TERM 2 - 2023
PHYSICS – PRACTICAL (232/3)
FORM THREE (3)
Time - $2\frac{1}{2}$ Hours

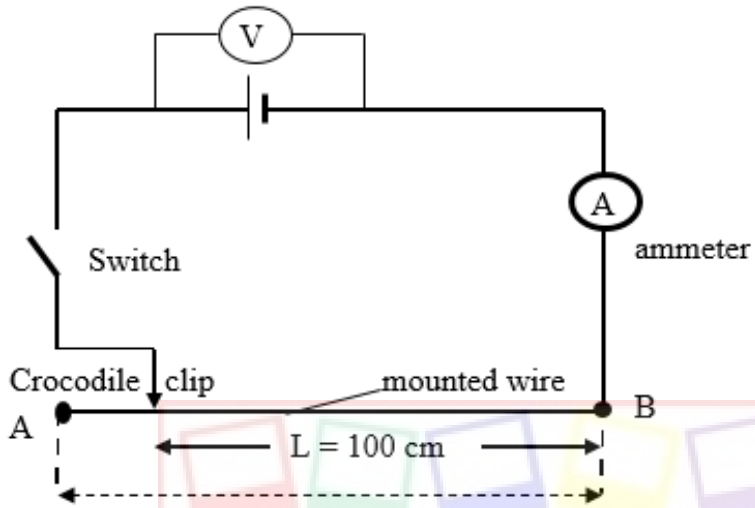
INSTRUCTION TO THE TEACHER:
This marking scheme may not be the final draft. The author acknowledges that there could be other perspectives to the facts and so the teacher concerned is highly encouraged to adapt this marking scheme accordingly.

QUESTION 1

You are provided with the following apparatus:

- One dry cell
- A cell holder
- A volt-meter (0-3V)
- An ammeter (0-1A)
- A switch
- Amounted resistance wire labelled AB
- Micrometer screw-gauge

PROCEED AS FOLOWS:



a) Set up the apparatus as shown in the circuit below, figure 1
Figure 1

b) Using the micrometer screw-gauge provided, measure the diameter, D of the mounted wire.

D = **0.28** mm D = **0.00028** m ($1\frac{1}{2}$ *marks*)

Notes:
1 mark for correct measurement
½ mark for correct conversion

c) Determine the cross-sectional area, A of the mounted wire given that:

$A = \pi R^2$ where, R is the radius of the wire (2 marks)

$\boldsymbol{A = 3.142 \times 0.00014^2}$ **; correct substitution**

$\boldsymbol{A = 6.158 \times 10^{-8} m^2}$ **; correct answer with units**

d) While the switch is open, record the voltmeter reading, V_0

$V_0 =$ **1.5 V ;** ($\frac{1}{2}$ mark)

e) Put on the switch. While the crocodile clip is at A (i.e. L = 100 cm) take the volt-meter reading (V) and the ammeter reading (I). Record V and I in the table, 1 below:

Table 1

Length, *L* (cm)	**100**	**80**	**60**	**40**	**20**
Voltage (V)	**1.50**	**1.45**	**1.45**	**1.40**	**1.30**
Current, I (A)	**0.04**	**0.06**	**0.08**	**0.10**	**0.12**
$R = \frac{v}{I}$ (Ω)	**37.50**	**24.17**	**18.13**	**14.00**	**10.83**

f) Repeat the procedure in (c) above for the lengths shown and complete the table 1 above. (10 marks)

Notes:
1 mark for each correct value of V up to a maximum of 4 (range: $\mp 0.1\ V$)
1 mark for each correct value of I up to a maximum of 4 (range: $\mp\ o.02\ A$)
1 mark for 3 correct values of R up to a maximum of 2

g) Determine, R_{av}, the average value of resistance, R (2 marks)

