TANZANIA HEADS OF ISLAMIC SCHOOL COUNCIL

FORM VI INTER ISLAMIC MOCK EXAMINATION 2026

133/3A **PHYSICS 3A**

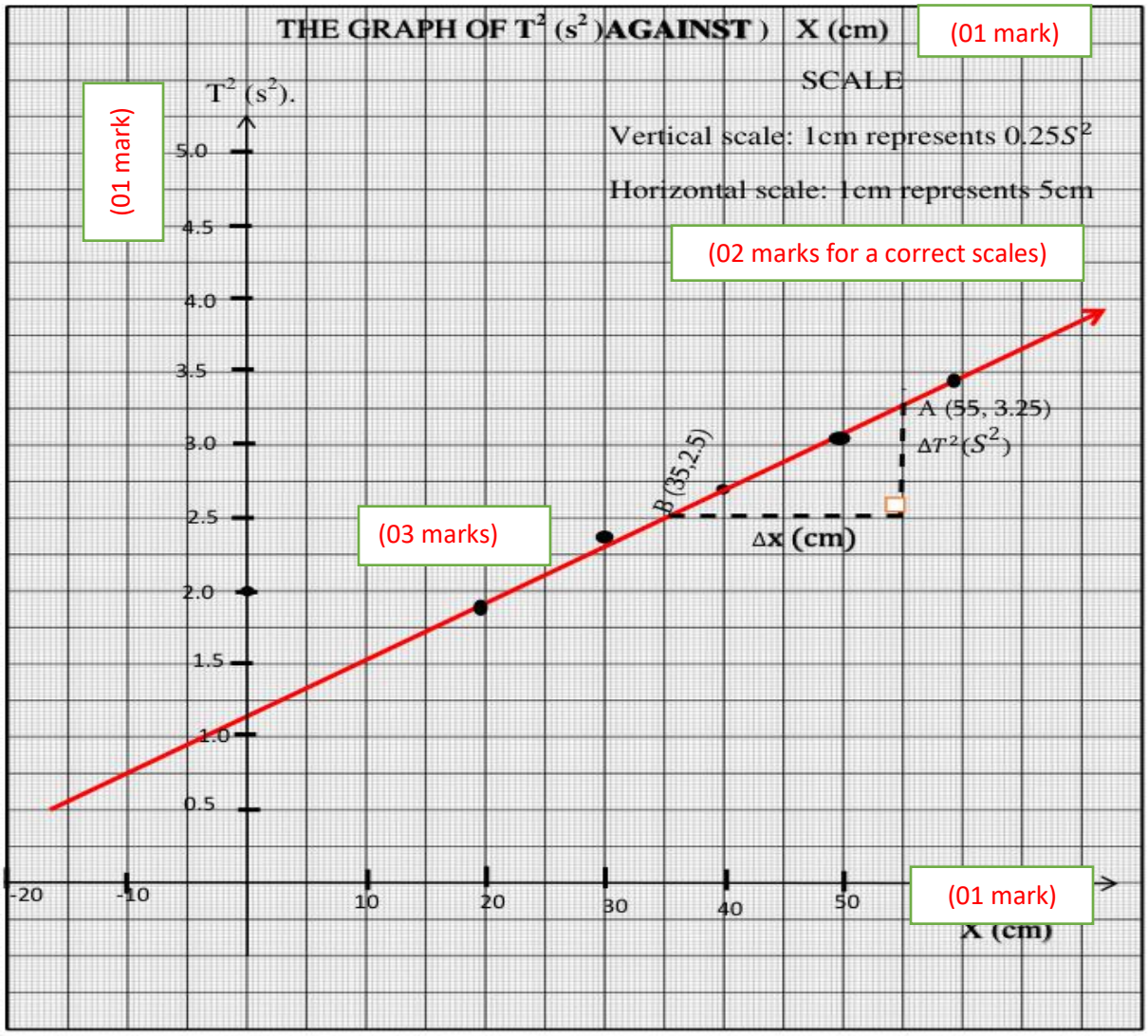
MARKING SCHEME

1. Solution

(c) (i) Table of results **(06 marks)**

Length X(cm)	20	30	40	50	60
Time t,(s)	27.78	30.45	33.09	34.99	37.02
Period T (s)	1.39	1.52	1.65	1.75	1.85
$T^2(s^2)$	1.93	2.32	2.72	3.06	3.42

(ii) The graph of T^2 (s^2) against X (cm)



(iii) The slope, m, from the graph

Slope ,$m = \frac{\Delta T^2(s^2)}{\Delta X(cm)}$ (01 mark)

Point to from the graph A (55, 3.25) and B (35, 2.5)

