

Question 1

You are provided with the following:

- two cells in a cell holder;
- a switch;
- a micrometer screw gauge;
- a nichrome wire mounted on a millimetre scale;
- a voltmeter;
- an ammeter;
- a jockey;
- connecting wires with crocodile clips.

Proceed as follows:

- (a) Using the micrometer screw gauge, measure and record the diameter d of the wire.

$d = 0.29 \pm 0.02$ mm. \checkmark 2 d.p. a must $0.27 \leftrightarrow 0.31$

$d = 2.9 \times 10^{-4}$ m. \checkmark Conversion of student's value correctly
Accept std form to whatever no. of d.p.

(1 mark)

- (b) Set up the apparatus as shown in **Figure 1**.

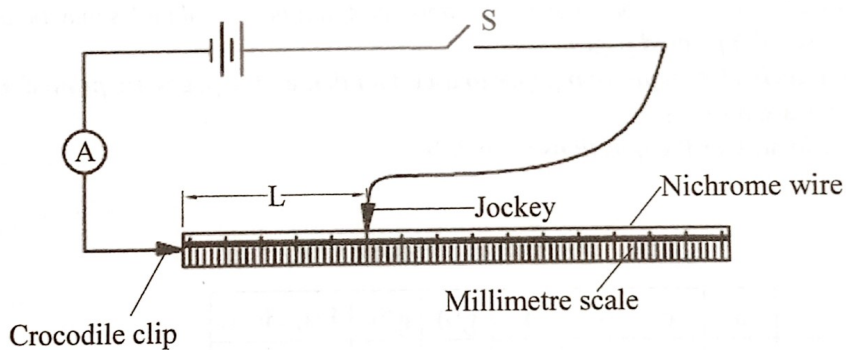


Figure 1

- (c) Using the voltmeter, measure the potential difference E across the battery before closing the switch.

$E = 3.1 \pm 0.1$ volts. \checkmark 1 d.p. a must

(1 mark)

(d) Adjust the length L of the wire to 0.1 m (10 cm). Close the switch, read and record the value of the current I in **Table 1**.

(e) Repeat (d) for the other values of L given in **Table 1**. Complete the table. (6 marks)

