

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: 2019

Instructions

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

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1. The aim of this experiment is to determine the density of a liquid L by means of a spiral spring.

(a) Assemble the apparatus as shown in Figure 1 with the zero mark of the meter rule at the uppermost end. Record the reading of the position of a pointer on the scale as y_0 .

$$y_0 = 15.0 \text{ cm}$$

(b) Hang the 50 g mass on the spring and record the reading on the metre rule as y . Find the extension $e = y - y_0$.

$$y = 17.6 \text{ cm}$$

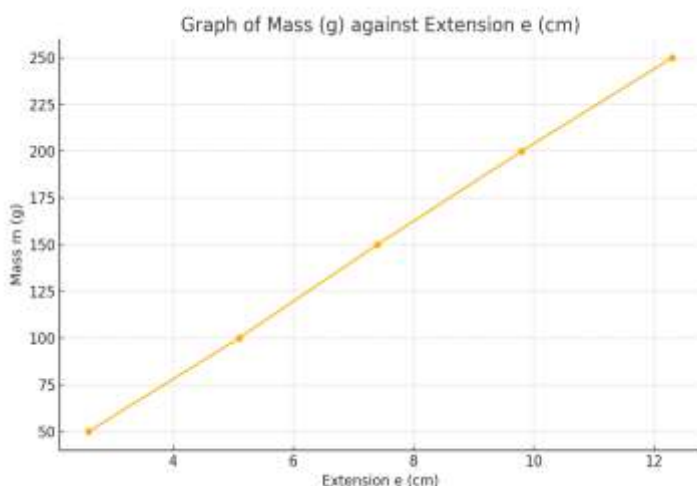
$$e = 17.6 - 15.0 = 2.6 \text{ cm}$$

(c) Without removing the 50 g mass, repeat the procedure in 1 (b) for $m = 100 \text{ g}$, 150 g , 200 g and 250 g to obtain a total of five readings.

(i) Prepare a table of results including the values of m , y and e .

$m \text{ (g)}$	$y \text{ (cm)}$	$e = y - y_0 \text{ (cm)}$
50	17.6	2.6
100	20.1	5.1
150	22.4	7.4
200	24.8	9.8
250	27.3	12.3

(ii) Plot a graph of mass $m \text{ (g)}$ against extension $e \text{ (cm)}$



Mass m on the y -axis and extension e on the x -axis. The graph is a straight line.

(iii) Find the gradient G of the graph

Using points ($e = 2.6$, $m = 50$) and ($e = 12.3$, $m = 250$):

$$G = (250 - 50) / (12.3 - 2.6) = 200 / 9.7 \approx 20.62 \text{ g/cm}$$

(iv) What will be the extension produced by a mass of 1.0 kg?

$$m = 1000 \text{ g}$$

$$e = m / G = 1000 / 20.62 \approx 48.48 \text{ cm}$$

(v) Use the information from the graph you have drawn to determine the density of liquid L in its SI units.

Mass of empty bottle Q = 60 g

Mass of Q + liquid = 160 g

Mass of liquid = 100 g

Volume of liquid = 100 cm³

$$\text{Density} = \text{mass} / \text{volume} = 100 \text{ g} / 100 \text{ cm}^3 = 1.0 \text{ g/cm}^3 = 1000 \text{ kg/m}^3$$

2. You are required to determine the value of unknown resistance X using metre bridge.

(a) Connect the circuit as shown in Figure 2, where R is a resistance box, E is a dry cell, K is a key, G is a galvanometer, J is a jockey and X is unknown resistance.

(b) Set $R = 1 \Omega$, close the key K , slide the jockey over the metre bridge wire until the galvanometer reads zero. Read and record length L_1 . Also read and record the corresponding length L_2 .

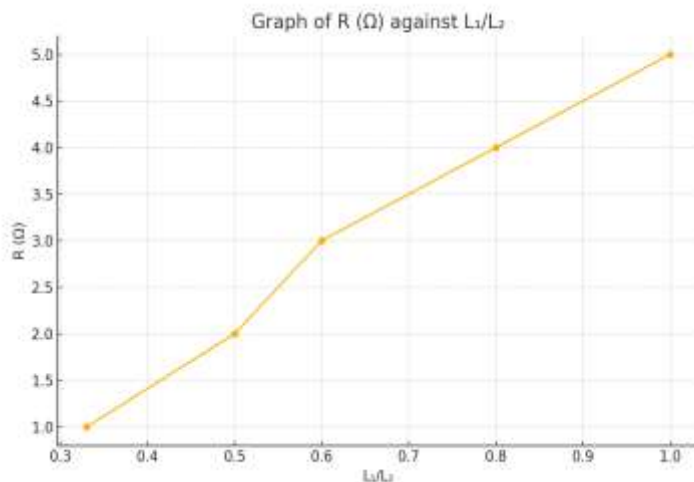
$$L_1 = 25.0 \text{ cm}, L_2 = 75.0 \text{ cm}$$

(c) Repeat the procedures in 2 (b) for $R = 2 \Omega$, 3Ω , 4Ω and 5Ω and record the value for L_1 and L_2 in each case.

(i) Tabulate your results including the values of L_1/L_2

$R (\Omega)$	$L_1 (\text{cm})$	$L_2 (\text{cm})$	L_1/L_2
1	25.0	75.0	0.33
2	33.3	66.7	0.50
3	37.5	62.5	0.60
4	44.4	55.6	0.80
5	50.0	50.0	1.00

(ii) Plot a graph of R against L_1/L_2



(iii) Deduce the slope, S of the graph

Using points ($L_1/L_2 = 0.33$, $R = 1 \Omega$) and ($L_1/L_2 = 1.00$, $R = 5 \Omega$):

$$S = (5 - 1) / (1.00 - 0.33) = 4 / 0.67 \approx 5.97$$

(iv) Find the value of unknown resistance X. Show clearly how you arrived to your answer.

The equation from metre bridge is $R / X = L_1 / L_2$

Hence, $R = X \times (L_1 / L_2)$

So slope $S = R / (L_1 / L_2) = X$

Therefore, $X = \text{slope} = 5.97 \Omega$