THE UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT
NJOMBE REGION

FORM SIX PRE-NECTA EXAMINATION-MARCH 2024

131/3B

PHYSICS 3B

(PRACTICAL A)

PROPOSED MARKING SCHEME

1. (a) RESULTS:

Number of oscillations (n) = 20 oscillation

L (cm)	t_1 (s)	T_1 (s)	T_1^2 (s^2)
100	40.01	2.00	4.00

(0/mark)

X (cm)	t_2 (s)	T_2 (s)	T_2^2 (s^2)	$T_1^2 - T_2^2$ (s^2)
10	37.90	1.895	3.591	0.409
20	35.83	1.792	3.211	0.789
30	33.48	1.674	2.802	1.198
40	31.12	1.556	2.421	1.579
50	28.35	1.417	2.008	1.992

(05 marks)

(c) Slope(m):

From the graph, Consider points A(12.5, 0.5) & B(25, 1.0)

$$\text{Slope}(m) = \frac{\Delta(T_1^2 - T_2^2)}{\Delta X}$$ (00/2 mark)

$$\text{Slope}(m) = \frac{1 - 0.5}{25 - 12.5}$$ (00/2 mark)

$$\text{Slope}(m) = 0.04\ s^2/cm \quad \text{---- (i)}$$ (0/mark)

(d) $T_1^2 - T_2^2$ Relate X:

From $T = 2\pi\sqrt{l/g}$. (00/2 mark)

When $L = 100(cm) = 1m$

$$T_1 = 2\pi\sqrt{1/g}$$

$$T_1^2 = \frac{4\pi^2}{g} \quad \text{---- (ii)}$$

$$T_1^2 = \frac{4\pi^2}{g}$$ (00/2 mark)

When $L=(1-X)$

$$T_2 = 2\pi\sqrt{\frac{1-X}{g}}$$ (0.01/2 mark)

$$T_2^2 = \frac{4\pi^2(1-X)}{g}$$

$$T_2^2 = \frac{4\pi^2}{g} - \frac{4\pi^2 X}{g} \quad \text{---(iii)}$$ (0.01/2 mark)

Subtract eqn (iii) from (ii)

$$T_1^2 = \frac{4\pi^2}{g}, \quad T_2^2 = \frac{4\pi^2}{g} - \frac{4\pi^2 X}{g}$$ (0.01/2 mark)

$$T_1^2 - T_2^2 = \frac{4\pi^2}{g} - \frac{4\pi^2}{g} + \frac{4\pi^2 X}{g}$$

$$(T_1^2 - T_2^2) = \frac{4\pi^2 X}{g}$$

$$(T_1^2 - T_2^2) = \frac{4\pi^2 X}{g} \quad \text{---(iv)}$$ (0.01/2 mark)

(e) Acceleration due to gravity (g)

From eqn (i) & (iv)

$$\text{Slope}(m) = \frac{4\pi^2}{g}$$ (0.01/2 mark)

$$g = \frac{4\pi^2}{\text{Slope}(m)}$$

$$g = \frac{4\pi^2}{0.04}$$

$$g = 986.96\ cm/s^2$$

$$g = 9.87\ m/s^2$$ (0.01/2 mark)

