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

FORM SIX PRE-NECTA EXAMINATION-MARCH 2024

131/3A

PHYSICS 3A

(PRACTICAL A)

PROPOSED MARKING SCHEME

(a) RESULTS:

1. Number of oscillations (n) = 20 oscillations.

L(m)	t(s)	T(s)	$T^2(s^2)$
1	40.09	2.005	4.020
0.9	38.10	1.905	3.629
0.8	35.90	1.795	3.222
0.7	33.61	1.681	2.826
0.6	31.11	1.556	2.421

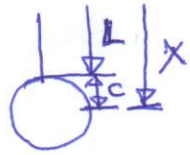
(05 marks)

(b) From: The Period of Pendulum.

Required L(m) against $T^2(s^2)$

But $T = 2\pi\sqrt{\frac{x}{g}}$ Where x is pendulum length

$x = L + c$, where c is Constant (00½ mark)



(00½ mark)

$$T = 2\pi\sqrt{\frac{L+c}{g}}$$

$$T^2 = 4\pi^2\left(\frac{L+c}{g}\right)$$

$$T^2 g = 4\pi^2(L+c)$$

$$L + c = \frac{T^2 g}{4\pi^2}$$ (00½ mark)

$$L = \frac{T^2 g}{4\pi^2} - c$$

$$L = \left(\frac{g}{4\pi^2}\right)T^2 - c \quad \text{——(i)}$$ (00½ mark)

(d) Slope(m):

From the graph, Consider points A(0.6, 0.15) & B(2.6, 0.65)

$$\text{Slope}(m) = \frac{\Delta L}{\Delta T^2} \qquad (00\tfrac{1}{2}\text{ mark})$$

$$\text{Slope}(m) = \frac{0.65 - 0.15}{2.6 - 0.6} \qquad (00\tfrac{1}{2}\text{ mark})$$

$$\text{Slope}(m) = 0.25\ m/s^2 \quad \text{---(ii)} \qquad (01\text{ marks})$$

(e) From equation (i) & (ii)

$$\text{Slope}(m) = \frac{g}{4\pi^2} \qquad (00\tfrac{1}{2}\text{ mark})$$

$$g = 4\pi^2 \times \text{Slope}(m) \qquad (00\tfrac{1}{2}\text{ mark})$$

$$g = 4\pi^2 \times 0.25$$

$$g = 9.87\ m/s^2 \qquad (01\text{ mark})$$

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

(f) Y-intercept (L-Intercept) $= 0.01m$ ---(iii) $(00\tfrac{1}{2}\text{ mark})$

From equation (i) & (iii)

$$\text{L-intercept}(c) = 0.01m$$

$$c = 0.01m$$

(it depends on the Bob used)

