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.

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.

$y_0 = 15.0$ cm

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

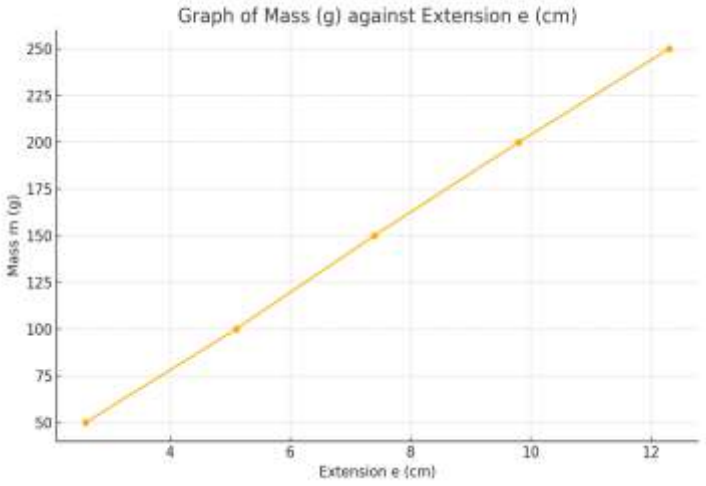
y = 17.6 cm
e = 17.6 − 15.0 = 2.6 cm

(c) Without removing the 50 g mass, repeat the procedure in 1 (b) for m = 100 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 (g)	y (cm)	e = y − y_0 (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 (g) against extension e (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):
$G = (250 - 50) / (12.3 - 2.6) = 200 / 9.7 \approx 20.62$ g/cm

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

m = 1000 g
$e = m / G = 1000 / 20.62 \approx 48.48$ 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 cm^3
Density = mass / volume = 100 g / 100 cm^3 = 1.0 g/cm^3 = 1000 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 Ω, 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.

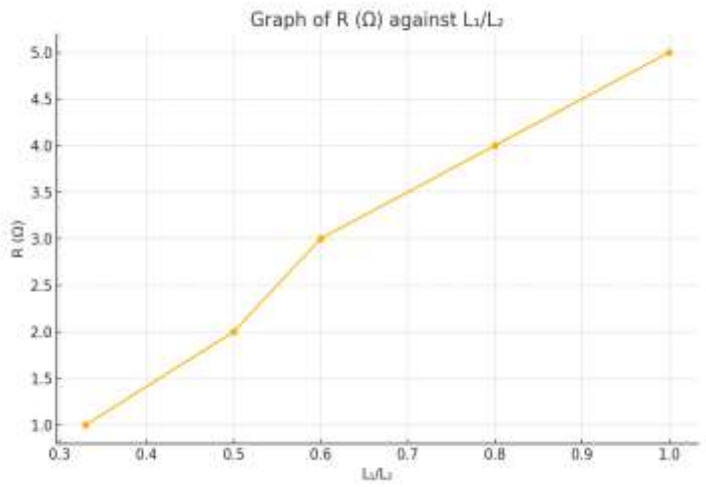
L_1 = 25.0 cm, L_2 = 75.0 cm

(c) Repeat the procedures in 2 (b) for R = 2 Ω, 3 Ω, 4 Ω and 5 Ω 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 (Ω)	L_1 (cm)	L_2 (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 = slope = 5.97 Ω