Acceleration due to gravity (g) $= 9.87\ m/s^2$

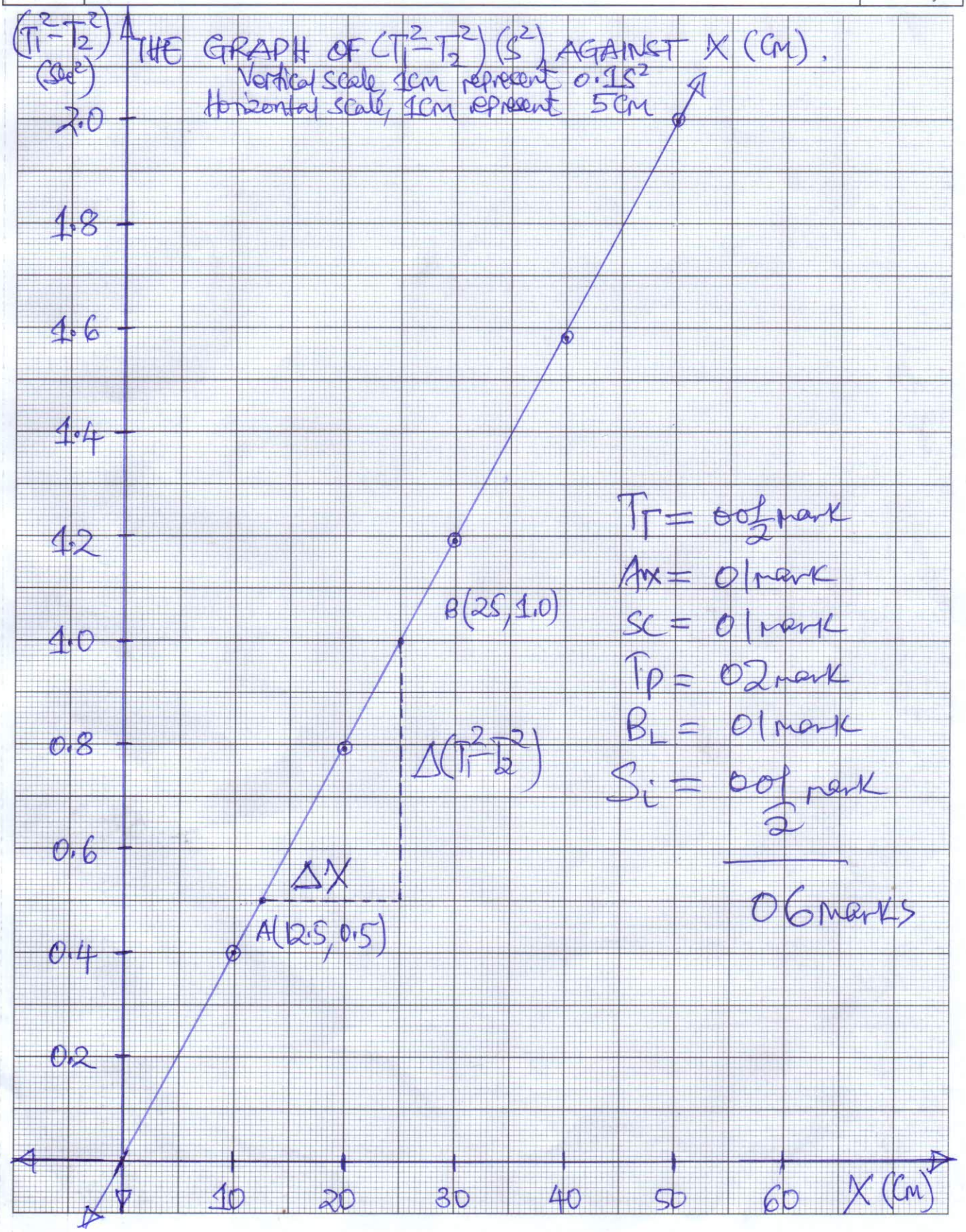
(F) Aim of experiment is Determination of Acceleration due to gravity (g) (0.1 mark)

(g) Sources of error:

(i) Air resistance (0.01/2 mark)

(ii) Tire reaction (0.01/2 mark)

SUBJECT NAME.....



TT = 00 1/2 mark
Ax = 0 1 mark
SC = 0 1 mark
TP = 02 mark
BL = 01 mark
Si = 00 1/2 mark

06 marks

2. Room Temperature (t_o) = 22°C (00½ mark)
Temperature of water in a Beaker (θ_w) = 20°C (00½ mark)

(a)

Time (min)	0	2	4	6	8	10	12	14	16	18	20
Temperature θ(°C)	20	37	58	78	94	96	96	96	96	96	96

(05 marks)

(b) Comments on t_o and θ_w:-
$t_o > \theta_w$, so they are NOT the same (00½ mark)

Reason:
(i) Heat capacities: water has large heat capacity compared to air, so more energy is needed to heat up water than air. Now they are subjected to the same heating. Air must have higher temperature than water ($\theta_w < t_o$).

