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

131/3A

PHYSICS 3A
ALTERNATIVE A PRACTICAL
(For Both School and Private Candidates)

Time: 3 Hours **Thursday 06 May 2004 a.m.**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Calculations must be clearly shown.
4. Mathematical tables and non-programmable calculators may be used.
5. Cellular phones are **not** allowed in the examination room.
6. Write your Examination Number on every page of your answer booklet(s).
7. The following may be used:

$$\pi = 3.14$$

1. You are required to determine the coefficient of rigidity of the wire provided. Proceed as follows.

(a) Tie the wire at the centre of the rod such that the rod hangs horizontally. Suspend the rod from the retort stand so that a length L = 50 cm of the wire is used. Ensure the wire is straight.

(b) Start the rod to oscillate horizontally by giving it a small angular displacement from one of its ends. Measure the time for ten (10) oscillations. Hence find the periodic time T. Repeat the procedure for four more values of L = 40, 30, 20 and 10 cm respectively. Tabulate your results.

(c) Measure the radius a of the wire, the mass M of the rod and the length d of the rod.

(d) Plot a graph of T^2 against L and use it to find the coefficient of rigidity μ of the wire, given that

$$T = 2\pi\sqrt{\frac{2IL}{\mu a4 - u}} \quad \text{and that } I = \frac{M^{\ 2}}{12}$$

(e) State the units of μ. **(20 marks)**

2. You are required to determine the refractive index η of the liquid L provided. Proceed as follows

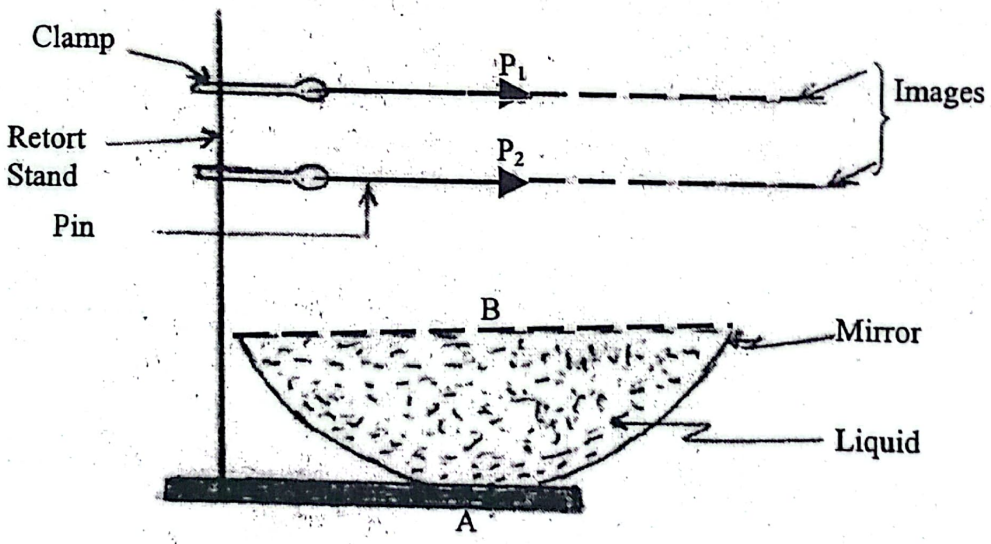

Fig. 1

(a) (i) Place the mirror on the base of the stand and adjust the position of the pin P_1 until the point coincides with its own image P_1 which appears at the centre of curvature of the mirror. Measure the distance P_1A of the pin from the pole of the mirror.

(ii) Displace the pin so as to get two more readings of P_1A and record the values in a tabular form.

(b) (i) Pour liquid L into the mirror (note two small drops of liquid will distort the image). Adjust the height of the pin until it again coincides with its own image P_2. Measure distance P_2A

(ii) Displace the pin again and take two more readings.

(c) Measure the depth of the liquid at its deepest point by dipping a piece of paper provided. Measure the length AB that is wetted by the liquid. Make at least three observations of this depth.

Record the measurements in a table as shown below:

	1	2	3	AVERAGE VALUE
Distance P_1A (cm)				
Distance P_2A (cm)				
Depth AB (cm)				

(d) Calculate the refractive index η_L of the liquid from the equation:

$$P_2A = \frac{P_1A}{\eta L} + AB - \frac{AB}{\eta L}$$

(e) State any three sources of error. **(15 marks)**

3. You are required to determine the electrical resistivity of the wire labelled X. Proceed as follows.

(a) (i) Set up the slide-wire metre bridge as illustrated in fig. 2 below, where E is an accumulator (driver cell), G a galvanometer, K a switch and J the jockey.

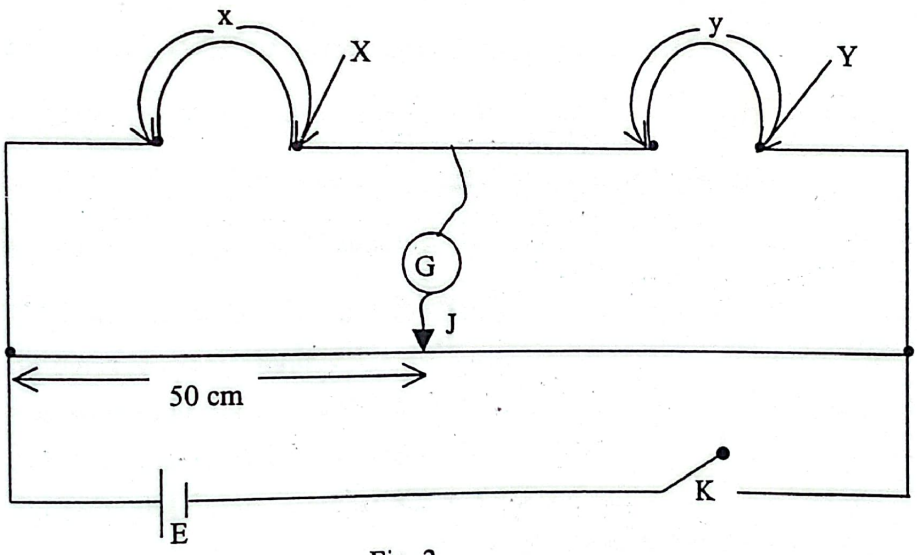

Fig. 2

(ii) Connect a length y = 10 cm of the wire labelled Y to the right hand gap of the metre bridge, to the left hand gap connect a length x of the wire labelled X which will give a balance point at the 50 cm mark of the bridge. Measure and record the length x.

(b) Repeat the procedure of a (ii) for values of y = 20, 30, 40, 50 and 60 cm while obtaining the corresponding lengths x of the wire X that will give the balance point at the 50 cm mark.

(c) (i) Record the values of x and y in a table.

(ii) Measure and record the diameters dx and dy of the wires X and Y respectively.

(d) Plot a graph of y against x and determine its slope S.

(e) Using the relation $y = \left(\frac{\rho x}{\rho y}\right)\left(\frac{dy}{dx}\right)^2 x$, where ρ_y is the given resistivity of wire Y, determine the resistivity ρ_x of wire X.

(f) State any two sources of errors in this experiment. **(15 marks)**