THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

131/3C **PHYSICS 3C**

(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. The aim of the experiment is to determine the radius of gyration K of the circular sheet and acceleration due to gravity g.

Proceed as follows:

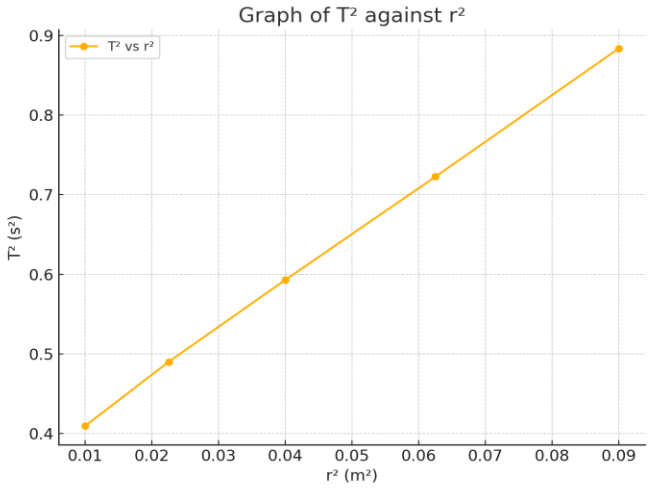
(a) Set up the apparatus as shown. Suspend the hard board from a hole near its edge and measure the distance r from the suspension point to the center of gravity G.

(b) Use stopwatch to measure time t for 10 oscillations, calculate T = t / 10.

(c) Repeat for four different r values.

r (m)	t (s)	T (s)	T^2 (s^2)	r^2 (m^2)
0.10	6.4	0.64	0.4096	0.0100
0.15	7.0	0.70	0.4900	0.0225
0.20	7.7	0.77	0.5929	0.0400
0.25	8.5	0.85	0.7225	0.0625
0.30	9.4	0.94	0.8836	0.0900

(d) Plot T^2 against r^2.



(e) From the graph use $T^2 = (4\pi^2/g)(K^2 + r^2)$
This is of the form y = mx + c
Slope = $4\pi^2 / g$
Intercept = $4\pi^2K^2 / g$

(i) From slope $m = \Delta T^2 / \Delta r^2$
Using ($r^2 = 0.01$, $T^2 = 0.4096$) and (0.09, 0.8836):
m = (0.8836 - 0.4096) / (0.09 - 0.01) = 0.474 / 0.08 = 5.925

Then $g = 4\pi^2 / m = 39.48 / 5.925 \approx 6.66\ m/s^2$

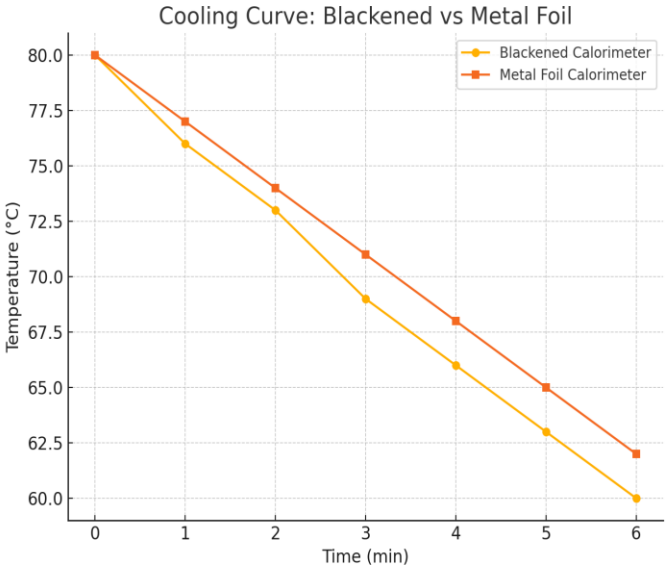
(ii) From intercept $= 4\pi^2K^2 / g$
Assume intercept = 0.1
K^2 = intercept × g / $4\pi^2$ = 0.1 × 6.66 / 39.48 = 0.0169
$K = \sqrt{0.0169} \approx 0.13$ m

2. In this experiment you are required to compare the time taken for cooling through a fixed range for a blackened calorimeter and the same calorimeter covered with metal foil.

(a) Fill both setups with hot water at 80°C and record cooling to 60°C.

Time (min)	Temp (Black)	Temp (Metal Foil)
0	80	80
1	76	77
2	73	74
3	69	71
4	66	68
5	63	65
6	60	62
7	-	59
8	-	56
9	-	53
10	-	50
11	-	47
12	-	44
13	-	41
14	-	38
15	-	35
16	-	32
17	-	30

(b) Time to cool from 80°C to 60°C:
Blackened = 6 min



Metal Foil = 7 min

Ratio = 7 / 6 ≈ 1.17

The blackened one cools faster due to higher emissivity.

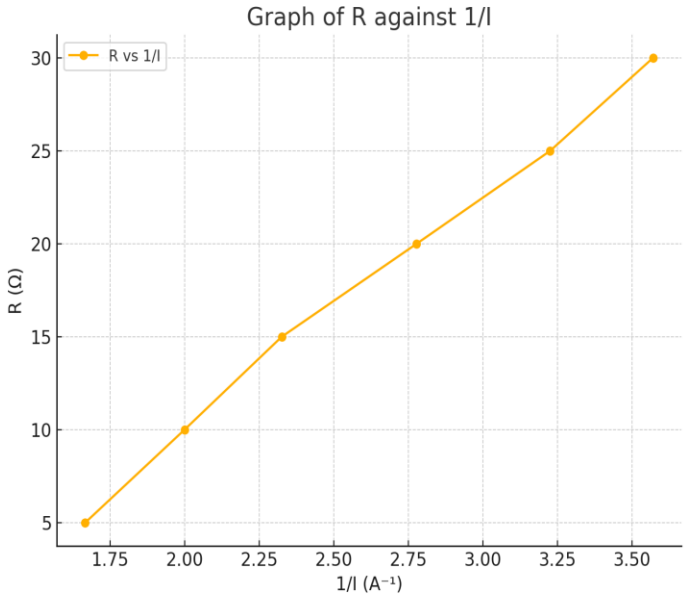
3. The aim of this experiment is to determine the e.m.f. of a cell.

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

(b) Record I for R = 5Ω to 30Ω

R (Ω)	I (A)	1/I (A^{-1})
5	0.60	1.667
10	0.50	2.000
15	0.43	2.326
20	0.36	2.778
25	0.31	3.226
30	0.28	3.571

(c) Plot R vs 1/I



(d)

(i) Slope = internal resistance r
Using (1.667, 5) and (3.571, 30):
r = (30 - 5) / (3.571 - 1.667) = 25 / 1.904 = 13.13 Ω

(ii) E = slope × I + IR
Use point: R = 10, I = 0.50, 1/I = 2.0
E = R + r = 10 + 13.13 = 23.13 V

(iii) Value of R when 1/I = 0 (infinite current)
Intercept gives e.m.f.

(e) Sources of error:
- Fluctuation in current
- Contact resistance