**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: 2011**

**Instructions**

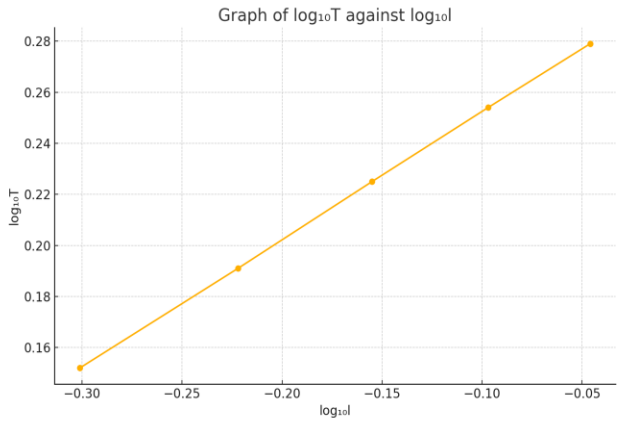
1. This paper consists of THREE questions.

2. Answer all questions.

(a) Tabulate your results:

| l (m) | T (s) | $T^2$ ($s^2$) | $\log_{10}l$ | $\log_{10}T$ |
|---|---|---|---|---|
| 0.50 | 1.419 | 2.012 | -0.301 | 0.152 |
| 0.60 | 1.554 | 2.415 | -0.222 | 0.191 |
| 0.70 | 1.678 | 2.817 | -0.155 | 0.225 |
| 0.80 | 1.794 | 3.219 | -0.097 | 0.254 |
| 0.90 | 1.903 | 3.622 | -0.046 | 0.279 |

(b) Plot a graph of $\log_{10}T$ against $\log_{10}l$.




Using two points: (-0.301, 0.152) and (-0.046, 0.279)
Slope S = (0.279 − 0.152) / (-0.046 − (-0.301)) = 0.127 / 0.255 = 0.498

(c) Use the relation $\log_{10}T = \frac{1}{2}\log_{10}l + \frac{1}{2}\log_{10}(2\pi^2/g)$,
So, S = 0.5. Since our slope is 0.498, this confirms the equation.
Using intercept $K = \log_{10}(2\pi^2/g) / 2$
Let's use the first point:
$0.152 = 0.5(-0.301) + 0.5\log_{10}(2\pi^2/g)$
$0.152 + 0.1505 = 0.5\log_{10}(2\pi^2/g)$
$0.3025 = 0.5\log_{10}(2\pi^2/g)$
$\log_{10}(2\pi^2/g) = 0.605$
10^0.605 = 4.027
$2\pi^2/g = 4.027$
$g = 2\pi^2 / 4.027 = 6.283^2 / 4.027 = 39.48 / 4.027 = 9.81\ m/s^2$

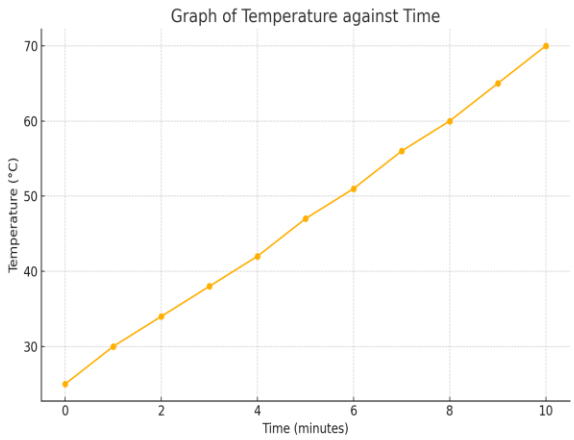
(d) State two sources of errors.
Inaccurate length measurement due to slanted thread.
Parallax error when reading stopwatch.

2. The aim of this experiment is to determine the thermal conductivity, K, of the rubber tubing.

(a) Tabulate your observations:

| Time (min) | Temperature (°C) |
|---|---|
| 0 | 25 |
| 1 | 30 |
| 2 | 34 |
| 3 | 38 |
| 4 | 42 |
| 5 | 47 |
| 6 | 51 |
| 7 | 56 |
| 8 | 60 |
| 9 | 65 |
| 10 | 70 |

(b) Plot a graph of temperature against time.
Straight line with slight curve due to heat loss.




(c)(i) From the graph, slope = $\Delta\theta / \Delta t = (70 - 51) / (10 - 6) = 19 / 4 = 4.75$ °C/min

(ii) Thermal conductivity K is proportional to rate of temperature rise. If calibration constant is known, K can be calculated. Otherwise, slope shows rate of heat flow.

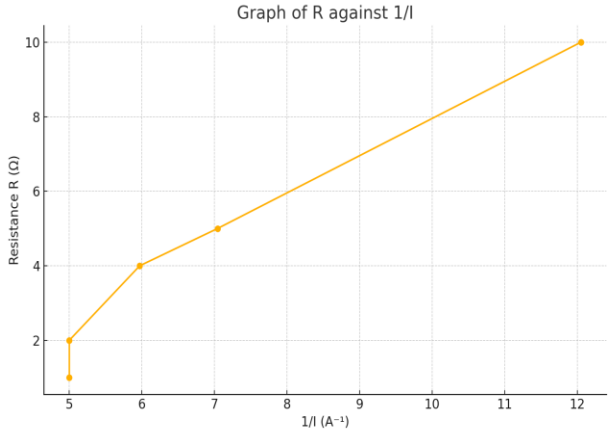
(d) Sources of error.
Heat loss to the surroundings.
Uneven stirring or inconsistent steam flow.

3. You are required to determine the internal resistance r of an ammeter and e.m.f E of the cell.

(c) Tabulate your results:

| R (Ω) | V (V) | I (A) | 1/I ($A^{-1}$) |
|---|---|---|---|
| 1 | 0.20 | 0.200 | 5.000 |
| 2 | 0.40 | 0.200 | 5.000 |
| 4 | 0.67 | 0.168 | 5.970 |
| 5 | 0.71 | 0.142 | 7.042 |
| 10 | 0.83 | 0.083 | 12.048 |

(d) Plot a graph of R against 1/I.




Use two points: (5.000, 1) and (12.048, 10)
Slope = ΔR / Δ(1/I) = (10 − 1) / (12.048 − 5.000) = 9 / 7.048 = 1.276
Intercept = R − S × 1/I = 1 − (1.276 × 5.000) = 1 − 6.38 = −5.38
Since intercept = −r, internal resistance r = 5.38 Ω
E = slope = 1.276 V

(e) (i) S = 1.276
(ii) When 1/I = 0, R = −intercept = 5.38 Ω

(f) How is r related to S?
r = −intercept of the graph R vs 1/I

(g) Two sources of error.
Voltmeter or ammeter calibration inaccuracy.
Internal heating of resistor during experiment.