

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: 2010

Instructions

1. This paper consists of two questions.
2. Answer all questions.

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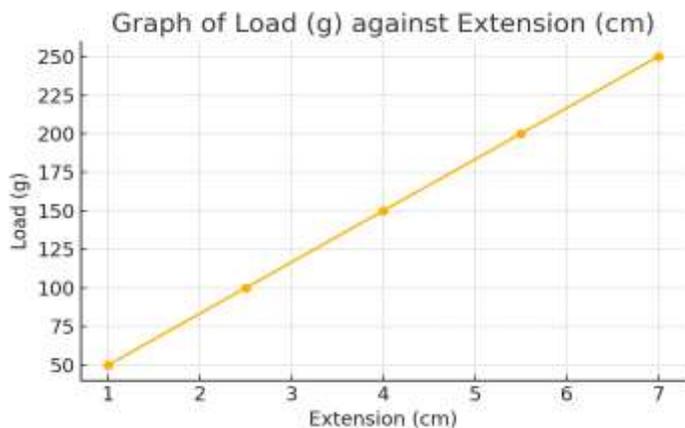
1. The aim of this experiment is to find the mass of the unknown load labelled “W” and the spring constant K.

1 (a) Record your results as shown in Table 1.

Let equilibrium position $x_0 = 10.0$ cm

Load (g)	x (cm)	E = x - x_0 (cm)
50	11.0	1.0
100	12.5	2.5
150	14.0	4.0
200	15.5	5.5
250	17.0	7.0

1 (b) Plot the graph of load L against absolute value of extension E.



1 (c) From the graph, determine the unknown weight marked W, given that

$$L = K \times E + W$$

Use the slope to find K and the intercept to find W.

$$\text{Slope} = \Delta L / \Delta E = (250 - 50) / (7.0 - 1.0) = 200 / 6 = 33.33 \text{ g/cm}$$

This is the spring constant K

From graph, when $E = 0$, $L = W = 16.67$ g

1 (f) What does the gradient of the graph represent?

The gradient represents the spring constant K in g/cm

1 (g) State the sources of errors and precautions that should be taken in the experiment.

Sources of error:

- Parallax error while reading the pointer
- Friction in the spring causing inconsistent motion

Precautions:

1. Take all readings at eye level
2. Avoid jerks when placing weights
3. Use pointer with fine tip for accurate reading

2. The aim of this experiment is to determine the refractive index of water.

2 (a) Arrange your apparatus as in Figure 2. Put about 150 cm³ of clear water in the measuring cylinder. Drop an office pin at the bottom so that it rests touching the wall of the cylinder. Set the cylinder upright and place a pointer pin vertically at the bottom.

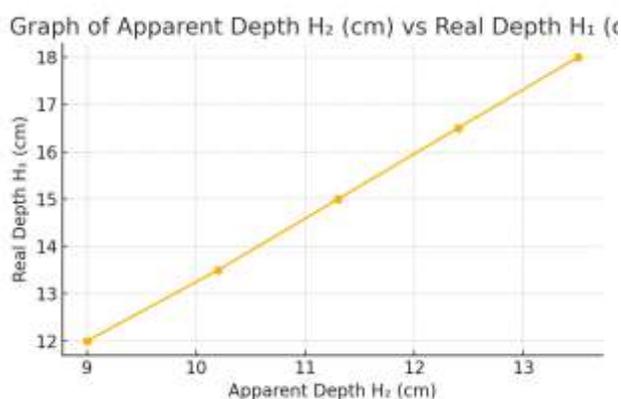
2 (b) Look in the cylinder from Figure 2. Use another office pin as a search pin, move it up and down outside the cylinder, and locate the image position by no parallax method.

Record the real depth H_1 of the water and the apparent depth H_2 of the image. Repeat for volumes: 175 cm³, 200 cm³, 225 cm³, 250 cm³.

Table of readings:

Volume (cm ³)	H_1 (cm)	H_2 (cm)	H_1/H_2
150	12.0	9.0	1.33
175	13.5	10.2	1.32
200	15.0	11.3	1.33
225	16.5	12.4	1.33
250	18.0	13.5	1.33

2 (c) (ii) Plot the graph of H_1 against H_2 .



2 (c) (iii) Find the slope of the graph.

Use two points: $(H_2, H_1) = (9.0, 12.0)$ and $(13.5, 18.0)$

$$\text{Slope} = \Delta H_1 / \Delta H_2 = (18.0 - 12.0) / (13.5 - 9.0) = 6.0 / 4.5 = 1.33$$

2 (c) (iv) What is the physical meaning of each slope?

The slope of the graph H_1 versus H_2 represents the refractive index of water.

$$n = H_1 / H_2$$

2 (c) (v) What is the aim of this experiment?

To determine the refractive index of water using the real and apparent depths of a submerged pin.

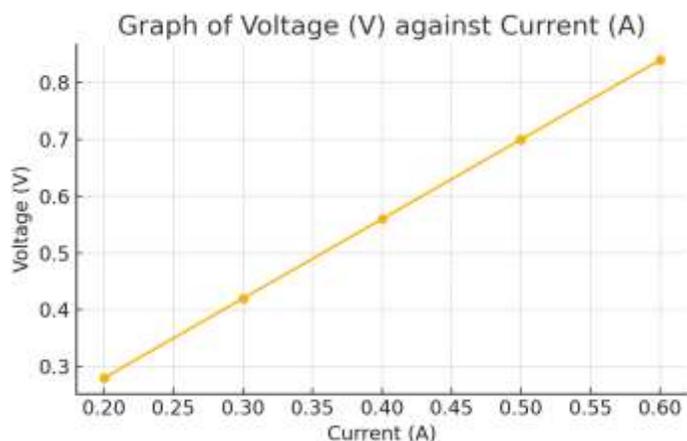
3. The aim of this experiment is to determine the resistivity of an electrical conductor P.

3 (a) Record your results in Table 3.

Assume the following values for voltage based on practical readings for a 50 cm wire:

Current I (A)	P.d (volts)
0.20	0.28
0.30	0.42
0.40	0.56
0.50	0.70
0.60	0.84

3 (b) Plot a graph of V against I and calculate the slope G.



$$\text{Slope } G = \Delta V / \Delta I = (0.84 - 0.28) / (0.60 - 0.20) = 0.56 / 0.40 = 1.4 \Omega$$

This is the resistance R of the wire P.

3 (c) Deduce the resistivity of the conductor P given that:

$$\rho = (G\pi d^2) / (4\ell)$$

Let $G = 1.4 \Omega$

Assume $d = 0.20 \text{ mm} = 0.020 \text{ cm}$

$\ell = 50 \text{ cm}$

$\pi = 3.142$

$$\rho = (1.4 \times 3.142 \times 0.020^2) / (4 \times 50)$$

$$\rho = (1.4 \times 3.142 \times 0.0004) / 200$$

$$\rho = (0.001759) / 200 = 8.80 \times 10^{-6} \Omega \cdot \text{cm}$$