator;
- Other titration apparatus.

(b) You are required to:

- Prepare a standard solution of 0.5M sodium carbonate;
- Standardise the dilute hydrochloric acid solution;
- Estimate the molarity of the ammonia solution by back-titration.

PROCEED AS FOLLOWS

(c) (i) Calculate the mass of sodium carbonate required to prepare $250cm^3$ of 0.5M sodium carbonate (Na = 23, C = 12, 0 = 16). (4 marks)

(ii) Weigh the mass of the sodium carbonate calculated in c(i) above.

(iii) Record the exact mass of the sodium carbonate weighed in c(ii) above. (1 mark)

(iv) Transfer the weighed mass into a $250cm^3$ volumetric flask and add $100cm^3$ of water. Shake until all the sodium carbonate dissolves and then top up to the mark with water.

(v) Calculate the exact molarity of the solution you have prepared. (3 marks)

(d) (i) Fill a burette with the dilute HCl solution.

(ii) Pipette 20 or 25cm^3 of the sodium carbonate solution into a clean conical flask and add three drops of methyl orange indicator.

(iii) Titrate the carbonate solution with the acid until a permanent colour change occurs. Repeat the experiment three more times and tabulate the results. (6 marks)

(iv) Calculate the molarity of the dilute HCl solution. (3 marks)

(e) (i) Measure 50cm^3 of the ammonia solution and transfer into a 250cm^3 beaker.

(ii) Measure 150cm^3 of the dilute HCl and mix with the ammonia solution.

(iii) Fill the burette with the sodium carbonate solution.

(iv) Pipette 20 or 25cm^3 of the reaction mixture and transfer into a clean conical flask. Add three drops of methyl orange indicator and titrate until a permanent colour change occurs. Repeat the experiment three more times and tabulate the results. (6 marks)

(v) Write an equation of the reaction taking place during the titration. (1 mark)

(vi) Calculate:

(I) moles of sodium carbonate used; (1 mark)

(II) moles of HCl in 20 or 25cm^3 of the reaction mixture; (1 mark)

(III) moles of HCl in 200cm^3 of the reaction mixture; (1 mark)

(IV) original moles of HCl; (1 mark)

(V) moles of HCl that reacted with ammonia; (1 mark)

(VI) moles of ammonia; (1 mark)

(VII) molarity of the ammonia solution. (1 mark)

(f) Explain why a solution of ammonia cannot be titrated directly with a standard solution of dilute HCl. (3 marks)

3. (a) You are provided with the following:

- two microorganisms labelled **P** and **K** growing on nutrient agar (NA);
- 2 microscope slides;
- 1 wireloop;
- 5ml normal saline in a bottle;
- crystal violet solution/gentian violet/methyl violet solution;
- gram's iodine;
- acetone/ethanol
- neutral red/safranin/dilute carbol fushin
- blotting paper
- oil immersion
- microscope with X10, X20, X40, X100 objectives.

(b) Examine the cultures and describe the colonial appearance of the two microorganisms. (10 marks)

(c) Make a smear for each microorganism and stain using the Gram stain method. (Outline the procedure). (15 marks)

(d) Describe the appearance of the microorganisms upon staining. (4 marks)

(e) List the factors necessary for growth of microorganisms in the laboratory. (4 marks)