$m = \frac{3.25-2.5}{55-35} = \frac{0.75}{20} = 0.04\, s^2 cm^{-1}$

The Slope, m, of the graph is $0.04\, s^2 cm^{-1}$ (01 mark)

From the relation $T = 2\pi\sqrt{\frac{(X+L)}{g}}$

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

$T^2 = \frac{4\pi^2}{g}X + \frac{4\pi^2}{g}L$ (01 mark)

Compare with the equation

$Y = mX + C$

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

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

$g = \frac{4\pi^2}{0.04\, s^2\, cm^{-1}} = 986.96\, cms^{-2} = 9.87 ms^{-2}$

$g = 9.87 ms^{-2}$ (01 mark)

(iv) Also from the relation , $T^2 = \frac{4\pi^2}{g}X + \frac{4\pi^2}{g}L$,Comparing with equation

$Y = mX + C$

$C = \frac{4\pi^2}{g}L$

$L = \frac{Cg}{4\pi^2}$ From the graph the value of $c = 1.125\, s^2$ (01 mark)

$L = \frac{1.125\times 9.87}{4\pi^2} = 0.28m \approx 28\, cm$

$L = 28\, cm$

The length of bicycle spoke is 28 cm (01 mark)

2. (c)

Initial temperature (θ_i) = 29°C

Final temperature (θ_f) = 29°C

Average temperature of the surrounding (θ_R)

$$\theta_R = \frac{\text{Initial+Final temperature}}{2}$$

$$\theta_R = \frac{\theta i + \theta f}{2}$$

$$\theta_R = \frac{29+29}{2}$$

$$\theta_R = 29°C$$

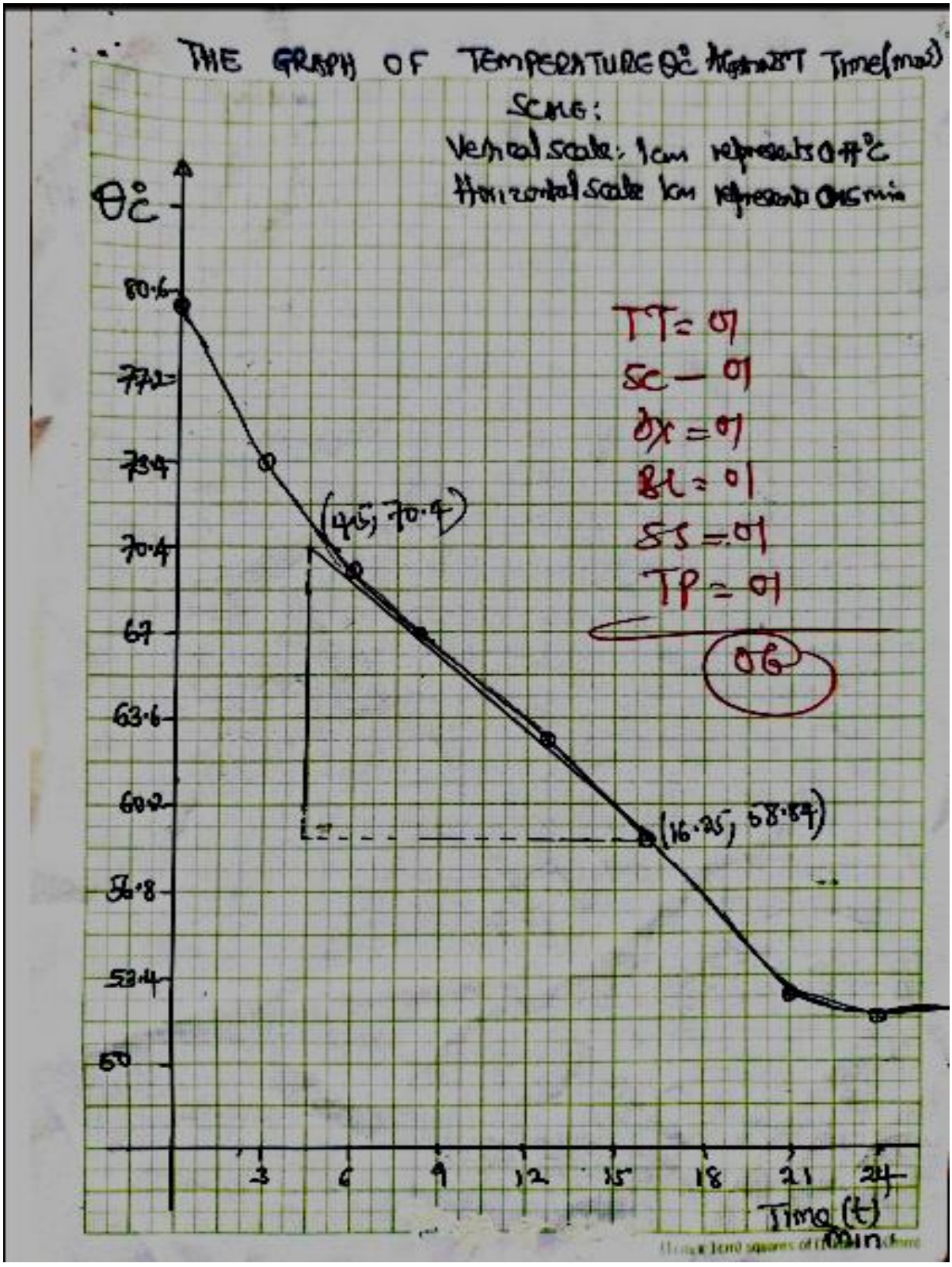
Average room temperature (θ_R) = 29°C **(001/2 Marks)**

