

**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.

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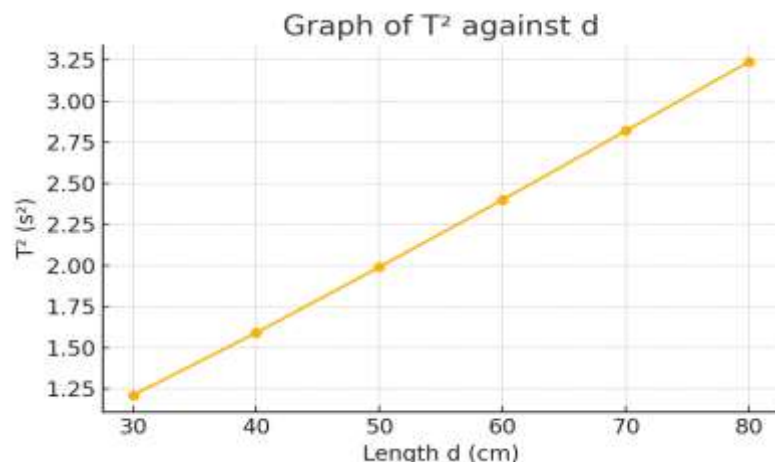


1. The aim of this experiment is to determine the acceleration (g) due to gravity.

(d) Tabulate your results:

| d (cm) | T (s) | T <sup>2</sup> (s <sup>2</sup> ) |
|--------|-------|----------------------------------|
| 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<sup>2</sup> against d



(i) Slope =  $\Delta T^2 / \Delta d = (3.24 - 1.21) / (80 - 30) = 2.03 / 50 = 0.0406 \text{ s}^2/\text{cm}$

Convert to s<sup>2</sup>/m:  $G = 0.0406 \times 100 = 4.06 \text{ s}^2/\text{m}$

(ii) Y-intercept  $\approx 0$  (since T<sup>2</sup> 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

$$G = 4\pi^2 / g$$

$$g = 4\pi^2 / G = 39.48 / 4.06 \approx 9.73 \text{ m/s}^2$$

(f) Sources of error:

- Human reaction time during timing
- Air resistance

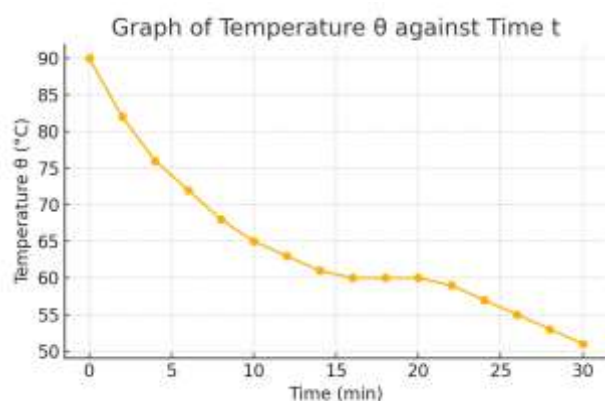
- Friction at the point of suspension

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

Record cooling:

| Time (min) | $\theta$ ( $^{\circ}\text{C}$ ) |
|------------|---------------------------------|
| 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  $\theta$  against  $t$



(b) Melting point is the flat region of temperature:  $\approx 60^{\circ}\text{C}$

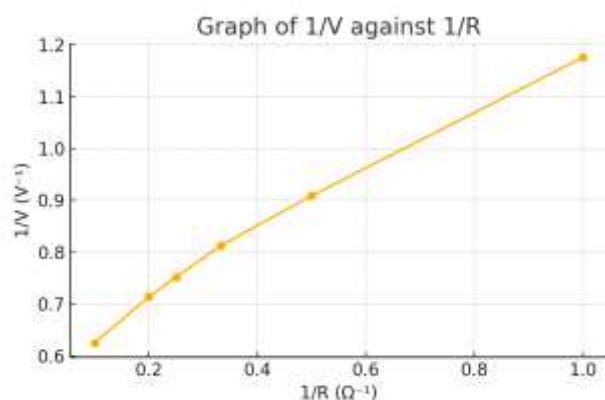
(c) The substance is likely naphthalene (melting point  $\approx 60^{\circ}\text{C}$ )

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:

| $R (\Omega)$ | $V (V)$ | $1/V (V^{-1})$ | $1/R (\Omega^{-1})$ |
|--------------|---------|----------------|---------------------|
| 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  $1/N = 1 / 0.560 \approx 1.786 \text{ V}$

(ii) When  $1/V = 0$ , extrapolate to find  $1/R = M = 1.080$

So  $1/M = 1 / 1.080 \approx 0.926 \Omega$

(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,

$$N = 1/V \text{ at } 1/R = 0 \rightarrow N = 1/E$$

$$M = 1/R \text{ at } 1/V = 0 \rightarrow M = E/r$$

So,

$$N/M = (1/E) / (E/r) = r / E^2$$

$$\text{But slope } G = r/E = N/M \times E$$

(d) (i) Current supplied by cell is  $I = E / (R + r)$

Using  $R = 1 \, \Omega$  and  $E \approx 1.786 \, \text{V}$ ,  $r \approx 0.926 \, \Omega$

$$I = 1.786 / (1 + 0.926) \approx 0.928 \, \text{A}$$

(ii)

$1/N = E = \text{emf of the cell}$

$1/M = r = \text{internal resistance of the cell}$