**CHRISTIAN SOCIAL SERVICES COMMISSION (CSSC)**

**NORTHERN ZONE JOINT EXAMINATIONS SYNDICATE (NZ-JES)**

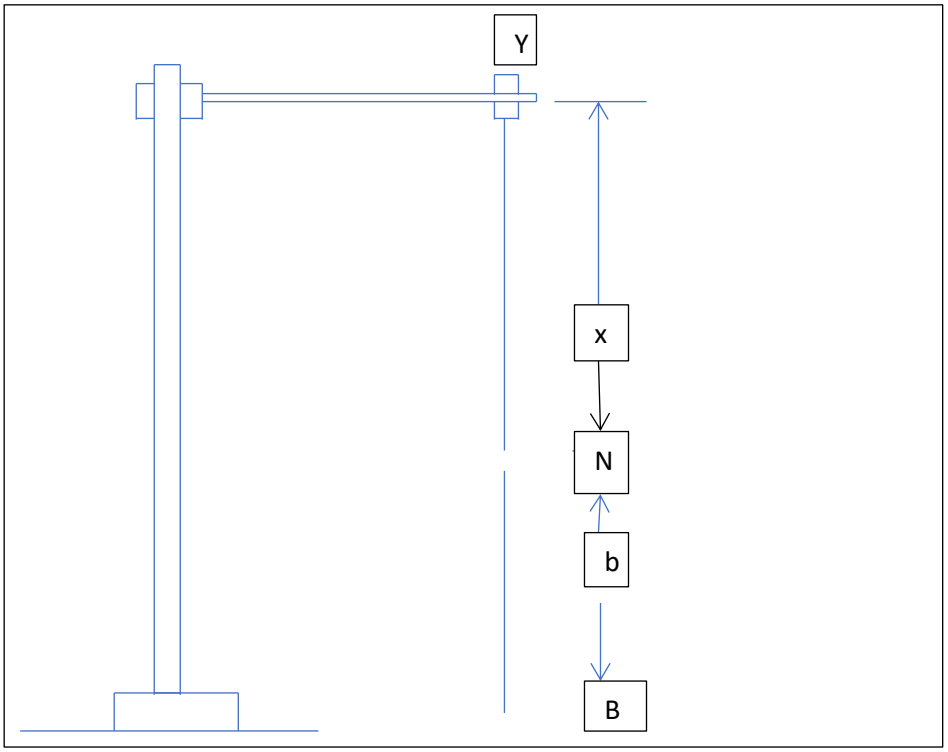
**FORM SIX PRE-NATIONAL EXAMINATION 2023**

**PHYSICS 3A**

**MARKING SCHEME**

1.

(a) (i)




***3marks***

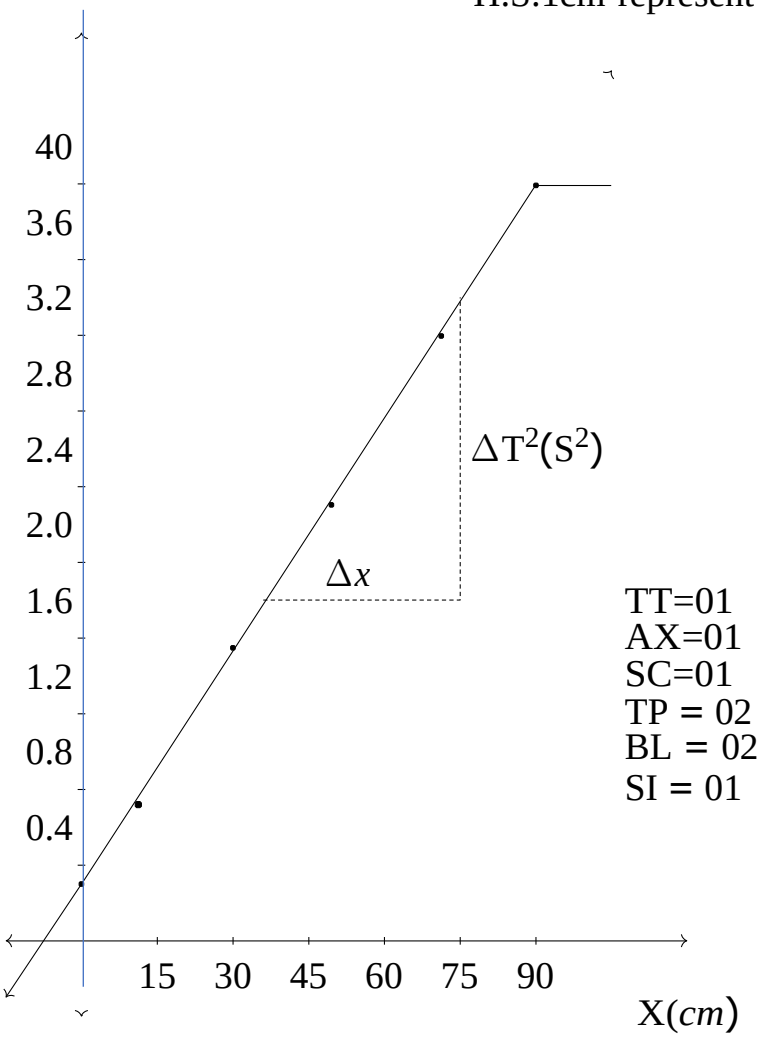
1.iii) Table of results

| X cm | t(s) | T(s) | $T^2(s^2)$ |
|---|---|---|---|
| 10 | 26.25 | 0.875 | 0.766 |
| 30 | 37.62 | 1.254 | 1.572 |
| 50 | 46.66 | 1.522 | 2.378 |
| 70 | 53.52 | 1.784 | 3.184 |
| 90 | 60.00 | 2.000 | 3.989 |