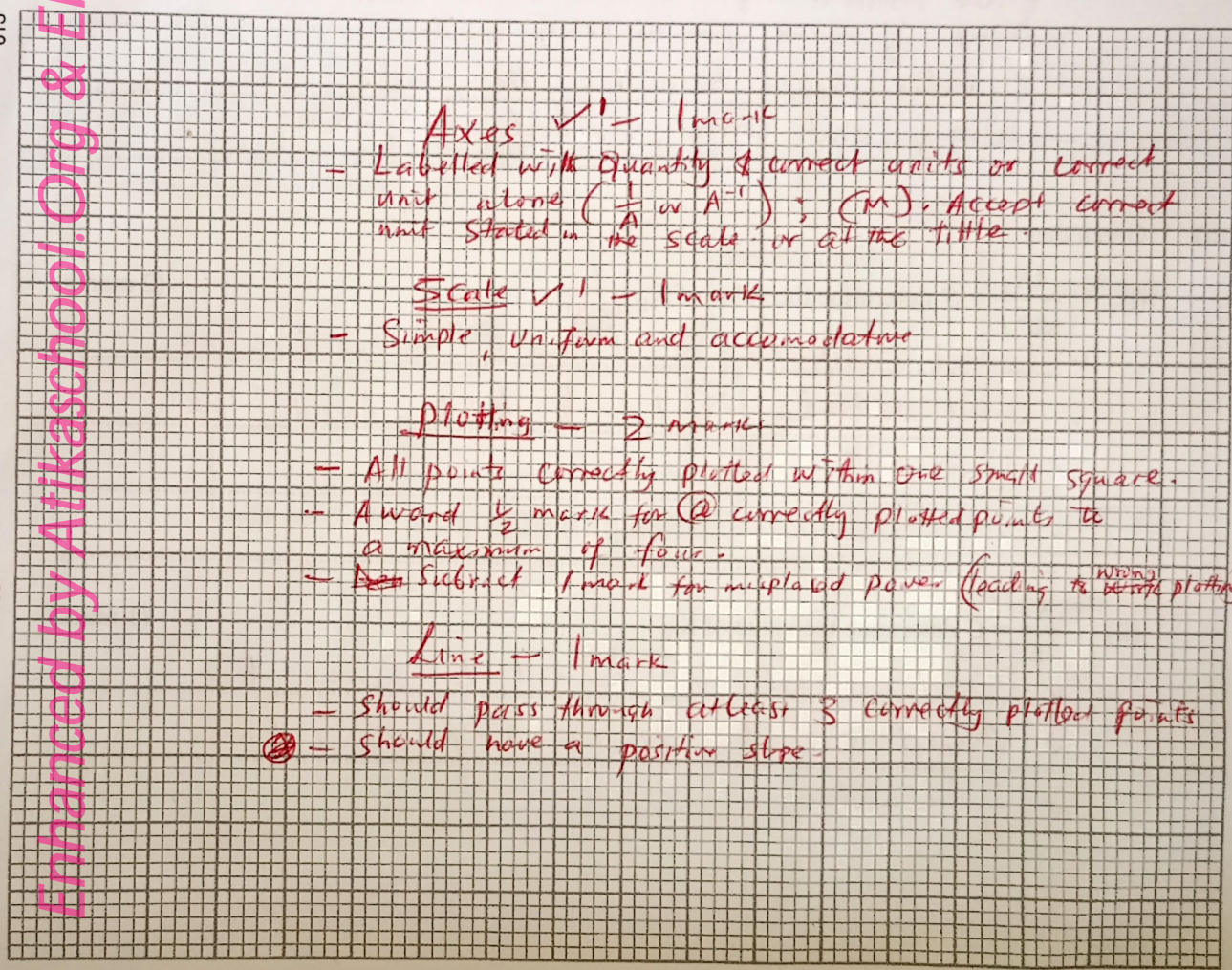
Table 1

Length L (m)	0.1	0.2	0.3	0.4	0.5	0.6	0.7
Current I (A) ± 0.10	0.72	0.53	0.44	0.38	0.33	0.29	0.27
$\frac{1}{I} A^{-1}$	- Correct reciprocals exact or to 4 s.f. - All correctly done award 1 mark						

- 2 dp a must
 - Trend - Decreasing from the 1st correct value

1 mark @ 10 to 5 = 5 marks

On the grid provided; plot the graph of $\frac{1}{I}$ (y axis) against L . (5 marks)



613

A133

Enhanced by AtikaSchool.Org & Elimuspace.co.ke

(g)

From the graph, determine the:

(3 marks)

(i) gradient S;

- $\Delta \frac{L}{I}$ ✓
 ΔL ✓ | Correct interval and size
 Extracting correctly i.e. correct interval and size
 Accept Correct interval and size (with grid or if argued) ✓
 It can be deduced from the graph.
- Accept Transfer of error or corrected power of 10
 No line mk no slope mk.
- Correct evaluation exact or to 4 s.f. award 1mk $(A^{-1} M^{-1})$ or $(M^{-1} A^{-1})$
 Deny evaluation mk if the unit is wrong; Deny $\frac{1}{2}$ mk for missing unit. or $(\frac{1}{A})$ (1 mark)

(ii) intercept C on the $\frac{1}{I}$ axis.

- Candidates value of C taking into account candidate error transcribe either positive or negative with correct units award 1 mark
 Deny $\frac{1}{2}$ mark for missing unit
 C-value should be within the grid.
 Wrong units correct evaluation - $\frac{1}{2}$ mark

(h)

Given that:

(i) $\frac{4K_1}{\pi d^2 E} = S$ determine the value of K_1 . (2 marks)

- ✓ Correct substitution S, d and E - Award 1mk
 ✓ Correct evaluation exact or to 4 s.f. - Award 1mk
 ✓ Ignore units

(ii) $\frac{K_2}{E} = C$ determine the value of K_2 . (1 mark)

- ✓ Correct substitution of C and E award 1mk
 ✓ Correct evaluation exact or 4 s.f. award $\frac{1}{2}$ mk.
 ✓ Ignore unit.