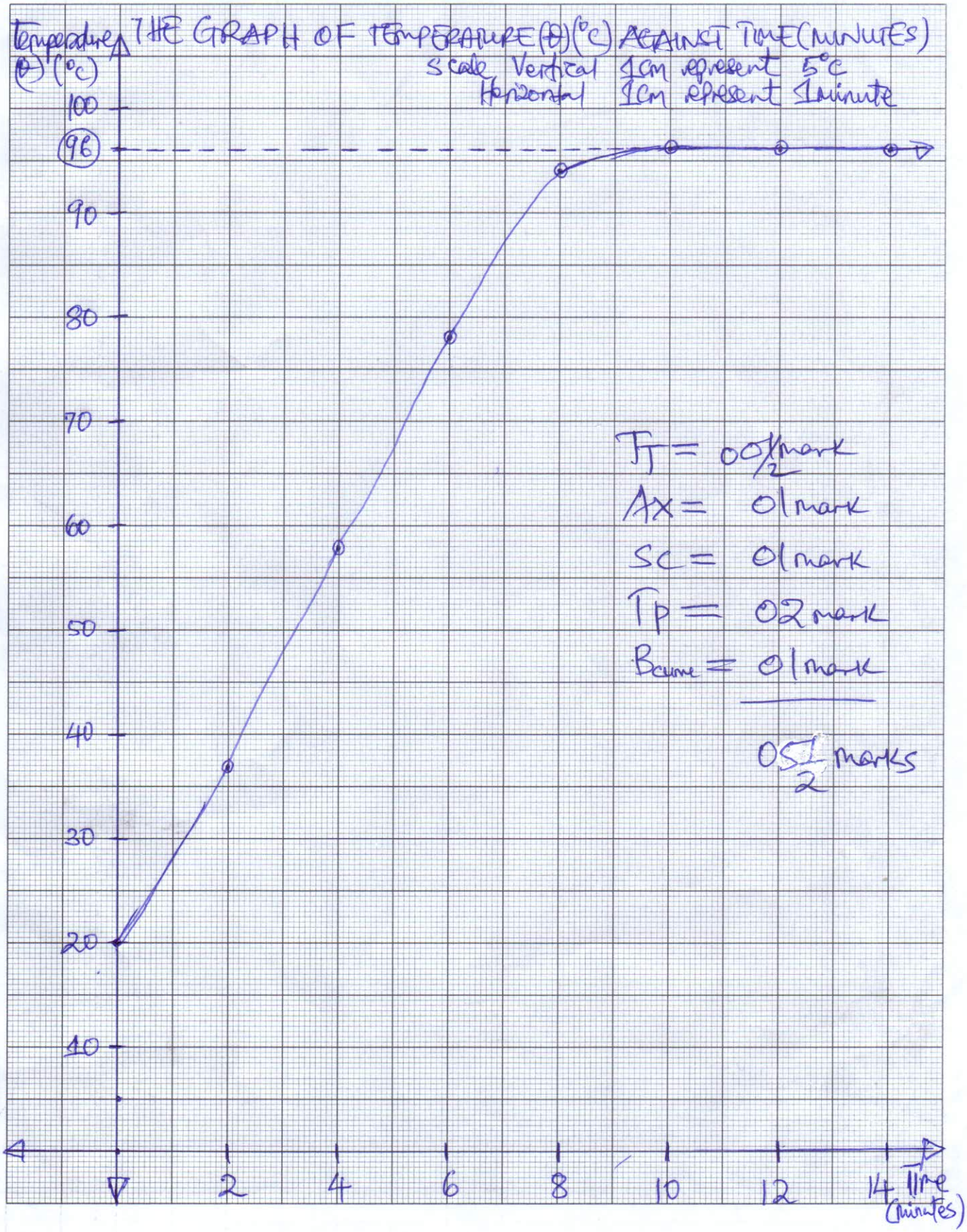
(ii) Evaporation that takes place in water reduces its temperature compared to that of air temperature ($\theta_w < t_o$). (00½ mark)

(c) The Nature of the graph is curve, and at Boiling of water [96°C], no more increase in temperature as Time increases. (00½ mark)

(d) The maximum temperature was expected to be 100°C (Theoretical boiling point water) But instead it is 96°C,
Reason:
The Boiling point of water depends on atmospheric pressure, At high altitude, water boils below 100°C of Low atmospheric pressure, that is, it boils at 96°C (harder for water to Boil, the partial pressure must be equal to atmospheric pressure) (01 mark)

(e) Aim - Determination of Boiling point of water at high altitude
OR
- Determination of rate of rise in temperature of water.
(01 mark)

	SUBJECT NAME.....	