(a) THE GRAPH OF $T^2(S^2)$ AGAINST x(cm)

SCALE

V.S:1cm represent $0.4S^2$
H.S:1cm represent 15cm



(b) Slope (m)

$$m = \frac{\Delta T^2(s^2)}{\Delta x(cm)}$$

$$m = \frac{3.4 - 1.8}{75 - 35}$$

$$m = 0.04003 s^2/cm$$

(**01 marks**)

(c) From

$$T = 2\pi \sqrt{\frac{x + b}{g}}$$

$$T^2 = \frac{4\pi^2}{g}(x + b)$$

$$= \frac{4\pi^2 x}{g} + \frac{4\pi^2 b}{g}$$

$$y = mx + c(\quad)$$

**00 marks**

Then slope $= \frac{4\pi^2}{g}$

$$\frac{4\pi^2}{g} = 0.04003$$

$$g = \frac{4\pi^2}{0.04003}$$

$$\therefore g = 986.22 cm/s^2$$

Acceleration due to gravity (g)= $986.22 cm/s^2$ (**00 marks**)

(d) x-intercept= $-9.86 cm$ (**01 marks**)

(e) Significance;

Is the distance between knot (N) and the bob B.

Simply signify distance **b** when x= 90cm (**01 marks**)

(f) $T^2-$axis intercept= $0.382 s^2$ (**01 marks**)

(g) From the equation above;

$$T = 2\pi \sqrt{\frac{x+b}{g}}$$

$$T^2 = \frac{4\pi^2}{g}(x+b)$$

$$= \frac{4\pi^2 x}{g} + \frac{4\pi^2 b}{g}$$

$y = mx + c$

h. value of b

2. Room temperature initially $Q_i$ =29ºC

Room temperature final $Q_f$ =29ºC

Average room temp $Q_R = \frac{Qi + Qf}{2} = \frac{(29+29)^o C}{2}$ =29ºC (001/2 marks)

Table of result

| Time (min) | Temperature(ºC) |
|---|---|
| 0 | 80 |
| 2 | 76 |
| 4 | 73 |
| 6 | 70 |
| 8 | 68 |
| 10 | 66 |
| 12 | 64 |
| 14 | 62 |
| 16 | 60 |
| 18 | 61 |
| 20 | 59 |
| 22 | 58 |
| 24 | 57 |

(04marks)

(d) mass of calorimeter Mc=67.56g = 0.0656kg (001/2marks)

Mass (calorimeter(c) +A) =168.19 = 0.16819Kg

$M_A$ =0.16819-0.0656) Kg =0.10063Kg. (001/2marks)

(e) cooling curve

From the graph.

The rate of cooling at $65^0$C

$\frac{d\theta}{dt} = \frac{\Delta\theta^o C}{\Delta t(\min)}$ (001/2marks)

$\frac{d\theta}{dt} = \frac{(70-59)^o C}{(3-14.5)\min}$ (001/2marks)

$\frac{d\theta}{dt} = -0.9565\frac{^o C}{(\min)}$ (001/2 marks)

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

(0.10063X$C_A$ +0.06756x390) x $(-0.9565)^0$C/min = -4.3

0.10063$C_A$= $\frac{430}{0.9569}$ - 26.3484 (01Marks)

**CA=4205.577578Jkg$^{-1}$ $^O$C$^{-1}$** (01marks)

Range of $C_A$ is 4150--------4250) J/Kg/$^0$C

(f)

3.Theory

$R_W = \frac{\delta L_W}{A}$------- (i)

$R_W = \frac{E}{I} - (R + r)$------ (ii)

Combine equation (i) and (ii)

$\frac{\delta l_w}{A} = \frac{E}{I}$ - (R + r)

$\frac{1}{I} = \frac{\delta}{EA}(l_{w)} + \frac{R+r}{E}$

$\frac{1}{I} = \frac{4\delta}{E\pi d^2}(L_W) + \frac{R+r}{E}$

Y =mx +c

TABLE OF RESULTS

| Length of wire(Lw) in (cm) | Current I (A) | $\frac{1}{I}(A^{-1})$ |
|---|---|---|
| 20 | 0.8 | 1.250 |
| 40 | 0.7 | 1.429 |
| 60 | 0.6 | 1.667 |
| 80 | 0.5 | 2.000 |
| 100 | 0.4 | 2.500 |

c) ii) Slope G=1.4788per meter per ampere

iii) Y-intercept =1/A

d) Diameter d of the wire =0.31mm

e) i) Resistivity of the wire $\delta=\frac{G\pi d^2 E}{4}=\frac{1.4788x\,\pi x\,0.000375^2\ x3}{4}=4.9x10^{-7}\Omega$m

ii) Internal resistance of the battery r

r= EY-R

r=3x1-2

r=1Ω