

Uranga Physics Exams 2022 (2021, t3)

Marking guide pp3

Question 1

i)

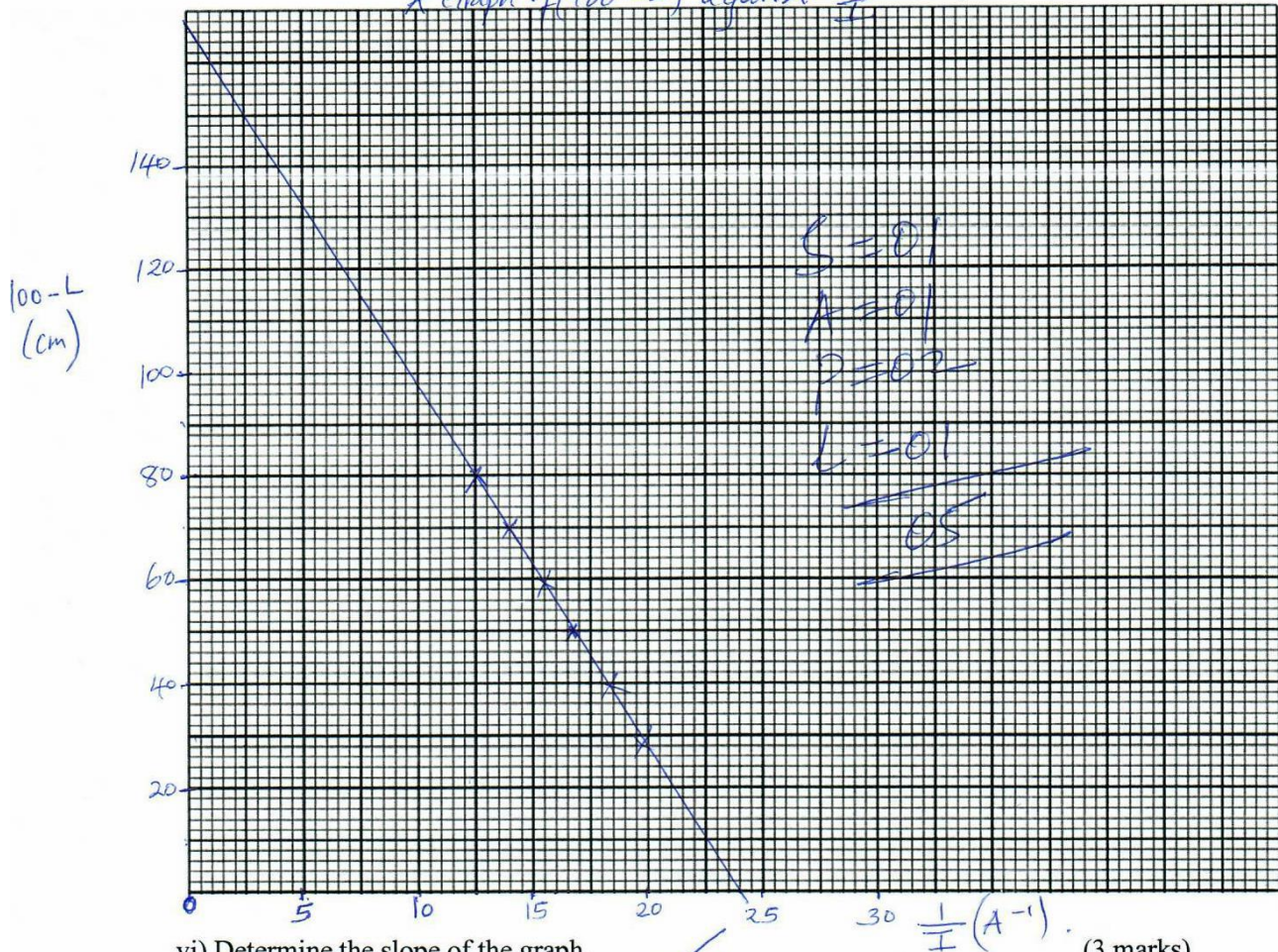
Length, L (cm)	20	30	40	50	60	70
Length (100 – L) cm	80.0	70.0	60.0	50.0	40.0	30.0
Current, I (A)	0.08	0.07	0.06	0.05	0.04	0.02
$\frac{1}{I}$ (A^{-1})	12.50	14.00	15.50	16.67	18.00	19.50

- Length (100- L) cm ; 1dp
- Current, I (A) ; accept 2 d.p **0.02A** (1/2 mark each)
- $\frac{1}{I}(A^{-1})$; 4sf

viii)

v) Plot the graph of Length $(100 - L)$ (vertical axis) against $\frac{1}{I}$

(5 marks)



vi) Determine the slope of the graph.

