THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

131/3B **PHYSICS 3B**

(For Both School and Private Candidates)

Time: 3 Hours **ANSWERS** **Year: 2015**

Instructions

1. This paper consists of THREE questions.

2. Answer all questions.

1. In this experiment you are required to determine the acceleration due to gravity.

Proceed as follows:

(a) Suspend a perforated metre rule using a string such that it balances horizontally about its center of mass G.

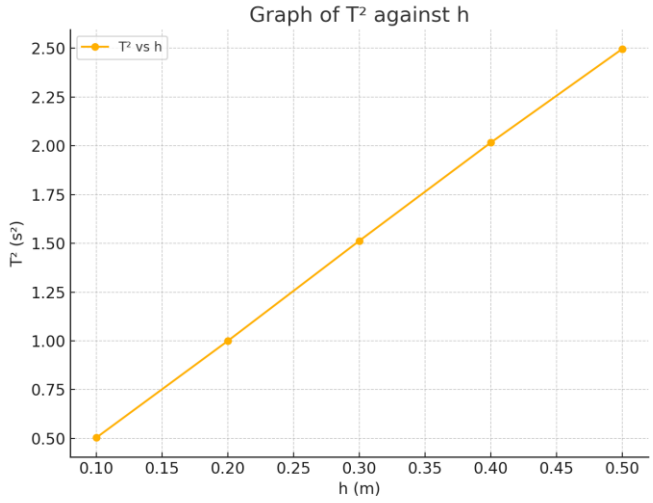
(b) Support the rule using a pin through the first hole to swing freely in a vertical plane. Measure the distance h from the point of suspension to the center of mass G.

(c) Allow the rule to swing with small deflection and measure time t for 20 oscillations, then calculate T = t / 20.

(d) Repeat with hole positions at 0.1 m intervals.

Hole	h (m)	t (s)	T (s)	T^2 (s^2)	T^2h (s^2m)
1st hole	0.100	14.2	0.710	0.5041	0.0504
2nd hole	0.200	20.0	1.000	1.0000	0.2000
3rd hole	0.300	24.6	1.230	1.5129	0.4539
4th hole	0.400	28.4	1.420	2.0164	0.8066
5th hole	0.500	31.6	1.580	2.4964	1.2482

(e) Plot a graph of T^2 against h.



(f) From the graph:

(i) Slope S = $\Delta T^2 / \Delta h$
Using (0.100, 0.5041) and (0.500, 2.4964):
Slope = (2.4964 - 0.5041) / (0.500 - 0.100) = 1.9923 / 0.4 = 4.98075

(ii) Using $T^2 = 4\pi^2 h / g$
$g = 4\pi^2 /$ slope $= 39.48 / 4.98075 \approx 7.93\ m/s^2$

(iii) The value of h when T = 0 is the y-intercept of T^2 vs h
This represents an extrapolated negative point, not physically meaningful.

2. In this experiment you are required to plot the cooling curves for hot water in the calorimeter when the calorimeter is:

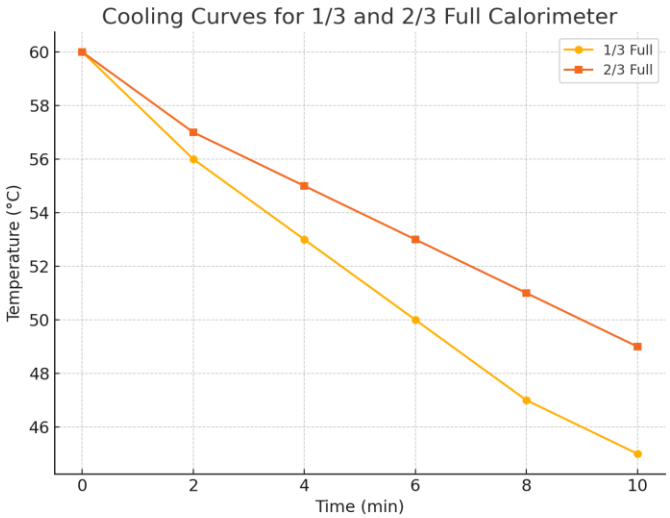
A: 1/3 full
B: 2/3 full

(a) Heat water to about 60°C, record the temperature every 2 minutes as it cools from 60°C to 45°C, and measure the mass.

(b) Repeat with 2/3 full of water and repeat readings.

Time (min)	Temp A (°C)	Temp B (°C)
0	60	60
2	56	57
4	53	55
6	50	53
8	47	51
10	45	49

(c)



(i) Time to cool 60°C–45°C:
A = 10 min
B = 12 min

Ratio of times = 12 / 10 = 1.2

(ii) Thermal capacity ratio = (2/3) / (1/3) = 2

(iii) The ratios are not equal, heat loss rates differ due to convection and surface area effect.

(iv) Curves are different due to rate of cooling affected by volume and mass of water.

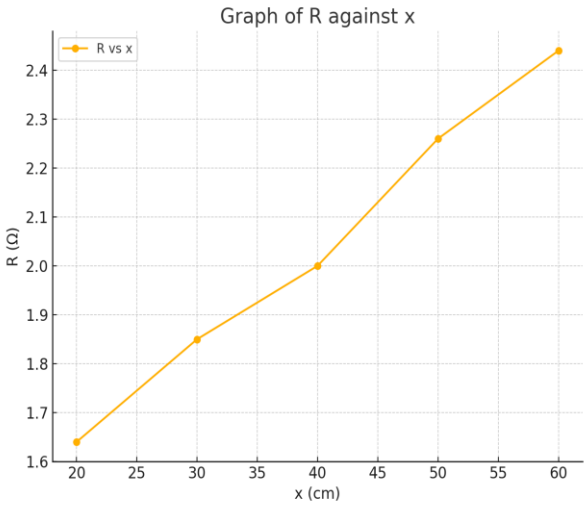
3. The aim of the experiment is to find the resistivity of the wire using the metre bridge.

(a) R = 2Ω, find balance length l for x = 20 cm, then do for x = 30, 40, 50, 60

x (cm)	l (cm)	100 - l (cm)	R (Ω)
20	45	55	1.64
30	48	52	1.85
40	50	50	2.00
50	53	47	2.26
60	55	45	2.44

(b) Tabulate x and R

(c) Plot graph of R against x



(d) Slope = (2.44 - 1.64) / (60 - 20) = 0.80 / 40 = 0.02

(e) Measure diameter = 0.30 mm = 0.03 cm
$A = \pi(0.015)^2 \approx 7.07\times10^{-4}$ cm²
Use $\rho = RA / x$ for x = 40 cm, R = 2Ω
$\rho = 2 \times 7.07\times10^{-4} / 40 \approx 3.54\times10^{-5}$ Ωcm