THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

131/3C **PHYSICS 3C**

(ACTUAL PRACTICAL C)

(For Both School and Private Candidates)

Time: 3 Hours 20 Minutes **ANSWERS** **Year : 2022**

Instructions

1. This paper consists of three (3) questions.
2. Answer all questions
3. Non-programmable calculators may be used.
4. Communication devices and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

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1. You are provided with a wire W. After setting up the spring system:

(i) Tabulate results for load F and extension e. Suppose experimental values were:

Mass (g)	Load F (N)	Extension e (m)
10	0.10	0.002
20	0.20	0.004
30	0.30	0.006
40	0.40	0.008
50	0.50	0.010

(ii) Graph of extension e against load F is a straight line.

(iii) Relationship: Extension is directly proportional to load (Hooke's law).

(iv) Slope $K = \Delta F / \Delta e = 0.50 / 0.010 = 50$ N/m.

(v) Using formula $K = (\pi \rho d^4)/(4L)$, rearrange: $\rho = (4LK)/(\pi d^2)$.

Suppose L = 0.20 m, diameter d = 0.0005 m.

$\rho = (4 \times 0.20 \times 50) / (3.14 \times (0.0005)^2)$.

$= (40) / (7.85 \times 10^{-7})$.

$= 5.10 \times 10^7$ N/m².

(vi) This value represents the **Young's modulus (rigidity modulus)** of the wire material.

2. Cooling experiment with calorimeter.

(i) Tabulate results (example):

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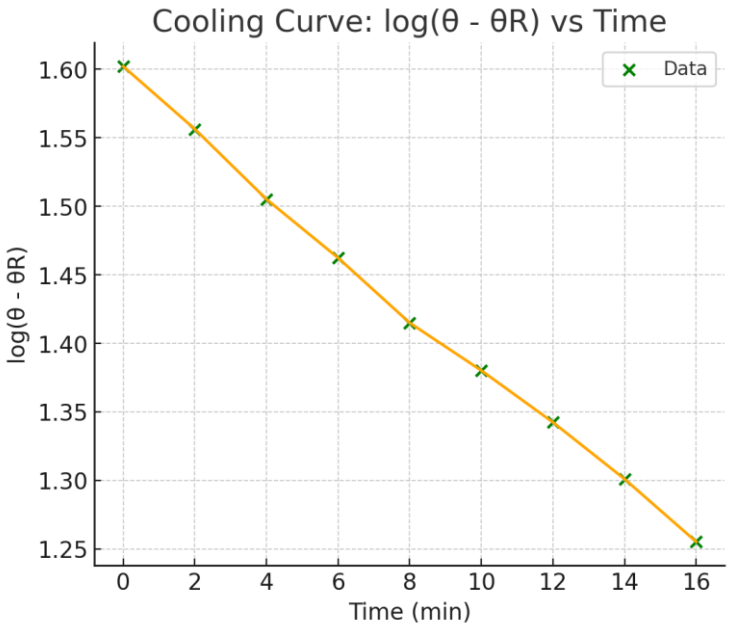
Time (min)	Temp θ (°C)	(θ – θR)	log(θ – θR)
0	65	40	1.60
2	61	36	1.56
4	57	32	1.51
6	54	29	1.46
8	51	26	1.41
10	49	24	1.38
12	47	22	1.34
14	45	20	1.30
16	43	18	1.26

(Room temperature θR = 25 °C).

(ii) Graph of log(θ – θR) against time is a straight line with negative slope.



(iii) Slope represents the cooling constant, related to heat loss rate in pipes from heater to bathroom outlets.

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(iv) From equation $\log(65 - \theta S) = -1/C$, the intercept C gives θS (surrounding temperature). Suppose intercept corresponds to $\log(65 - \theta S) = 1.30$.

$65 - \theta S = 20$.

$\theta S = 45\ °C$.

(v) Conclusion: Room temperature $\theta R = 25\ °C$, surrounding $\theta S = 45\ °C$. Since $\theta S > \theta R$, this indicates heating influence of solar heater and pipes raising effective surroundings temperature.

3. Meter bridge with aluminium foil.

(i) Circuit diagram: Standard Wheatstone bridge with foil in one arm, resistance box in other, battery, galvanometer, jockey.

(ii) Suppose values recorded:

R (Ω)	Balance length L (cm)	1/L (cm^{-1})
5	40	0.025
4	44	0.023
3	50	0.020
2	60	0.017
1	75	0.013

(iii) Governing relation: $(1/L) = (1/m)(1/R) + (1/b)$, where m and b constants.

(iv) Graph of 1/L against R gives straight line.

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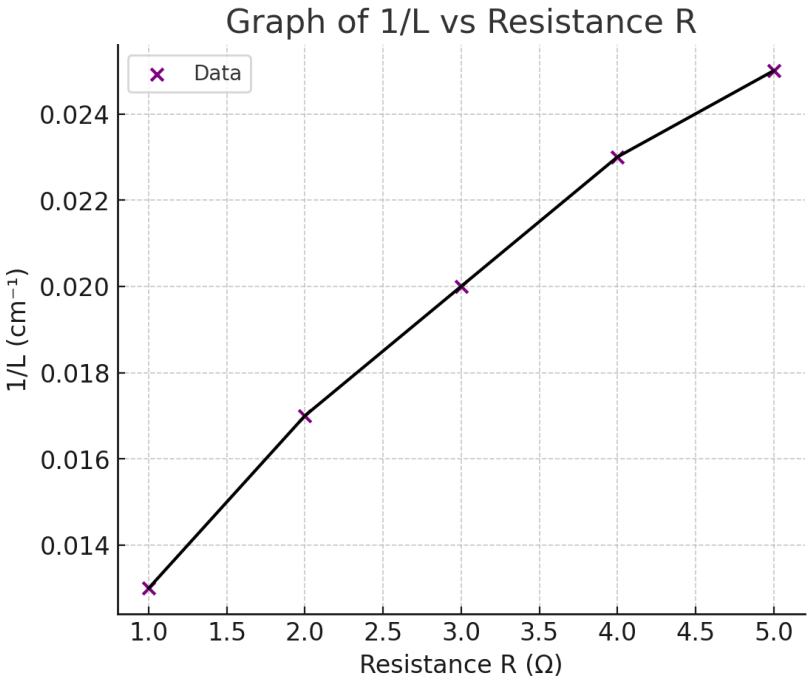

(v) Gradient = $\Delta(1/L)/\Delta R$.

Using (R=5, 1/L=0.025) and

(R=1, 1/L=0.013): slope = (0.025 – 0.013)/(5 – 1)

= 0.012/4

= 0.003 cm^{-1}/Ω.

(vi) Resistance of large electrode:

From scaling, sheet area A = 30 m^2,

resistivity of aluminium $\rho \approx 2.8\times10^{-8}$ Ωm,

thickness t ≈ 0.002 m.

R = $\rho L/A$.

For equivalent sheet, $R \approx 2.8\times10^{-8} \times 2 / 30 \approx 1.9\times10^{-9}$ Ω (very small).

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