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: 2001**

Instructions

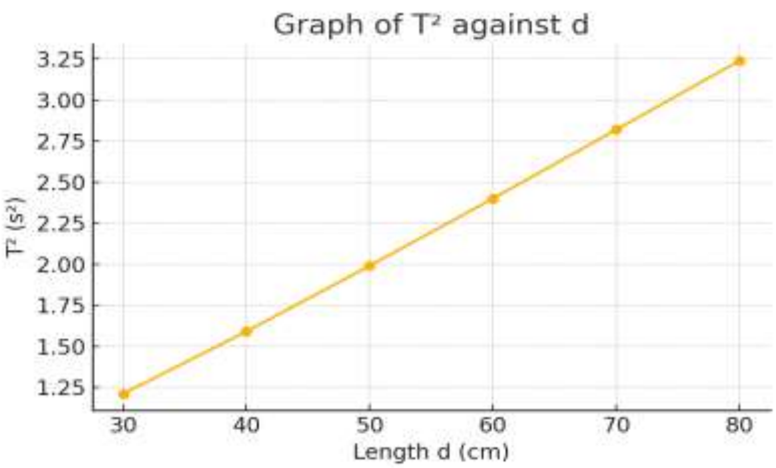
1. This paper consists of two questions.
2. Answer all questions.

1. The aim of this experiment is to determine the acceleration (g) due to gravity.

(d) Tabulate your results:

d (cm)	T (s)	T^2 (s^2)
30	1.10	1.21
40	1.26	1.59
50	1.41	1.99
60	1.55	2.40
70	1.68	2.82
80	1.80	3.24

(e) Plot the graph of T^2 against d



(i) Slope = $\Delta T^2 / \Delta d$ = (3.24 - 1.21) / (80 - 30) = 2.03 / 50 = 0.0406 s^2/cm
Convert to s^2/m: G = 0.0406 × 100 = 4.06 s^2/m

(ii) Y-intercept ≈ 0 (since T^2 passes through near origin)

(iii) The intercept on y-axis represents the square of the time due to small amplitude offset (negligible here)

(iv) From $T^2 = (4\pi^2/g)d + 4\pi^2H/g$
Compare with $T^2 = Gd + C$, then
$G = 4\pi^2 / g$
$g = 4\pi^2 / G = 39.48 / 4.06 \approx 9.73$ m/s^2

(f) Sources of error:
- Human reaction time during timing
- Air resistance

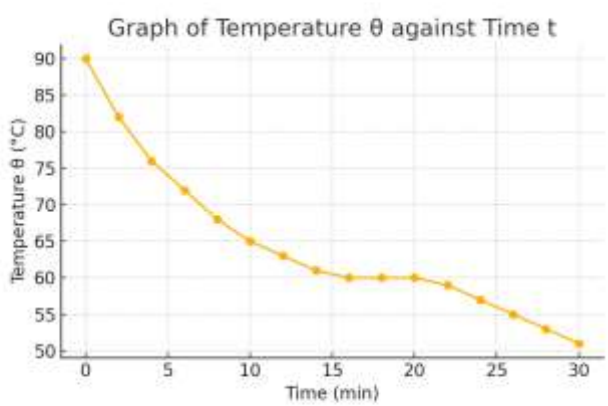
- Friction at the point of suspension

2. The aim of this experiment is to determine the melting point of a powdered substance N

Record cooling:

Time (min)	θ (°C)
0	90
2	82
4	76
6	72
8	68
10	65
12	63
14	61
16	60
18	60
20	60
22	59
24	57
26	55
28	53
30	51

(a) Plot θ against t



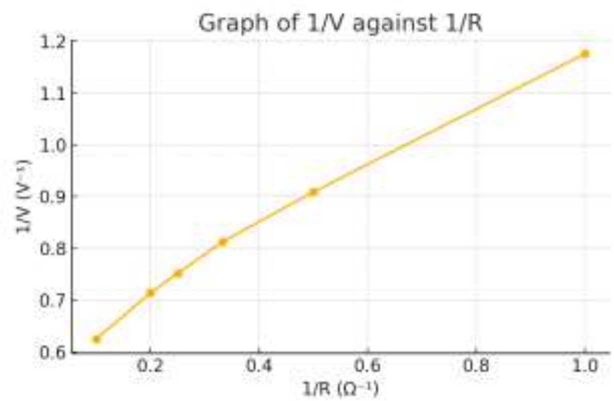
(b) Melting point is the flat region of temperature: ≈ 60°C
(c) The substance is likely naphthalene (melting point ≈ 60°C)

3. You are provided with dry cell(s) C, a resistance box R, a voltmeter V, a switch S and connecting wires. Arrange the apparatus as shown in the diagram.

(iii) Tabulate your observations:

R (Ω)	V (V)	1/V (V^{-1})	1/R (Ω^{-1})
1	0.85	1.176	1.000
2	1.10	0.909	0.500
3	1.23	0.813	0.333
4	1.33	0.752	0.250
5	1.40	0.714	0.200
10	1.60	0.625	0.100

(a) Plot a graph of 1/V against 1/R



(b) From the graph:

(i) When 1/R = 0, extrapolate to find 1/V = N = 0.560
So 1/N = 1 / 0.560 ≈ 1.786 V

(ii) When 1/V = 0, extrapolate to find 1/R = M = 1.080
So 1/M = 1 / 1.080 ≈ 0.926 Ω

(c) From the equation:

$1/V = (1/E) + (r/E)(1/R)$
This is of the form $y = c + mx$, where slope $G = r/E$
Then,
$N = 1/V$ at $1/R = 0 \rightarrow N = 1/E$
$M = 1/R$ at $1/V = 0 \rightarrow M = E/r$

So,
$N/M = (1/E) / (E/r) = r / E^2$
But slope $G = r/E = N/M \times E$

(d) (i) Current supplied by cell is $I = E / (R + r)$
Using $R = 1\ \Omega$ and $E \approx 1.786$ V, $r \approx 0.926\ \Omega$
$I = 1.786 / (1 + 0.926) \approx 0.928$ A

(ii)
$1/N = E$ = emf of the cell
$1/M = r$ = internal resistance of the cell