

QUESTION ONE.

You are provided with the following;

- 2 new dry cells
- Cell holder
- Ammeter (0-1A)
- Voltmeter
- 6 connecting wires (at least 3 with crocodile clips)
- Nichrome wire mounted on millimeter scale
- Micrometer screw gauge (may be shared)
- Jockey .

Proceed as follows;

a) Using micrometer screw gauge, measure the diameter, D of the nichrome wire. ✓ (1/2)

i) $D = 0.35 \pm 0.02$ mm - 2 d.p a must ✓ (1/2)

ii) $D = 0.00035$ m - 5 d.p a must ✓ (1 mark)

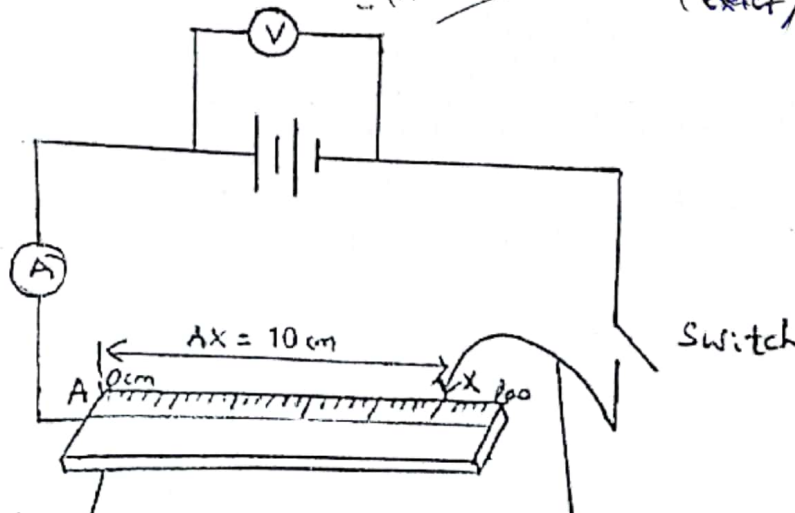
iii) The cross sectional area A is obtained by; (Allow std. form)

$A = \pi r^2$ Where $r = D/2$

Determine the cross sectional area (A) in SI units. (2marks)

$A = \frac{\pi}{4} \times \left(\frac{0.00035}{2}\right)^2 = 9.625 \times 10^{-8} \text{ m}^2$

b) Set up the apparatus as shown below. in. SE with



Nichrome wire mounted on cm scale.

Jockey key.

Rule for units

- penalize 1/2 mk - no units
 penalize 1 mk - wrong units
 2 page

c) Record the e.m.f across the terminals of the dry cells when the switch is open.

Emf = 3.1 V ± 0.1 (at least 1 d.p) - units a must

d) Adjust the position of jockey key such that length AX = 10cm.

Close the switch and record the voltmeter and ammeter reading on the table given.

e) Repeat step d) above for the other lengths shown on the table.

f) Complete the table.

(5 marks)

Length, L AX (cm)	10	20	30	50	70	80
Voltage (V)	2.0	2.3	2.6	2.7	2.8	2.85 ± 0.2
Current (A)	0.82	0.56	0.44	0.30	0.24	0.20 ± 0.02
Resistance (V/I) (Ω)	2.683	4.286	5.909	9.000	11.67	14.25

At least 1 d.p

2 d.p a must

Exact / at least 4 s.f.

