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

031/2A

PHYSICS 2A
ACTUAL PRACTICAL A
(For Both School and Private Candidates)

Duration: 2:30 Hours **Year: 2025**

Instructions

1. This paper consists of **two** (**2**) questions. Answer **all** the questions.
2. Marks for the questions are indicated at the end of each question.
3. Mathematical tables and non-programmable calculators may be used.
4. Communication devices and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

The following information may be useful:
The density of water = 1 g/cm^3

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1. Density is one of the physical quantities that is used to differentiate materials with the same dimensions. To quantify this statement, you are required to perform an experiment to determine the numerical value of the density of steel by using the following apparatus; plastic measuring cylinder of 250 cm^3, six (6) steel slotted masses each of 50 g, water filled in the beaker. Proceed as follows:

(a) Pour water into the measuring cylinder to the volume, $v_o = 100\ cm^3$.

(b) Insert the slotted mass, m of 50 g in the cylinder and record the corresponding new volume readings.

(c) Repeat the procedure 1 (b) by adding another mass (m) of 50 g until you get the total of six (6) readings. Read and record the volume readings in each case.

Questions

(i) Record your results in tabular form as shown in the following Table.
Initial volume $v_o = 100\ cm^3$.

Mass, m (g)	$\frac{1}{m}\left(g^{-1}\right)$	**Volume Readings, v (cm^3)**	$(v - v_0)\ cm^3$	$\frac{1}{v - v_0}\ cm^{-3}$
50				
100				
150				
200				
250				
300				

(ii) Plot the graph of $\frac{1}{m}$ against $\frac{1}{v - v_0}$.

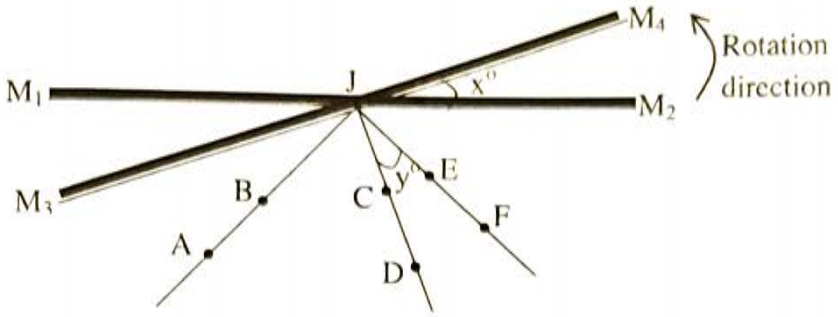
(iii) Determine the slope of the graph plotted in 1 (ii).

(iv) What does the slope in 1 (iii) represent?

(v) Determine the density and relative density of the material used to make the slotted masses of the steel. **(25 marks)**

2. You are required to perform an experiment to investigate optical properties of a plane mirror. You are given a plane mirror glued on wooden block, 4 optical pins, 4 thumb pins, white paper, protractor and drawing board. Proceed as follows:

(a) Pin the clean white paper on the drawing board, and then draw two straight lines M_1M_2 and M_3M_4 such that the angle between the lines x^o is 10^o as shown in the following Figure.



(b) Draw a line through J to represent the incident ray, and then erect two pins A and B on this line as shown in the given figure. Place the reflecting surface of the mirror along M_1M_2.

(c) Erect pins C and D to appear in line with the images of A and B. Remove the pins C and D, and then mark their position with pencil. Draw the line JCD to represent the reflected ray.

(d) Rotate the mirror such that it is along line M_3M_4. Erect pins E and F to appear in line with the images of A and B. Remove the pins E and F then draw the line JEF to represent the new position of the reflected ray.

(e) Remove the mirror and pins A and B then measure the angle y^o as shown in the figure.

(f) Repeat the procedures in 2 (a) to (e) for values of $x = 15^o, 25^o, 35^o$ and 40^o. Record the corresponding values of angle y^o in each case.

Note: For each case, new plain white paper must be used and attached with the answer booklet(s) for submission.

Questions

(i) Prepare a table for values of x^o and y^o.

(ii) Plot a graph of y^o against x^o.

(iii) Calculate the slope of the graph plotted in 2 (ii).

(iv) How is x^o related to y^o?

(v) What is the aim of doing this experiment? **(25 marks)**