Question 2

You are provided with the following:

- a metre rule;
- a biconvex lens;
- a source of light (bulb in a bulb holder, cells in a cell holder and a switch);
- a stand boss and clamp;
- a lens holder;
- a screen;
- a half metre rule;
- three pieces of plastic pipes A, B and C;
- a vernier callipers (to be shared);
- a stopwatch;
- some plasticine.

Proceed as follows

PART A

- (a) Clamp the bulb holder onto the stand. Arrange the bulb, the lens and the screen along the metre rule as shown in **Figure 2**.

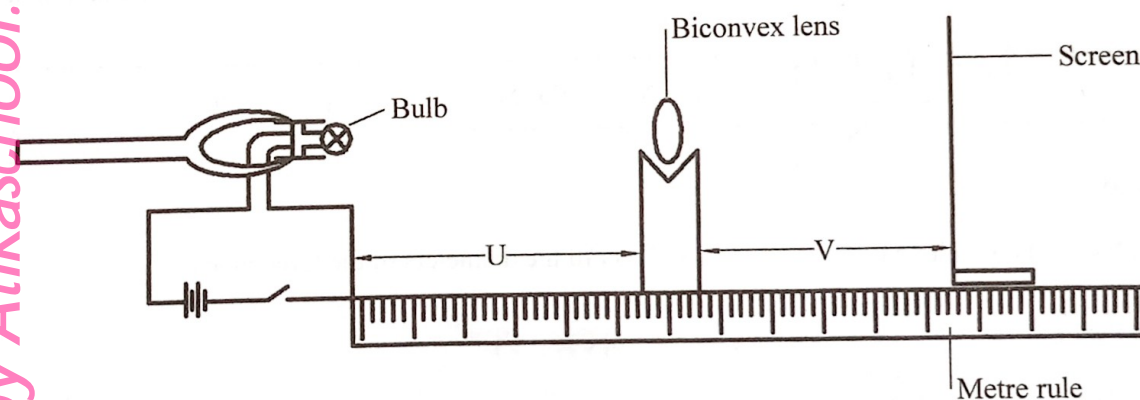


Figure 2

- (b) Adjust the distance of the bulb from the lens to $U = 25$ cm. Put on the switch and adjust the position of the screen from the lens so that a sharp image of the bulb is observed. Record the distance V between the screen and the lens in **Table 2**.
- (c) Repeat part (b) for the other values of U shown in **Table 2**. Complete the table. 5
(7 marks)

Table 2

U cm	25	30	35
V cm	45.0	35.0	30.0
$M = \frac{V}{U}$	- Each value correctly evaluated - All correct award 1mk.		
$F = \frac{V}{M+1}$	- Correct evaluation exact or to 4 s.f. - All correct award 1mk.		

± 10 cm @ 1mk; values with decreasing trend - Exact or to 4 s.f

- (d) Determine the average value of F . (2 marks)

- Statement of principle of averaging students value award 1mk.
- Correct evaluation exact or to 4 s.f - award 1mk.
- Ignore units.

$$\left(\frac{F_1 + F_2 + F_3}{3} \right) \Rightarrow \text{Principle of averaging shown.}$$

PART B

- (e) Using the vernier callipers measure and record the diameters of the three pipes.

d_A, d_B and d_C ^{2dp} ✓ 1 Correct conversion $\frac{1}{2}$

$d_A = 3.00 - 3.70$ ✓ 1 cm m (1 mark)

$d_B = 3.60 - 4.90$ ✓ 1 cm m (1 mark)

$d_C = 5.10 - 5.80$ ✓ 1 cm m (1 mark)

- (f) Measure and record the thickness X of the half metre rule.