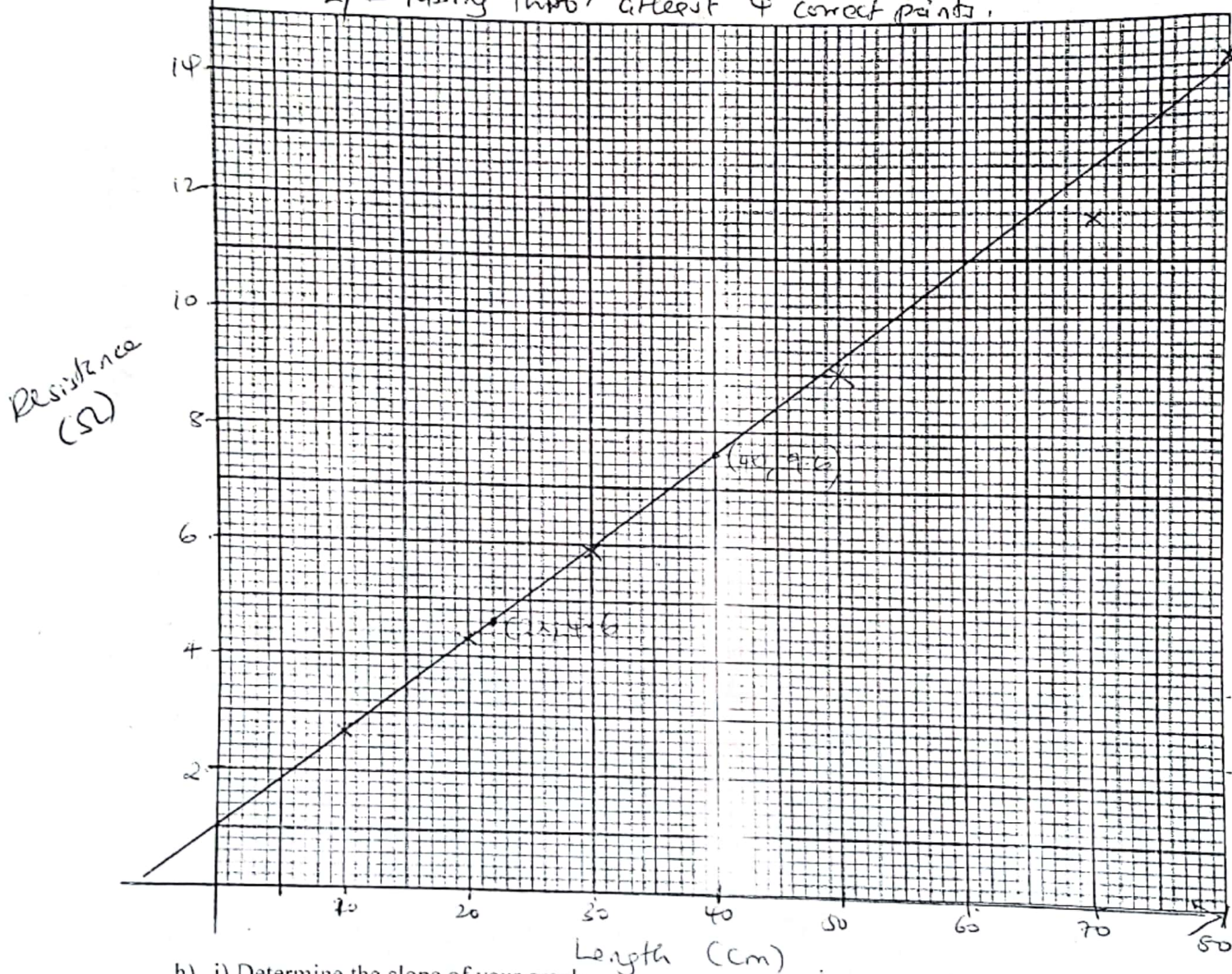
g) Plot a graph of resistance (Ω) against Length (cm) on the graph provided below. (5 marks)

⇒ 1/2 mk for a pair of correct values of voltage & current - 2 mks
 to a max. of 2 mks for each

Voltage column - 2 mks
 Current - 2 mks
 Resistance - 1 mk (for all correct)

~~Do not~~ (Do not split this mk)

- A₁ - Axes well labelled with quantities & units.
- S₁ - Uniform/simple scale.
- P₂ - accurate plotting → lead to a max. of 2 marks.
- L₁ - Passing thro' atleast 4 correct points.



h) i) Determine the slope of your graph.

(3marks)

$$\text{Slope} = \frac{\Delta R}{\Delta L} = \frac{9.6 - 4.6}{40 - 20} \Rightarrow \frac{5}{20} = 0.27778 \Omega/\text{cm}$$

$$\Rightarrow \frac{5}{0.18 \text{ m}} = 27.778 \dots \Omega/\text{m}$$

⇒ Extraction of points ✓

Evaluation of $\frac{\Delta R}{\Delta L}$ ✓

Answer - exact/atleast 4 sig ✓
(with units)

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

Substitution
Answer ✓

ii) ✓ The relationship between L and R is given by the equation; $R = \frac{\rho L}{A}$, determine the value of ρ . (2marks)

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

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

$y = mx + c$

$\rho = 27.778 \text{ } \Omega / \text{m} \times 9.625 \times 10^{-8} \text{ m}$
 $= 2.674 \times 10^{-6} \text{ } \Omega \text{ m}$ (Ignore units)

iii) Suggest what constant ρ represents. (1mark)

✓ Resistivity

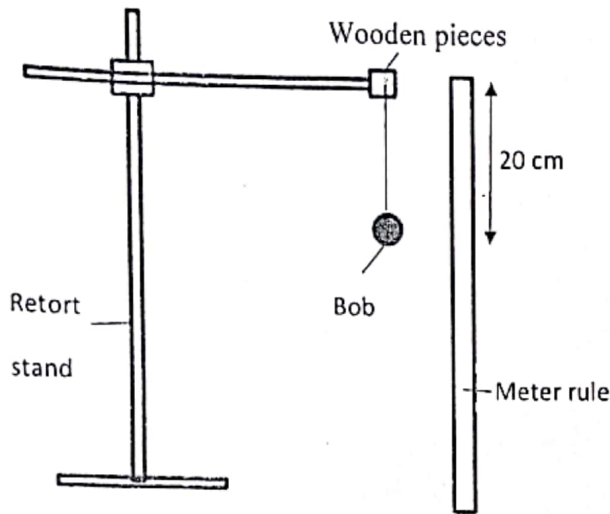
QUESTION TWO (A)

You are provided with the following apparatus;

- Retort stand, clamp and boss
- A piece of thread
- Two small pieces of wood blocks
- Pendulum bob
- Meter rule
- Stop watch

Procedure;

Tie the bob to one end *20cm length* of the thread and suspend it from the retort stand with the help of the wooden blocks as shown in the diagram.