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(a) RESULTS:

Length (L_x) (m)	I (A)	$\frac{1}{I}$ (A^{-1})
0.2	0.55	1.82
0.4	0.45	2.2
0.6	0.35	2.9
0.8	0.30	3.3
1	0.25	4

(05marks)

(c) From the graph, consider points A(0.27,2) & B(0.7,3.17)

$$\text{Slope}(m) = \frac{\Delta \frac{1}{I}}{\Delta L_x}$$

$$\text{Slope}(m) = \frac{3.17-2}{0.7-0.27}$$

$$\text{Slope}(m) = 2.7\ A^{-1}/m \quad \text{---(i)} \qquad (00\tfrac{1}{2}\text{mark})$$

$\frac{1}{I}$-intercept (From the graph)

$\frac{1}{I}$-intercept $= 1.25\ A^{-1}$ —(ii) $\qquad (00\tfrac{1}{2}\text{mark})$

(d) Diameter of the wire provided (d) $= 0.28\text{mm} = 0.28\times10^{-3}\text{m}$. $\qquad (00\tfrac{1}{2}\text{mark})$

(e) From circuit diagram provided:-

short theory: $E = Ir + IR + IR_s$ $\qquad (00\tfrac{1}{2}\text{mark})$

Required $\frac{1}{I}$ against L_s

$E = I(r+R+R_s)$ but $R=2\Omega$

$E = I(R_s+(2+r))$.

$$\frac{E}{I} = R_x + (2+r)$$

$$\frac{1}{I} = \frac{R_x}{E} + \frac{(2+r)}{E}, \text{ but } R_x = \frac{\rho L_x}{A}$$

$$\frac{1}{I} = \left(\frac{\rho}{AE}\right) L_x + \left(\frac{2+r}{E}\right)$$

$$\frac{1}{I} = \left(\frac{\rho}{AE}\right) L_x + \left(\frac{2+r}{E}\right) \quad \text{——(iii)} \quad (00\tfrac{1}{2}\text{ mark})$$

Compare eqn (i) & (iii)

$$\text{Slope}(m) = \frac{\rho}{AE} \quad \text{but } E = 3V, \text{ given.}$$

$$\text{Resistivity}(\rho) = \text{Slope}(m) \times A \times E$$

$$\rho = 2.7 \times 3 \times \frac{\pi(0.28\times10^{-3})}{4}$$

$$\rho = 4.99\times10^{-7}\ \Omega m.$$

∴ Resistivity is $4.99\times10^{-7}\ \Omega m$ / $49.9\times10^{-8}\ \Omega m$. (00½ mark)

Compare eqn (ii) & (iii)