From the student's values:

$$\frac{37.50+24.17+18.13+14.00+10.83}{5}; = 20.93\Omega\ ;$$

Notes:
Correct substitution ;
Correct evaluation to 4 S.F ;

h) The relationship between resistance, R and length, l is given by the equation:
$R_{av} = \frac{\rho l}{A}$, determine the value of the constant, ρ when $l = 100cm$ (3 marks)

$$20.93 = \frac{\rho \times 1}{6.158 \times 10^{-8}} \quad ;$$

$$\rho = 20.93 \times 6.158 \times 10^{-8}; = 1.289 \times 10^{-6}\Omega m \quad ;$$

i) State the significance of the constant, ρ (1 mark)

Resistivity of the mounted wire ;

QUESTION TWO

You are provided with the following:

- a metre rule
- 3 optical pins
- 2 small wooden blocks
- a stop watch
- a stand, a boss and clamp
- a piece of sello-tape

Proceed as follows:

a) Using the two wooden blocks, clamp two optical pins about 4 cm apart in the stand so that they project out of the blocks in a horizontal plane.

b) Using a piece of sellotape, attach the third optical pin across the metre rule at a distance x = 10 cm from the 50 cm mark. Now suspend the metre rule on the two clamped pins so that it can swing freely in a vertical plan with the third pin as the axis. (See **figure 2**)

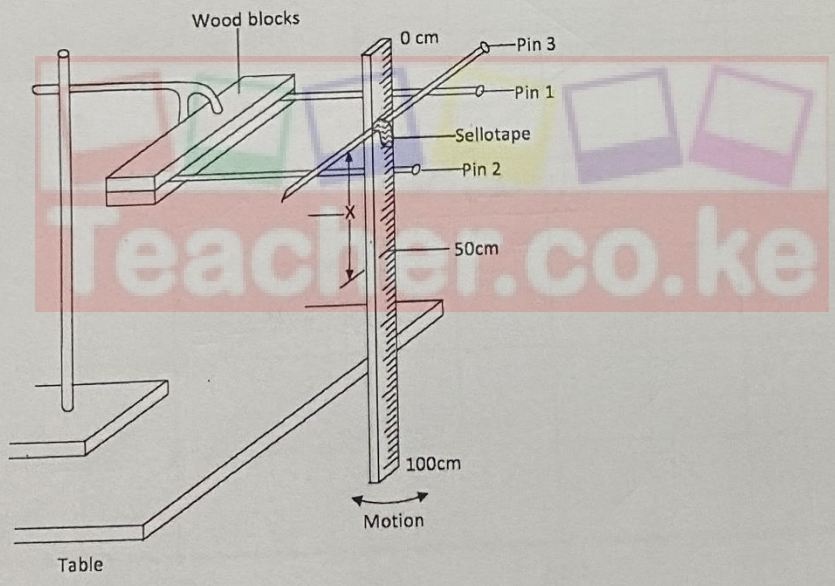


Figure 2

c) Displace the lower end of the metre rule slightly and let it oscillate as shown in the **figure 2**. Measure and record in table 2 the time t (s) for 20 oscillations.

