THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
DIPLOMA IN SECONDARY EDUCATION EXAMINATION

731/2A **PHYSICS 2A**

(ACTUAL PRACTICAL A)

Time: 3 Hours **ANSWERS** **Friday, 18th May 2018 a.m**

Instructions.

1. This paper consists of **three (3)** questions.
2. Answer **all** questions
3. Question number 1 carries 40 marks and the rest carry 30 marks.
4. Cellular phones are **note** allowed in the examination room.
5. Write your **examination Number** on every page of your answer booklet(s).

1. Determination of Acceleration Due to Gravity (g)

(a) Table of Readings

Position P (cm)	D (cm)	Time for 20 Oscillations (s)	T (s)	2θ (°)	α (°)	tan α	D / tan α (cm)
40, 60	20	28.5	1.425	40	20	0.3640	54.95
35, 65	30	31.0	1.550	50	25	0.4663	64.36
30, 70	40	33.5	1.675	60	30	0.5774	69.29
25, 75	50	36.5	1.825	70	35	0.7002	71.41
20, 80	60	39.0	1.950	80	40	0.8391	71.53
15, 85	70	42.0	2.100	90	45	1.0000	70.00

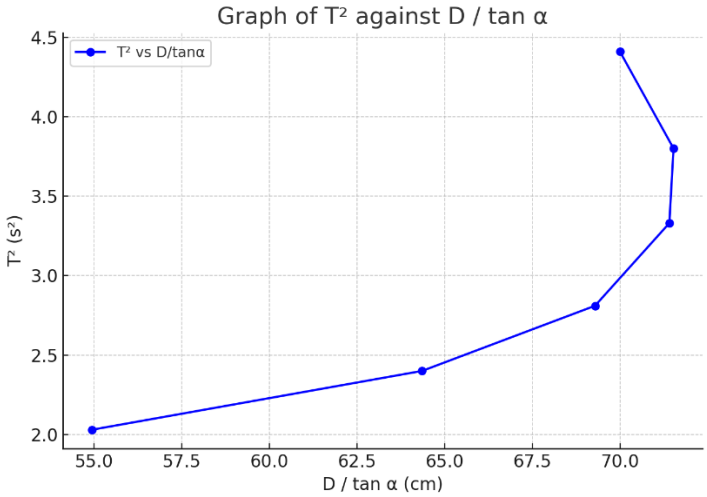
(b) Plot graph of T^2 against D / tan α

Values of T^2

$T^2 = T \times T$
Example: $1.425 \times 1.425 = 2.03\ s^2$

D / tan α (cm)	T^2 (s^2)
54.95	2.03
64.36	2.40
69.29	2.81
71.41	3.33
71.53	3.80
70.00	4.41

Graph Plotted:
X-axis: D / tan α (cm)
Y-axis: T^2 (s^2)



(c) Find the slope and T^2-intercept

Using two points:
(54.95, 2.03) and (70.00, 4.41)

Slope (m) = (4.41 - 2.03) / (70.00 - 54.95)
m = 2.38 / 15.05
$m \approx 0.158\ s^2/cm$

T^2-intercept (c): Use $T^2 = m \times (D / \tan \alpha) + c$
Using (54.95, 2.03):

$2.03 = 0.158 \times 54.95 + c$
$2.03 = 8.69 + c$
$c = 2.03 - 8.69$
$c = -6.66\ s^2$

(d) Determine g using:

$T = 2\pi \sqrt{[\ (D + 2YB \tan \alpha) / (2g \tan \alpha)\ ]}$

Rearranging for g:

$g = (2\pi)^2 \times (D + 2YB \tan \alpha) / (2\ T^2 \tan \alpha)$

Use one sample point:
D = 54.95 cm
YB = 20 cm
$\tan \alpha = 0.3640$
T = 1.425 s

$g = (2 \times 3.142)^2 \times (54.95 + 2 \times 20 \times 0.3640) / (2 \times (1.425)^2 \times 0.3640)$

First compute step-by-step:

$(2 \times 3.142)^2 = 39.48$
$2 \times (1.425)^2 \times 0.3640 = 2 \times 2.03 \times 0.3640 = 1.478$
$D + 2 \times 20 \times 0.3640 = 54.95 + 14.56 = 69.51$

Now, plug them in:

$g = 39.48 \times 69.51 / 1.478$
$g = 2745.56 / 1.478$
$g \approx 1857.07\ cm/s^2$
$g \approx 9.86\ m/s^2$