$$\frac{1}{I} \text{ intercept} = \frac{2+r}{E}$$

$$1.25 = \frac{2+r}{E} \quad \text{but } E = 3V$$

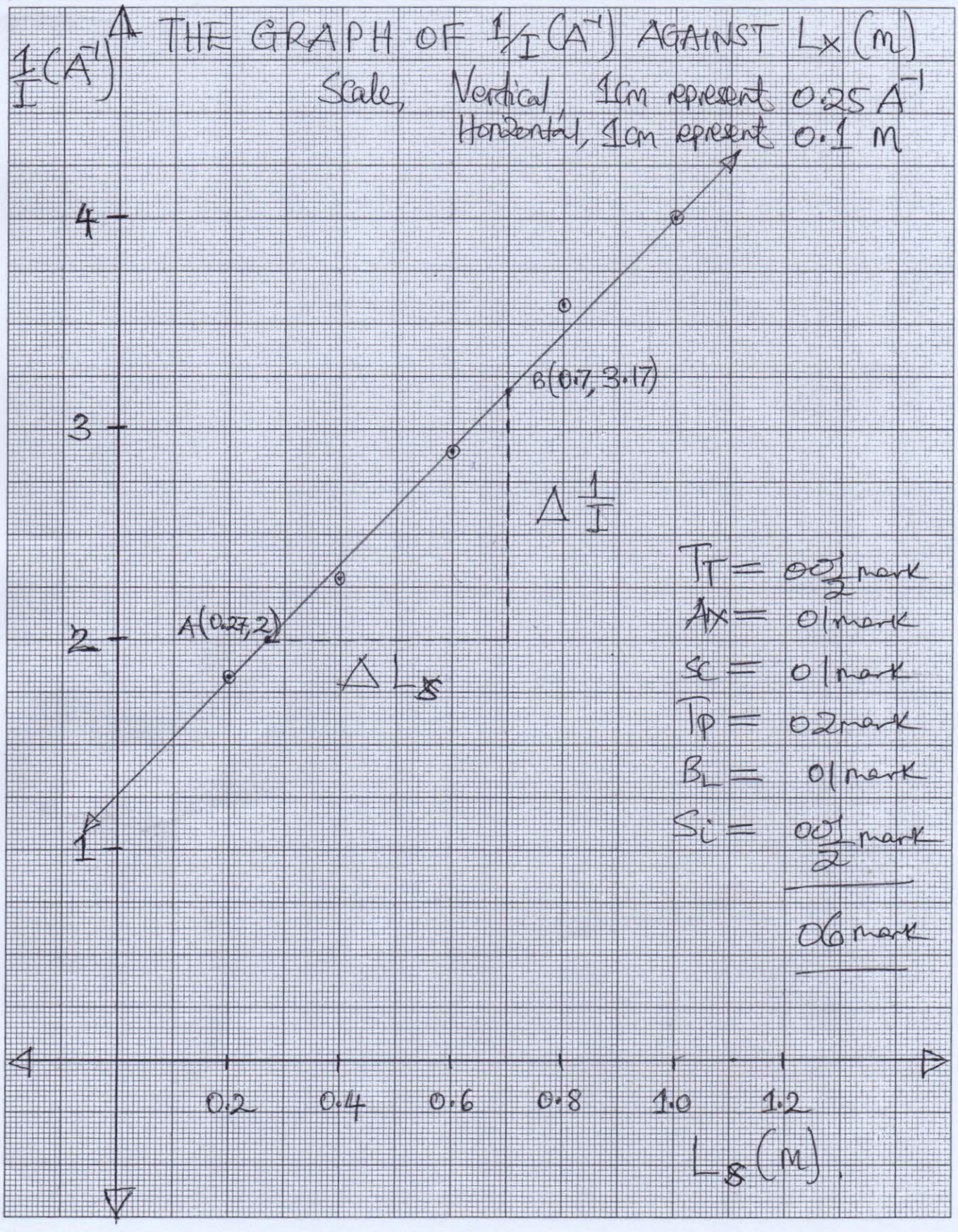
$$(1.25\times3) = 2+r$$

$$r = (1.25\times3) - 2$$

$$r = 1.75\Omega.$$

∴ The internal resistance of the battery $(r) = 1.75\Omega$ (00½ mark)

(f) The aim of experiment was to determine the resistivity of the wire provided and the internal resistance of the battery. (00½ mark)


THE GRAPH OF 1/I (A⁻¹) AGAINST Lx (m)
Scale, Vertical 1cm represent 0.25 A⁻¹
Horizontal, 1cm represent 0.1 m
1/I (A⁻¹)
4
3
2
1
B(0.7, 3.17)
A(0.27, 2)
Δ 1/I
Δ L_S
0.2
0.4
0.6
0.8
1.0
1.2
L_S (m)
T_T = 0½ mark
A_X = 0 mark
S_C = 0 mark
T_D = 02 mark
B_L = 0 mark
S_i = 0½ mark
06 mark