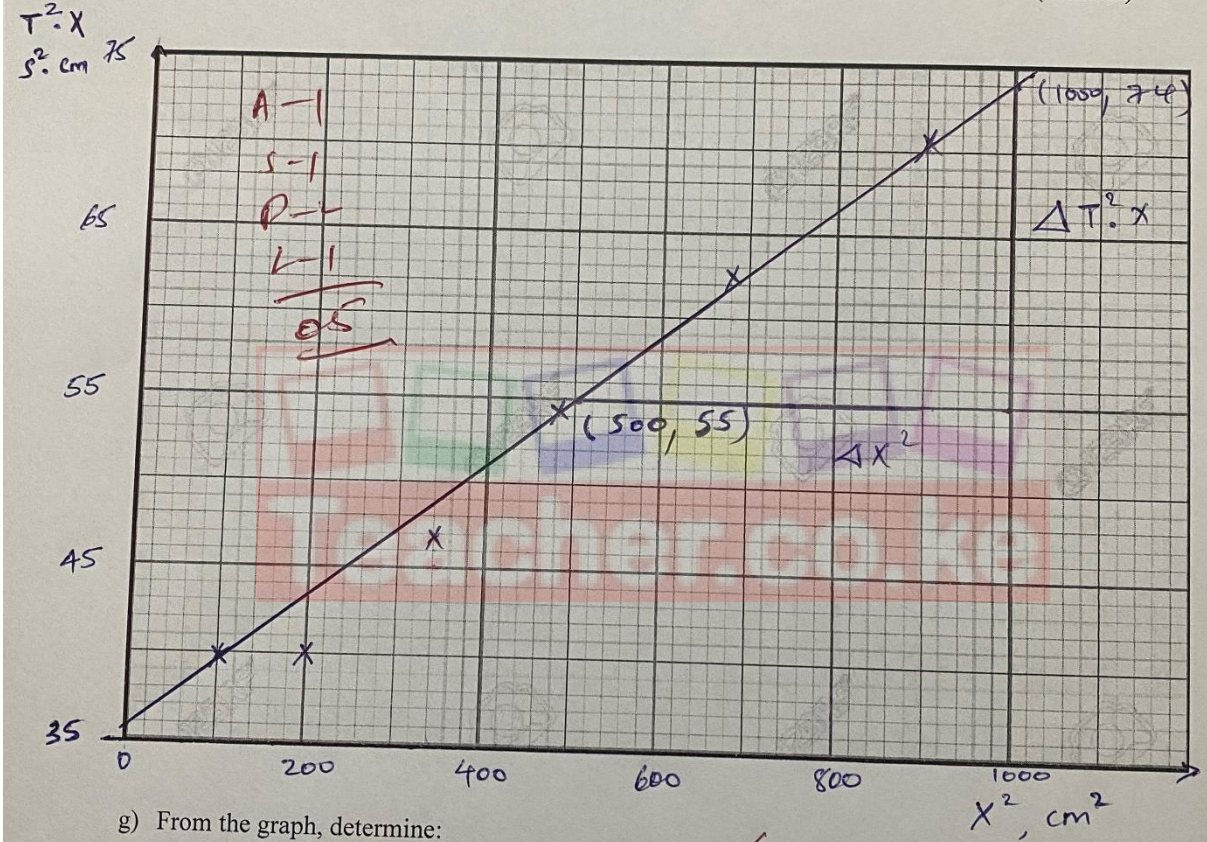
d) Repeat the procedure in (b) and (c) for the values of x shown in table 2.

e) For each value of x shown in the table, determine the period T(s), and complete the table. (The period T is the time for one complete oscillation).

Distance X(cm)	10	14	18	22	26	30
Time t (s) 4 SF	39.75	33.63	32.22	31.47	31.00	30.69
Period T (s) 4 SF	1.9875	1.682	1.611	1.574	1.550	1.535
T^2. X (correct to 1 decimal place) 4 SF	39.50	39.60	46.72	54.50	62.47	70.69
X^2 (cm^2)	100	196	324	484	676	900

6 max
1 max
1 max
1 max

f) On the grid provided, plot a graph of T^2. X (y-axis) against X^2 **(9 marks)**
(5 marks)



g) From the graph, determine:

i. the slope S of the graph. (3 marks)

$$\text{Slope, } S = \frac{\Delta T^2 X}{\Delta X^2} = \frac{74-55}{1000-500}$$

$$= 0.038\ s^2/cm$$

-deny 1 for no units.
-No line no slope.

ii. The value of constant r given that: $rS = 39.5$ (3 marks)

$r \times 0.038 = 39.5$ correct sub.

$$\therefore r = \frac{39.5}{0.038} = 1039.5\ cm/s^2$$

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