THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2A **PHYSICS 2A**

ACTUAL PRACTICAL A

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2012**

Instructions

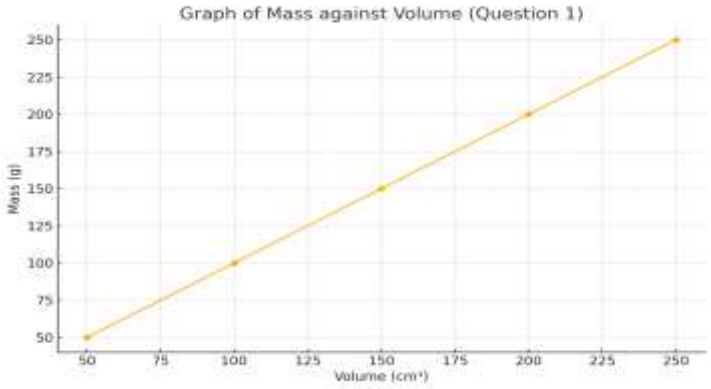
1. This paper consists of two questions.

2. Answer all questions.

1. You are provided with a measuring cylinder, eureka can, nylon thread, standard masses and water. Proceed as follows:
(a) Pour water into eureka can until it is just beginning to overflow.
(b) Hold a suitable measuring cylinder under the spout and immerse a standard mass of 50g in the eureka can as shown in Figure 1. Water will pass through the spout and will be collected in the measuring cylinder. Wait for it to drop until it starts to cease and take long interval drop. Record the reading of the water collected.
(c) Repeat the procedures in 1(b) for standard masses of 100g, 150g, 200g and 250g.
(d) Tabulate your results showing the quantities as follows:

Mass (g)	Volume (cm^3)	Mass ÷ Volume (g/cm^3)
50	50	1.00
100	100	1.00
150	150	1.00
200	200	1.00
250	250	1.00

(e) Plot a graph of mass against volume.



(f) State the nature of the graph.
The graph is a straight line passing through the origin. This shows a direct proportionality between mass and volume.

(g) From the graph:
(i) Calculate the slope.
Slope = Δmass / Δvolume = (250 - 50) / (250 - 50) = 1 g/cm^3

(ii) What does the slope of the graph show?
The slope shows the density of the material.

(iii) What is the relationship between mass and volume?
Mass is directly proportional to volume: $m \propto V$.

(iv) Establish the formula governing the experiment.
$m = \rho V$, where ρ is the density.

(h) Identify with reasons the best to the least satisfactory method of finding the constant value mass divide by volume.
The best method is by calculating the slope of the graph because it considers the overall trend and reduces random measurement errors. The least satisfactory is taking individual mass ÷ volume values which can vary due to measurement inaccuracies.

(i) State two possible errors in this experiment.
1. Parallax error when reading the measuring cylinder.
2. Spillage or retention of water during transfer from eureka can.

(j) How can you minimize errors in 1(i)?
1. Take measurements at eye level to avoid parallax.
2. Use a dry and calibrated measuring cylinder, ensure no water adheres to the standard mass when withdrawn.

2. You are provided with two plane mirrors, an optical pin, a sheet of plane drawing paper, mirror holder or office pins, a protractor, a ruler and a drawing table. Proceed as follows:

(a) Draw two lines at right angles.

(b) Place the two plane mirrors along the top two lines using the mirror holders or office pins as shown in Figure 2.

(c) Put an optical pin at O when $\theta = 90°$. Look onto one of the mirrors and count the number of images, n, you see.

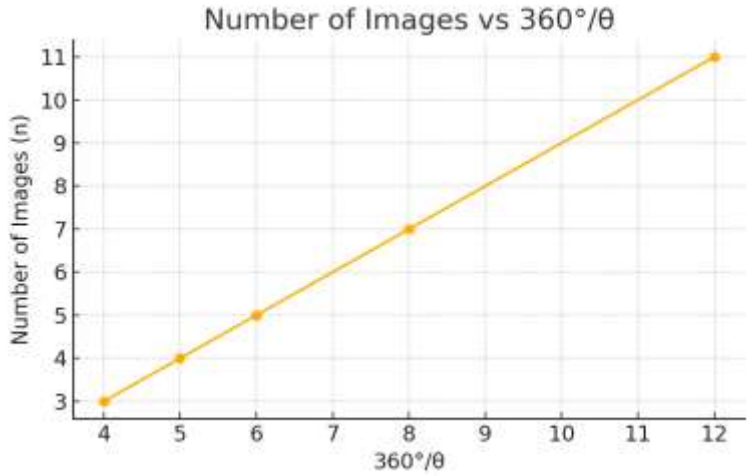
(d) Repeat the procedures in 2(c) for $\theta = 72°$, $\theta = 60°$, $\theta = 45°$ and $\theta = 30°$.

(e) Tabulate your results for the values of θ, n and $360°/\theta$.

θ (degrees)	n (number of images)	$360°/\theta$
90°	3	4.00
72°	4	5.00
60°	5	6.00
45°	7	8.00

30° | 11 | 12.00

(f) Plot a graph of number of images, n, against 360°/θ.



(g) From the graph:

(i) Determine the slope.

Slope = Δn / Δ(360°/θ) = (11 - 3) / (12.00 - 4.00) = 8 / 8 = 1

(ii) Find the number of images when 360°/θ = 9.

From the graph and the relation, n = 360°/θ - 1, then

n = 9 - 1 = 8 images

(iii) Find the value of the y-intercept.

From n = (360°/θ) - 1, y-intercept = -1

(iv) Derive the equation relating the number of images and 360°/θ.

n = (360°/θ) - 1

(h) From your experiment:

(i) What happens to the number of images as the value angle θ is reduced?

As θ decreases, the number of images increases.

(ii) What happens to the number of images when θ = 0°?

When θ = 0°, 360°/θ tends to infinity, so the number of images becomes infinitely many (impractical).

(i) State a possible source of error and how you can minimize it.

Source of error: Miscounting the images due to overlapping reflections.

Minimization: Use a black background and focus light to reduce multiple reflections.

(j) What is the aim of this experiment?

To determine the relationship between the angle between two plane mirrors and the number of images formed.