Physical meaning of c is Radius of Bob $(00\tfrac{1}{2}\text{ mark})$

(g) Two possible aim of this experiment:-

(i) Determination of acceleration due gravity (g) $(00\tfrac{1}{2}\text{ mark})$

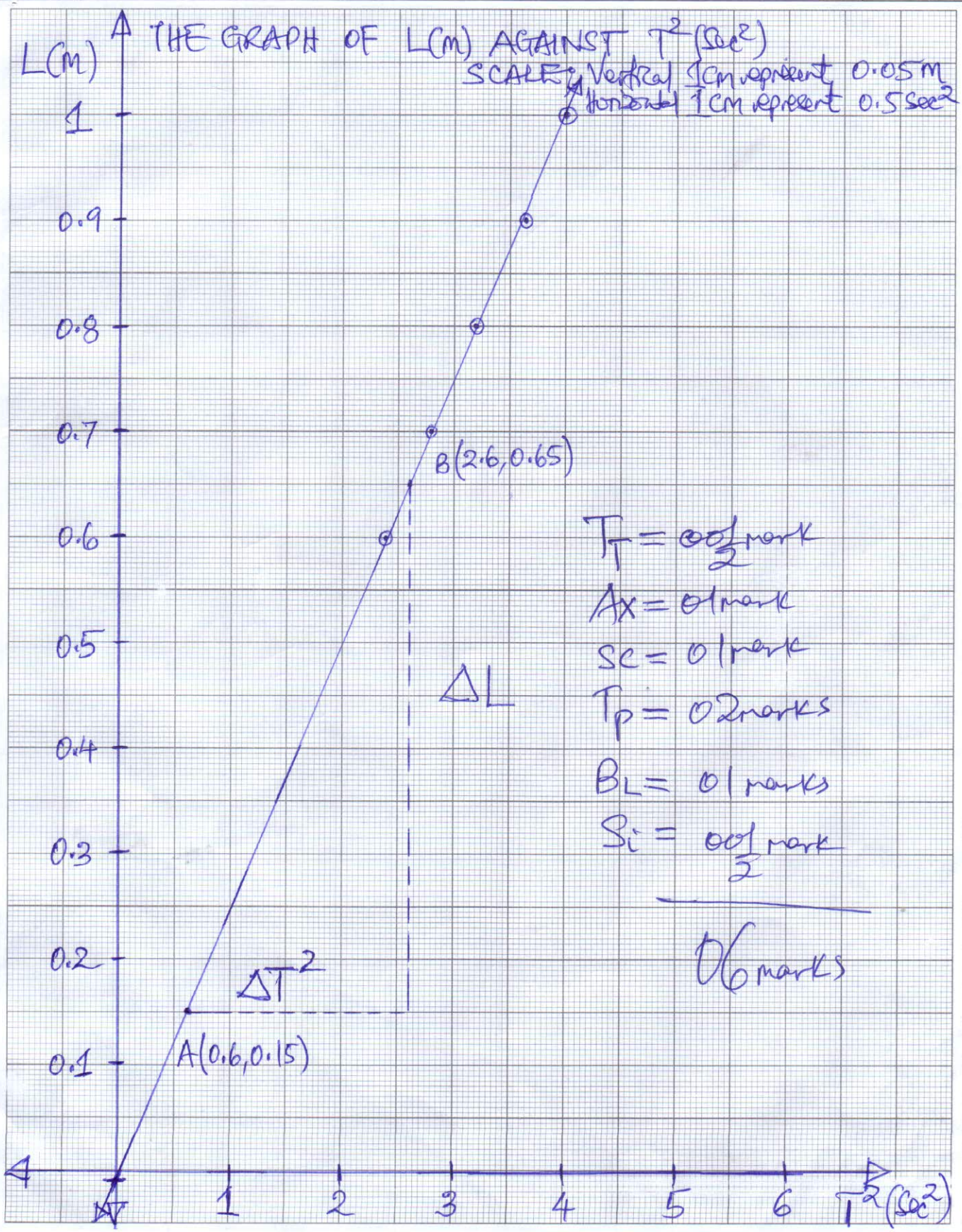
(ii) Determination of Radius of Bob. $(00\tfrac{1}{2}\text{ mark})$

(h) possible Sources of errors:

(i) Air resistance $(00\tfrac{1}{2}\text{ mark})$

(ii) Time reaction $(00\tfrac{1}{2}\text{ mark})$

SUBJECT NAME.....



T_T = 00½ mark

Δx = 01 mark

Sc = 01 mark

T_P = 02 marks

B_L = 01 marks

S_i = 00½ mark

06 marks

2 initial temperature (θ_{si}) = 22°C

Final temperature (θ_{sf}) = 23°C

Room temperature (θ_s) = $\frac{22°C+23°C}{2}$ = 22.5°C

(a) RESULTS: (0½ mark)

Time (minute)	0	2	4	6	8	10	12	14	16	18	20
θ (°C)	80	75	70	66	63	60	58	55	53	51	49
$(\theta-\theta_s)$ (°C)	57.5	52.5	47.5	43.5	40.5	37.5	35.5	32.5	30.5	28.5	26.5
$\log(\theta-\theta_s)$	1.7597	1.7202	1.6767	1.6385	1.6075	1.5740	1.5502	1.5119	1.4843	1.4548	1.4232

(05 marks)

(b) The graph plotted on graph paper.

(c) Given $A = \log_{10}(\theta-\theta_s) \neq kt$

Required $\log_{10}(\theta-\theta_s)$ Vs time(t).

$$\log_{10}(\theta-\theta_s) = -kt + A$$

$$\log_{10}(\theta-\theta_s) = -kt + A \quad \text{---(i)} \qquad (0\tfrac{1}{2}\text{ mark})$$

From the graph, Consider points A(26.6, 1.3), & B(15, 1.5)

$$\text{Slope}(m) = \frac{\Delta \log(\theta-\theta_s)}{\Delta \text{time}(t)}$$

$$\text{Slope}(m) = \frac{1.5-1.3}{15-26.6}$$

$$\text{Slope}(m) = -0.0172$$

$$\text{Slope}(m) = -0.02\ \text{min}^{-1} \quad \text{---(ii)} \qquad (0\tfrac{1}{2}\text{ mark})$$

Compare eqn (i) & (ii)

$$\text{Slope}(m) = -K$$

$$-0.02 = -K$$

$$K = 0.02\ min^{-1}$$

$$K = 0.02\ min^{-1}$$ (00½ mark)