Table of results

Time (t) min	Temperature (θ)
0	80
2	77
4	75
6	72
8	70
10	68
12	66
14	64
16	62
18	61
20	59
22	58
24	57

(04 Mark)

(i) The graph of cooling curve for liquid A



(ii) From the graph, the points are (16.35 min, 58.84) and (4.5 min, 70.4°C).

The rate of cooling at 65°C

$$\frac{d\theta}{dt} = \frac{\Delta\theta°C}{\Delta t\ min}$$

$$\frac{d\theta}{dt} = \frac{(70.4 - 58.84)}{(45 - 16.35)}$$

$$\frac{d\theta}{dt} = -0.96\ °C/min$$

(iii) $M_C = 67.56\ g = 0.0675kg$

$M_A = M_{C+A} - M_C$

$M_A = 168.19g - 67.56g$

$M_A = 0.10063kg$ **(001/2 Mark)**

From

$(M_AC_A + M_CC_C)\frac{d\theta}{dt} = -430Jmin$

$$(0.10063 \times C_A + 0.0675 \times 390) = \frac{430Jmin}{0.96°C/min}$$ **(001/2 Mark)**

$C_A = 4189.52J/kg°C$ **(01 Mark)**

Range = $(4150Jkg^{-1}\ °C^{-1} - 4150Jkg^{-1}\ °C^{-1})$

(f) Two factors on which rate of heat loss by a body depends

(i) Excess temperature **(001/2 Mark)**

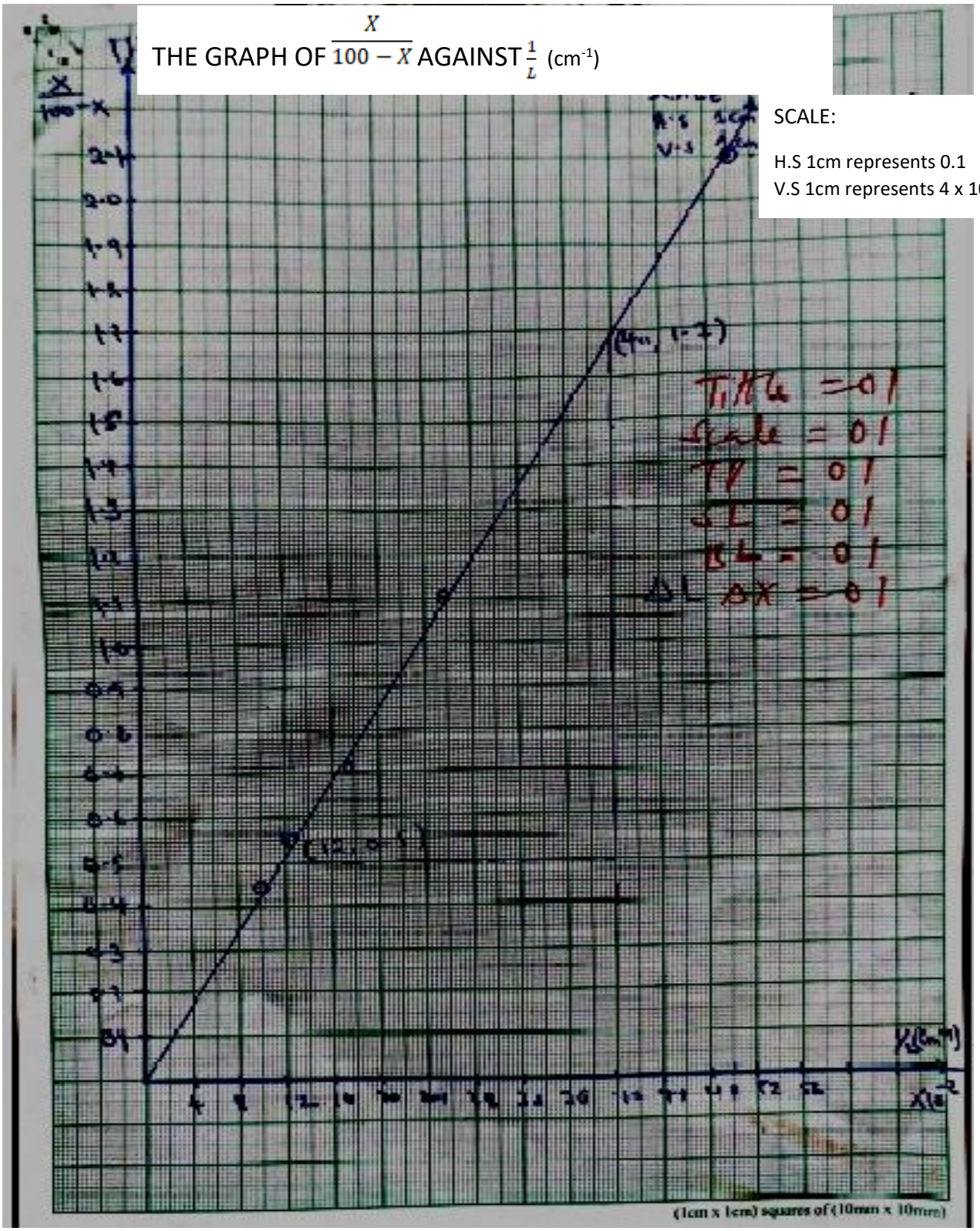
(ii) Area of the body **(001/2 Mark)**

3. (i) Table of results

L(cm)	20	40	60	80	100
X(cm)	68.7	52.4	42.2	35.4	30.5
$\frac{1}{L}(cm^{-1})$	0.05	0.025	0.017	0.0125	0.01
$\frac{X}{100 - X}$	2.19	1.10	0.73	0.55	0.44

(05 Marks)

(ii) The graph of $\frac{x}{100}$ against $\frac{1}{L}$



(iii) From the graph ,slope $s = \frac{\Delta\left(\frac{X}{100-X}\right)}{\Delta\left(\frac{1}{L}\right)}$

Slope, s = $\frac{(17.7-9)\,x\,10^{-1}}{(40-20)\,x\,10^{-2}}$ = 44cm^{-1}

Slope, s = 44cm^{-1} or 0.44m^{-1} **(01 Mark)**