(3 marks)

$$\begin{aligned} \text{slope} &= \frac{(80 - 50) \text{ cm}}{(12.5 - 16.6) \text{ A}^{-1}} \\ &= \frac{30 \text{ cm}}{-4.1 \text{ A}^{-1}} \\ &= -7.317 \text{ cm A} \end{aligned}$$

vii) Measure the diameter of the mounted wire using the micrometer screw gauge.

Record the diameter, d.

d = 0.38 mm

(1 mark)

$$\begin{aligned} K &= \frac{-7.317}{100} \times 1.5 \times \frac{22}{7} \times \left(\frac{0.038}{100} \right)^2 \\ &= -1.245 \times 10^{-8} \text{ m}^3 \text{ A V} \\ &= -1.245 \times 10^{-8} \text{ m}^3 \text{ W} \end{aligned}$$

Part B

b (ii) $E = 1.5V \pm 0.1V$ 1mk to 1d.p.

(iii) $V = 1.1V \pm 0.1V$ 1mk to 1d.p.

$$I = 0.10A \pm 0.02A \text{ 1mk to 2d.p.}$$

(iv) $E - V = Ir$

$$1.5 - 1.1 = 0.10r \text{ 1mk substitution}$$

$$r = \frac{0.4}{0.10}$$

$r = 4\Omega$ 1mk for correct student's value with units

Question 2

Part A

a) $x_0 =$ student's value in m (3d.p a must) (1mark)

b) (i) $e_1 = \text{difference in students values} = 0.148 \pm 0.0m$

(Correct subtraction = 1/2mk, correct evaluation = 1/2mk)

(ii) $t_1 = 16.37 \mp 0.5s$ (1mk)

(Value within the range and 2dp a must = 1mk, no unit deny a half mark)

(iii)

$$T_1 = \frac{16.37}{20} \\ = 0.8184s$$

(Correct division = 1/2mk, correct evaluation with unit = 1/2mk)

(ii) $T = 2\pi \sqrt{\frac{e}{p}}$. (2marks)

$$0.8184s = 2(3.142 \sqrt{\frac{0.148}{P_1}} \text{ (Correct substitution = 1mk)}$$

$$P_1 = \frac{0.148}{0.01616} \\ = 9.158m/s^2 \text{ (Correct evaluation to 4sf = 1mk)}$$

d) (i) $e_2 = x_2 - x_0 = 0.196 \mp 0.01m$.

(Correct subtraction = 1/2mk, correct evaluation = 1/2mk).(1mk)

(ii) $t_2 = 18.62 \pm 0.5s$ (1mk)

(Value within the range and 2dp a must = 1mk, no unit deny a half mark)

(iii) Find periodic time T_1

$$T_2 = \frac{18.62}{20}$$

$$= 0.9310 \text{ s} \quad (1\text{mk})$$

(Value within the range and 2dp a must = 1mk, no unit deny a half mark)

$$(iv) \quad T = 2\pi \sqrt{\frac{e}{p}} \quad (2\text{marks})$$

$$0.9310 \text{ s} = 2(3.142 \sqrt{\frac{0.196}{P_2}}) \quad (\text{Correct substitution} = 1\text{mk})$$

$$P_2 = \frac{0.196}{0.01616}$$

$$P_2 = 8.929 \text{ m/s}^2 \quad (\text{Correct evaluation to 4sf} = 1\text{mk})$$

$$e) \quad P_{av} = \frac{P_2 + P_1}{2} \\ = \frac{8.929 + 9.158}{2} \quad (\text{Averaging principle} = 1\text{mk}).$$

$$= 9.044 \text{ m/s}^2 \quad (\text{Correct evaluation to 4sf} = 1\text{mk})$$

PART B

a)

$$t = 1.50 \text{ cm} \quad 0.015 \text{ m} \quad \checkmark$$

g)

$$y = 96^\circ \pm 2^\circ \quad \checkmark \quad \text{Confirm measured from } \checkmark \quad (2 \text{ marks})$$

i.

$$M = \left(\frac{y}{2}\right)^{-1}$$

$$M = \left(\frac{0.015 \times 96}{2}\right)^{-1} = 1.388 \\ \approx 1.4$$

ii.

check the
plain paper
to confirm
what the student
has drawn. ✓