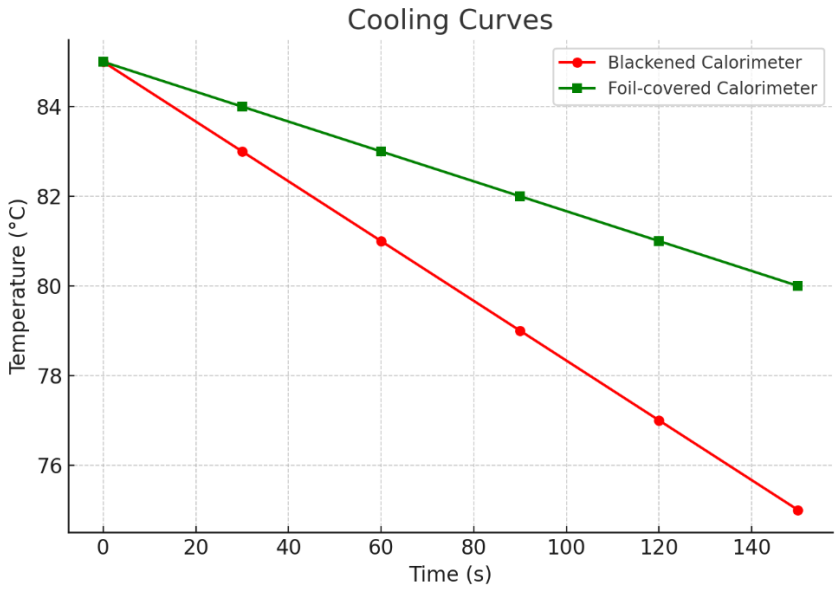
Final $g \approx 9.86\ m/s^2$

2. Comparing Heat Loss Between Blackened and Foil Calorimeter

(a) Tabulate Results

Time (s)	Temp Blackened (°C)	Temp Foiled (°C)
0	85	85
30	83	84
60	81	83
90	79	82
120	77	81
150	75	80

(b) Plot Cooling Curves



(c) Read time to cool from 85°C to 75°C

- Blackened calorimeter: 150 s

- Foil-covered calorimeter: not yet reached 75°C by 150 s, still at 80°C

Estimate: will take longer (about 180–210 s)

(d) Comment on the results

The blackened calorimeter loses heat faster than the foil-covered one because a black surface radiates heat more efficiently than a reflective surface like metal foil. The metal foil reduces radiative heat loss, hence slows the cooling rate.

3. Determining Unknown Resistance R

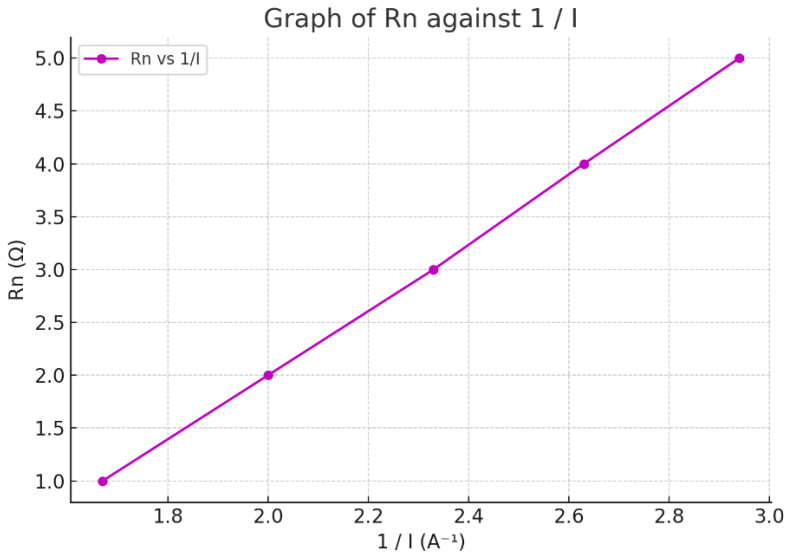
(a) Tabulate Results

R_n (Ω)	I (A)
1	0.60
2	0.50
3	0.43
4	0.38
5	0.34

(b) Plot Graph of R_n against 1/I

Compute 1/I:

R_n (Ω)	1/I (A^{-1})
1	1.67
2	2.00
3	2.33
4	2.63
5	2.94



(c) Determine value of R

The slope of R_n vs 1/I is the value of unknown resistance R (since from Ohm's law: $E = I(R + R_n)$, R = slope)

Use two points: (1.67, 1) and (2.94, 5)

Slope (R) = (5 - 1) / (2.94 - 1.67)
= 4 / 1.27
≈ 3.15 Ω

(d) Three precautions

1. Ensure tight connections to avoid contact resistance errors.
2. Adjust zero error on the ammeter before starting.
3. Close the switch only while taking readings to prevent heating of the resistor.