From the graph:

$$y\text{-intercept}(\log_{10}(\theta - \theta_s)) = 1.76 \quad \text{---(iii)}$$

Compare (i) & (iii)

$$\log_{10}(\theta - \theta_s) \text{ intercept} = A$$

$$1.76 = A$$

$$A = 1.76$$

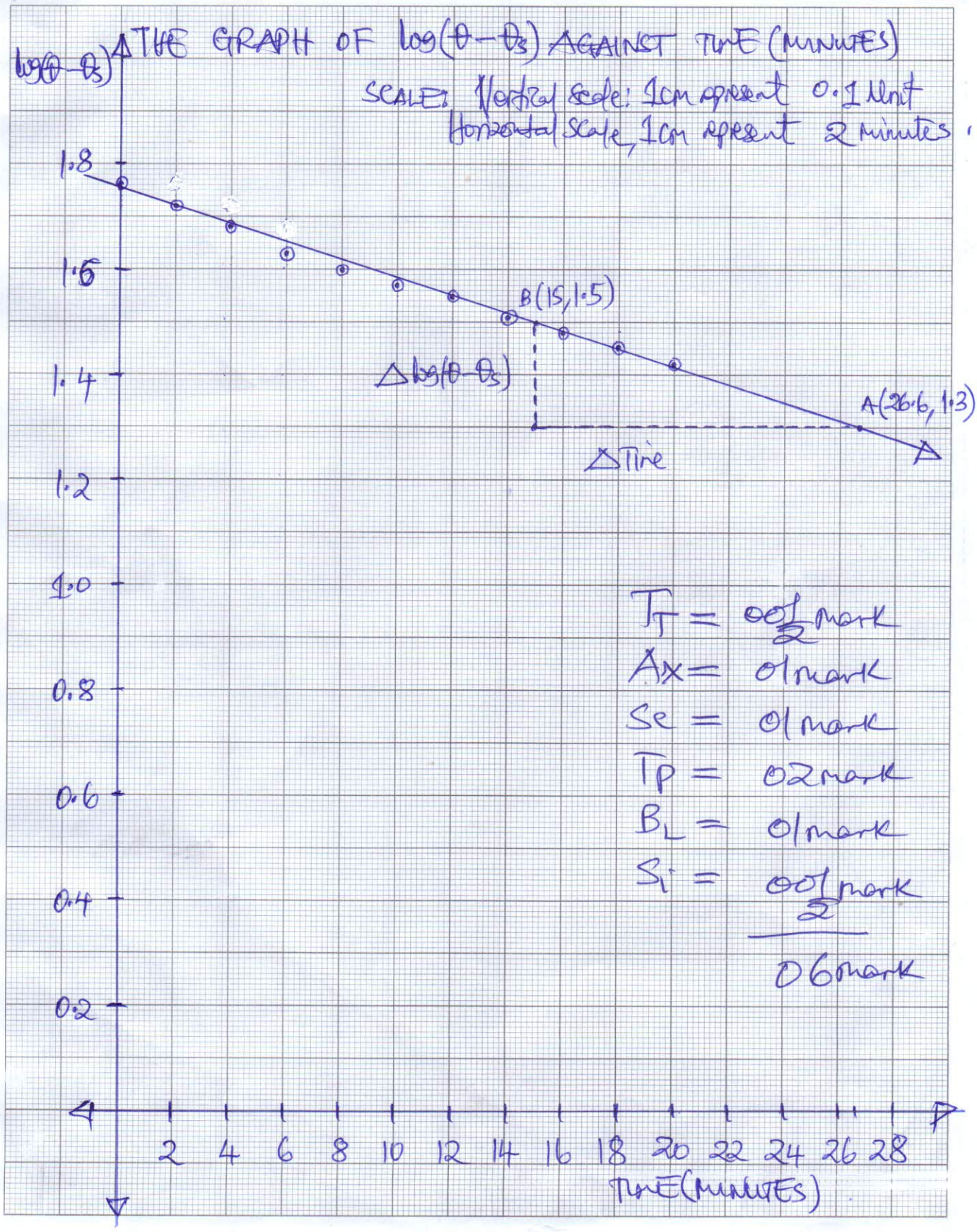
Constant $(A) = 1.76$ (00½ mark)

(d) From the graph:
The relation between Rate of heat loss from Calorimeter and its excess Temperature over its Surrounding is LINEAR (00½ mark)

(e) Newton's Law of cooling (00½ mark)

(f) The physical meaning of K is Cooling Constant rate (00½ mark)

SUBJECT NAME.....