(iv) The value of X for L = 75 cm = 0.75 m can be obtained as follows:

$$s = \frac{\left(\frac{X}{100-X}\right)}{\left(\frac{1}{L}\right)}$$

$$\frac{S}{L} = \frac{X}{100-X}$$

$$LX = 100S - SX$$

$$X(L+S) = 100S$$

$$X = \frac{100S}{L+S}$$

$$X = \frac{100\times0.44}{0.75+0.44} = 36.97\ cm \approx 37cm$$

$$X = 37cm$$ **(01 mark)**

(v) The value of resistivity ρ of wire W is calculated from following relation:

From

$$\frac{R_e}{X} = \frac{R_w}{100-X}$$

Where Re is an equivalent resistance of the parallel group and R_w is the resistance of wire W. Then

$$\frac{1}{R_e} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_e} = \frac{1}{6\Omega} + \frac{1}{6\Omega} + \frac{1}{6\Omega}$$

$$R_e = 2\Omega$$

$$R_w = \frac{\rho L}{A}$$

$$\frac{2}{X} = \frac{\frac{\rho L}{A}}{100-X}$$

$$\frac{X}{100-X} = \left(\frac{2A}{\rho}\right)\frac{1}{L}$$

$$\text{slope} = \frac{2A}{\rho}$$

$$\rho = \frac{2A}{\text{slope}}$$

$$A = \text{cross section area of the wire W}$$

$$A = \frac{\pi d^2}{4}$$

$$d = 0.37\text{mm}$$

$$d = 3.7 \times 10^{-4}\text{m}$$

$$\rho = \frac{2\pi \times (3.7 \times 10^{-4})^2}{4 \times 0.44}$$

$$= 4.88484 \times 10^{-7}\Omega\text{m}$$

$$\boldsymbol{\rho \approx 4.9 \times 10^{-7}\Omega m}$$

Resistivity of the wire, $\rho_w = 4.9 \times 10^{-7}\ \Omega$m

(01 Mark)

(iv) The aim of doing this experiment is to determine the resistivity ρ of wire W and the value of balancing length x if L = 75cm **(01 Mark)**