THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2A **PHYSICS 2A**

ACTUAL PRACTTICAL A

(For Both School and Private Candidates)

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

Instructions

1. This paper consists of **two (2)** questions. Answer all the questions.
2. Mathematical tables and non-programmable calculators may be used.
3. All writing must be in **blue** or **black** pen.
4. All answers must be written in the answer booklet(s) provided.
5. Communication devices and any unauthorised materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s)

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.

Procedures

(a) Pour water into the measuring cylinder to the volume, Vo = 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 (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 Vo = 100 cm^3

Mass, m (g): 50, 100, 150, 200, 250, 300

(ii) Plot the graph of m against (V − Vo).
(iii) Determine the slope of the graph plotted in (ii).
(iv) What does the slope in (iii) represent?
(v) Determine the density and relative density of the material used to make the slotted masses of steel.

SOLUTION

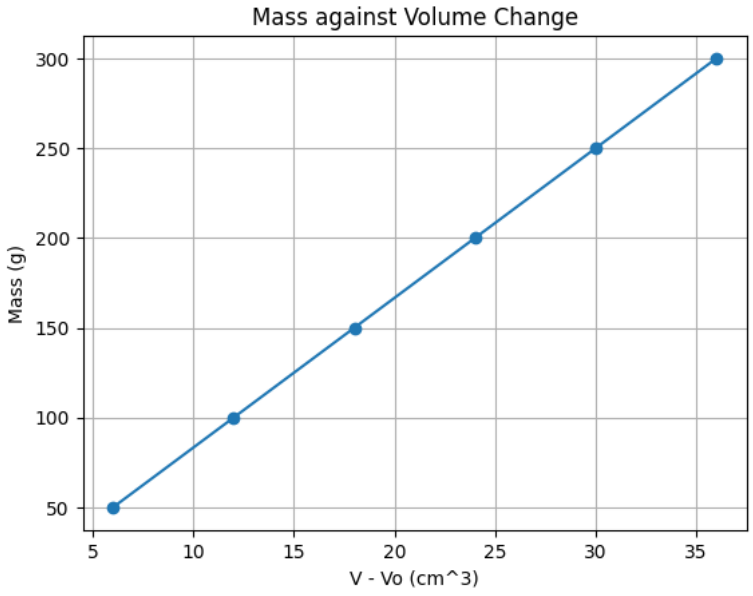
(i) Table of results

Initial volume Vo = 100 cm³

Mass m (g)	Final volume V (cm³)	V − Vo (cm³)
50	106	6
100	112	12
150	118	18
200	124	24
250	130	30
300	136	36

These values are reasonable because steel displaces a small volume of water.

(ii) Graph



(iii) Slope of the graph

Slope = change in mass / change in volume

Using two points on the graph

Point 1: $(V - Vo) = 6\ cm^3$, $m = 50\ g$

Point 2: $(V - Vo) = 36\ cm^3$, $m = 300\ g$

Slope = $(300 - 50) / (36 - 6)$

Slope = $250 / 30$

Slope = $8.33\ g/cm^3$

(iv) Meaning of the slope

The slope represents the density of the material of the slotted masses.

(v) Density and relative density

Density of steel

Density = slope = $8.33\ g/cm^3$

Relative density

Relative density = density of steel / density of water

Given density of water = $1\ g/cm^3$

Relative density = $8.33 / 1$

Relative density = 8.33

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

Procedures

(a) Pin the clean white paper on the drawing board, and then draw two straight lines M_1M_2 and M_1M_3 such that the angle between the lines x° is 10°.
(b) Draw a line through J to represent the incident ray, and then erect two pins A and B on this line. 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_1M_4.
(e) 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.
(f) Repeat the procedures for x = 15°, 25°, 35° and 40°. Record the corresponding values of angle y°.

Questions

(i) Prepare a table for values of x° and y°.
(ii) Plot a graph of y° against x°.
(iii) Calculate the slope of the graph plotted in (ii).
(iv) How is x° related to y°?
(v) What is the aim of doing this experiment?

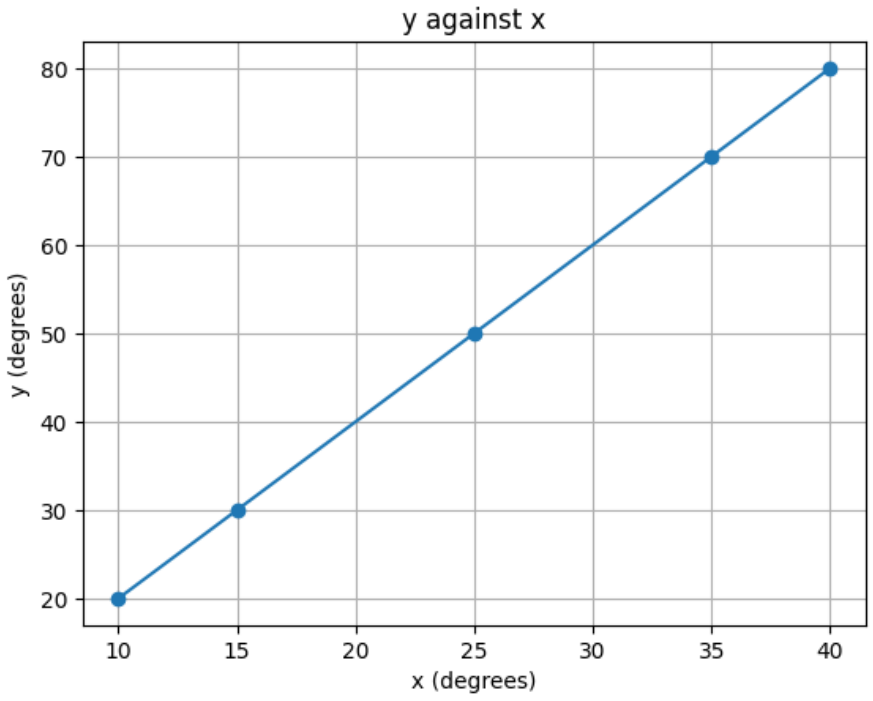
SOLUTION.

(i) Table of results

Angle x (degrees)	Angle y (degrees)
10	20
15	30
25	50
35	70
40	80

(ii) Graph

A graph of y° on the vertical axis against x° on the horizontal axis is plotted. The graph is a straight line passing through the origin.



(iii) Slope of the graph

Slope = change in y / change in x

Using two points

Point 1: x = 10°, y = 20°

Point 2: x = 40°, y = 80°

Slope = (80 − 20) / (40 − 10)

Slope = 60 / 30

Slope = 2

(iv) Relationship between x and y

y is directly proportional to x

y = 2x

(v) Aim of the experiment

The aim of the experiment is to investigate the effect of rotation of a plane mirror on the angle of deviation of the reflected ray and to verify that the angle of deviation is twice the angle of rotation of the mirror.