T_T = 00½ mark
A_x = 01 mark
S_e = 01 mark
T_P = 02 mark
B_L = 01 mark
S_i = 00½ mark

06 mark

3

(a) RESULTS:

Length(Lx) (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)

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

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

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

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

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

(d) Diameter of the wire provided (d) $= 0.28mm = 0.28 \times 10^{-3} m$.
$(\text{ooo}\tfrac{1}{2}\text{mark})$

(e) From circuit diagram provided;-

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

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)

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

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

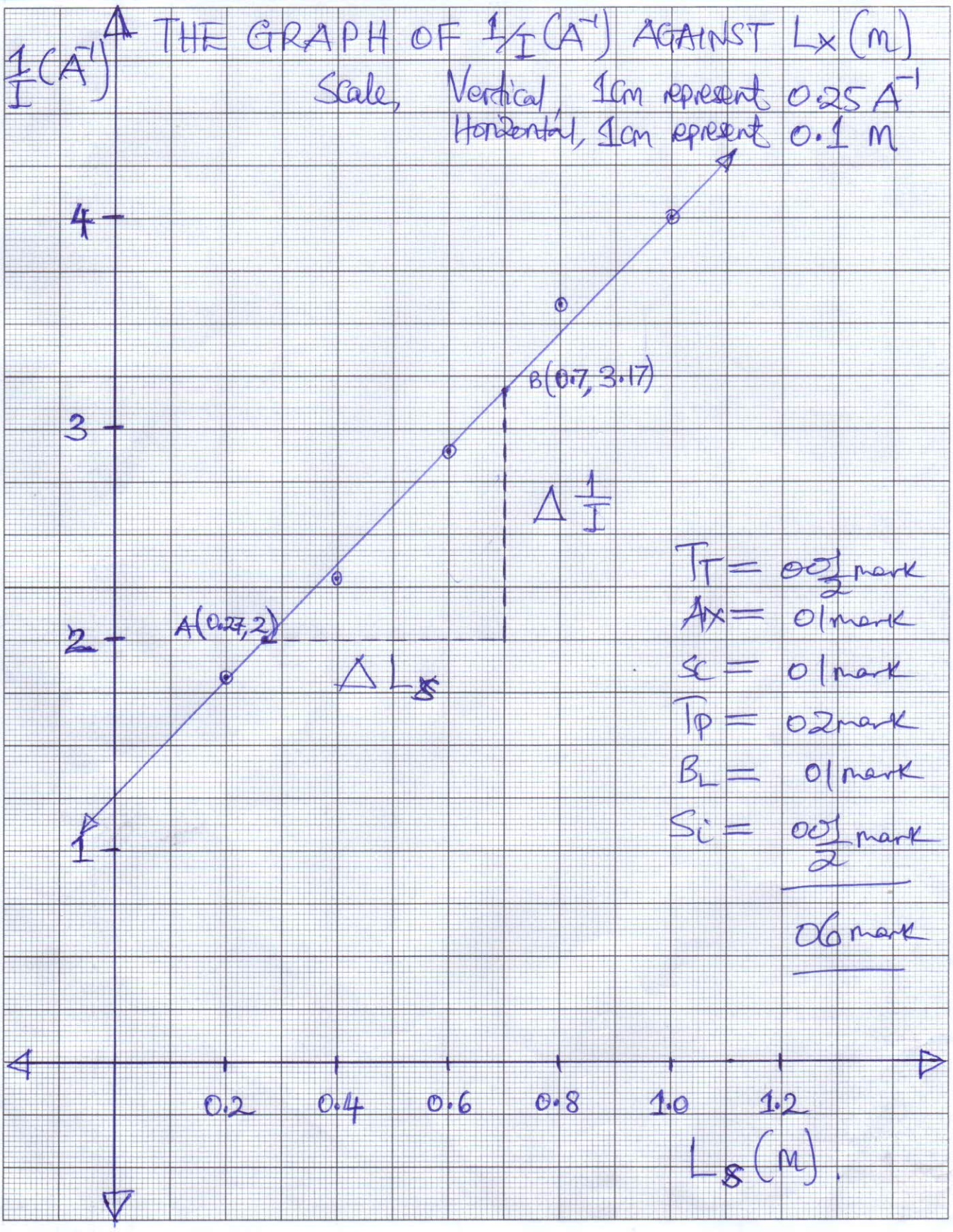
$$(1.25\times3) = 2+r$$

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

$$r = 1.75\Omega.$$

∴ 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)
TT = 0½ mark
Ax = 0 mark
Sc = 0 mark
Tp = 02 mark
BL = 0 mark
Si = 0½ mark
06 mark