Displace the bob by a small angle say 10° ; start the stopwatch simultaneously and allow it to swing to make ten oscillations. Stop the clock and record the time taken in the table below.

Length L (m)	0.20	0.40	0.60	0.80
Time t for 10 oscillations (s)	9.80 ✓	13.20 ✓	16.00 ✓	18.30 ✓
Period T (s)	0.980	1.320	1.600	1.830 ✓
$T^2 (s^2)$	0.9604	1.742	3.349	2.56 ✓
$Q = \frac{4\pi^2 L}{T^2}$	8.221	9.065	7.073 9.253	9.430

2 d.p. a.m.s.c.
3 d.p. a.m.s.c.
exact/ atleast 4 s.f.
Greck / atleast 4 s.f.

+ 0.5 *

Repeat the same procedure for different lengths of thread 40cm, 60cm, 80cm and record the corresponding times t taken in the table above.

Fill in the table above by determining the various values of T, T^2 and Q as stated in the table.

(8marks)

Time t \Rightarrow each correct value (1 mk).

Period T \Rightarrow All correct (1 mk)

T^2 \Rightarrow All correct (1 mk)

Q \Rightarrow each correct value (1/2 mk)

Do not split this mark

Determine the average value of quantity Q and state its SI units

(2 marks)

$$Q_{\text{Average}} = \frac{8.221 + 9.065 + 9.253 + 9.430}{4} \Rightarrow \text{expression}$$

$$= 8.992 \Rightarrow \text{Answer (exact/ atleast 4 sf)}$$

Name the physical quantity represented by Q

(1 mark) Ignore unit

- Gravitational field strength (gravity)
- Acceleration due to gravity.

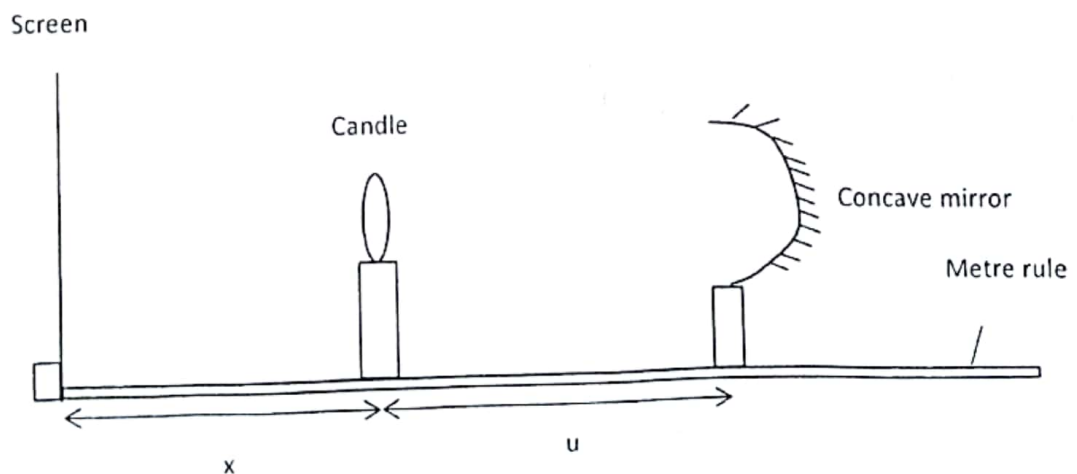
QUESTION TWO (B)

You are provided with the following apparatus.

- A concave mirror
- Mirror holder
- White screen
- Meter rule
- A candle

Procedure

i) Set the apparatus as shown in the diagram below



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ii) Place a candle at a distance of $x = 10$ cm from the screen. Move the mirror to and fro to focus a clear, sharp image of the candle flame on the screen.

iii) Measure the distance u between the mirror and the candle and the distance v between the candle and the screen.

iv) Repeat the experiment for $x = 15$ cm and 20 cm. Complete the table below. (6 marks)

X (cm)	10	15	20	25
u (cm)	34.0	31.5	30.0	28.0
$V = (u + x)$ (cm)	44.0	46.5	50.0	53.0
$Z = \frac{uv}{u+v}$ (cm) exact/ atleast 4.s.f	19.18	18.78	18.75	18.32

± 5.0 ✓ each correct value 1 MK
 ✓ All correct (1 MK)
 ✓ All correct (1 MK)

v) Determine the average value of Z. (2marks)

$$Z_{\text{average}} = \frac{19.18 + 18.78 + 18.75 + 18.32}{4} \Rightarrow \text{expression} \quad \checkmark$$

$$= 18.76 \Rightarrow \text{Answer (exact/ atleast 4sf)} \quad \checkmark$$

vi) What is the significance of Z? (1mark)

Focal length of the mirror. ✓