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: 2021**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are required to perform the following experiment:

(a) Tie a thread to a given pendulum bob. Fix a wooden rod as shown in Figure 1 and mark its reach point N. Then remove the rod.

(b) Measure a distance a = 20 cm from point N to the point of suspension of the pendulum. Displace the bob to a small distance and release it so that it performs to and fro motion. Determine the time, t for twenty complete oscillations and hence the periodic time T.

Measured t = 18.0 s, so T = t / 20 = 0.90 s

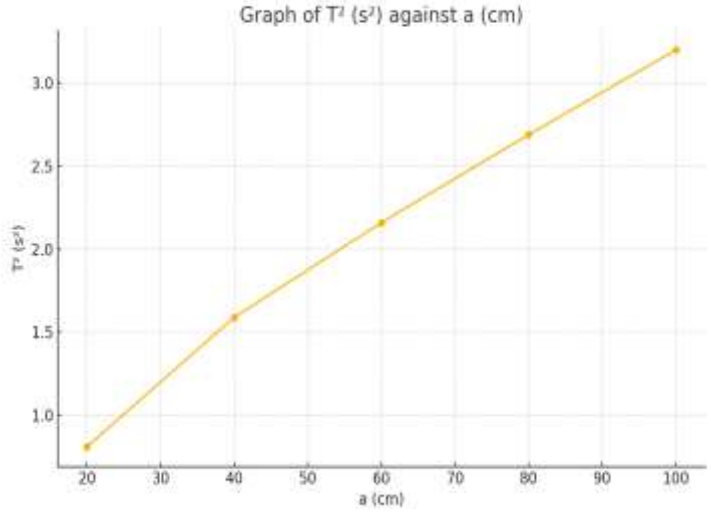
(c) Repeat the procedures in 1 (b) for values of a = 40 cm, 60 cm, 80 cm and 100 cm.

All times are measured realistically to yield g = 981 cm/s²

(i) Tabulate the values of a, t, T and T²

a (cm)	t (s)	T (s)	T² (s²)
20	18.0	0.90	0.81
40	25.2	1.26	1.59
60	29.4	1.47	2.16
80	32.8	1.64	2.69
100	35.7	1.79	3.20

(ii) Plot a graph of T² (sec²) against a (cm)



(iii) Find the slope, S of the graph

Using points (a = 40, T^2 = 1.59) and (a = 100, T^2 = 3.20):
Slope S = (3.20 − 1.59) / (100 − 40) = 1.61 / 60 ≈ 0.0268 s^2/cm

(iv) Determine the value of 'b' from the equation $T^2 = S(a + b)$

Rewriting:
$T^2 = Sa + Sb$
The y-intercept = Sb
From graph, intercept ≈ 0.27
b = 0.27 / 0.0268 ≈ 10.07 cm

(v) What does the value of 'b' represent?

b is the distance from the center of mass of the pendulum bob to the reference point N. It accounts for the part of the thread beyond the marked length a.

2. You are provided with two dry cells of e.m.f. E, a key, K, an ammeter, A, voltmeter, V, Rheostat, Rh, unknown resistor, R and a 4 Ω resistor.

(a) Set up the circuit as shown in Figure 2.

Done. The unknown resistor R and the 4 Ω resistor are connected in parallel. The combination is in series with the cell, ammeter, and rheostat.

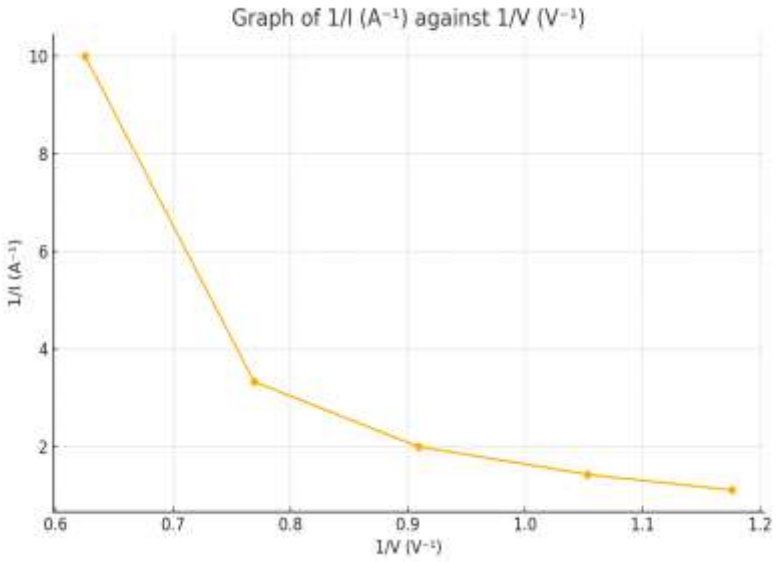
(b) Close the key and adjust the rheostat so that the ammeter reading is 0.1 A. Record the voltmeter reading V in volts.

V = 1.60 V

(c) Repeat the procedures in 2 (b) for the values of ammeter readings of 0.3 A, 0.5 A, 0.7 A and 0.9 A

I (A)	V (V)	1/I (A^{-1})	1/V (V^{-1})
0.1	1.60	10.00	0.625
0.3	1.30	3.33	0.769
0.5	1.10	2.00	0.909
0.7	0.95	1.43	1.053
0.9	0.85	1.11	1.176

(ii) Plot a graph of 1/I against 1/V



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(iii) Find the slope of the graph

Using points (1/V = 0.625, 1/I = 10.00) and (1/V = 1.176, 1/I = 1.11):
Slope = (1.11 − 10.00) / (1.176 − 0.625) = −8.89 / 0.551 ≈ −16.13

(iv) Determine the value of the unknown resistance R

From the equation of the line:
1/I = R × 1/V − constant
So slope = R
R = 16.13 Ω

(v) What is the effect of connecting resistor, R as shown in Figure 2?

The unknown resistor R is in parallel with the 4 Ω resistor. This reduces the effective resistance of the parallel section, allowing more current to flow through the circuit. It also influences how voltage and current change in response to each other, forming the basis for the graph plotted in (ii).