$X = 0.50 - 0.65$ ✓ 1 cm m (1 mark)



- (g) Place the pipe marked A on the bench and use the plasticine to stop it from rolling. (see Figure 3 (a)).

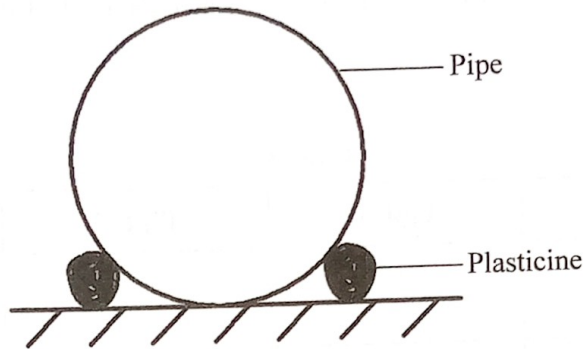


Figure 3 (a)

- (h) Place the half metre rule onto the pipe such that it balances horizontally. Ensure that the half metre rule is perpendicular to the axis of the pipe. (see Figure 3 (b)).

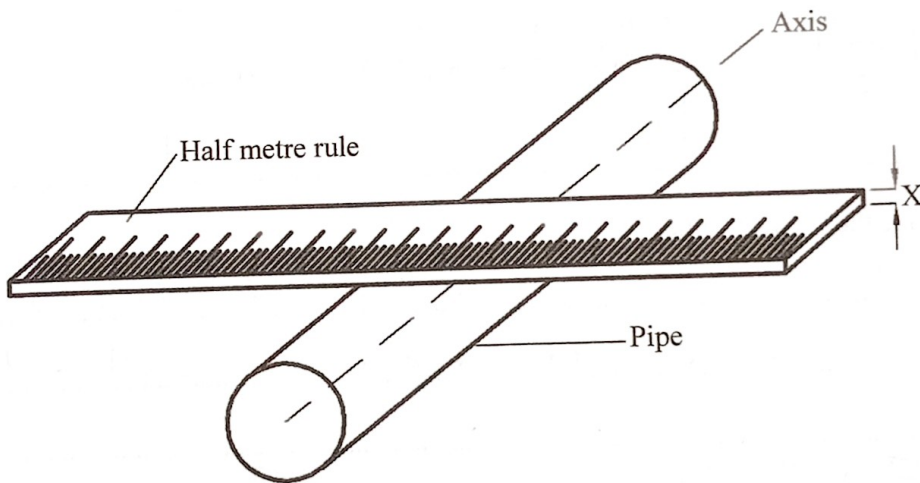


Figure 3 (b)

613
A133
Enhanced by Atikaschool.Org & Elimuspace.co.ke

- (i) Push one end of the balanced half metre rule slightly downwards and release it so that it oscillates up and down. Measure and record in **Table 3** the time for five complete oscillations.
- (j) Repeat the procedure in (g), (h) and (i) for the other pipes B and C. Complete **Table 3**.

(5 marks)

Table 3

	Pipe A	Pipe B	Pipe C
Diameter d (m)			
Time for five oscillations	12.60	10.60	9.80
Periodic time T (s)	✓ Correct evaluation	exact or to 4 s.f	all correct 1 mark
$Z = T \sqrt{\frac{3(d-x)}{2}}$	✓ Each value correctly evaluated $\frac{1}{2}$ mark to a max of 1 mark ✓ 4 s.f or exact ✓ Value of x must be in metres.		

+ 1 to 2 dt
@ 1 mark

- (k) Determine the average value of Z.

(2 marks)

- Statement of principle of averaging of students value - 1 mark
 - Correct evaluation exact or 4 s.f (ignore unit) - 1 mark

~~Eq~~
$$\frac{Z_1 + Z_2 + Z_3}{3}$$
 (principle of averaging shown)

If work is cancelled and replaced, mark the replaced one
 If work is cancelled and not replaced, mark the cancelled one.

THIS IS THE LAST PRINTED PAGE.

Enhanced by Atikaschool.Org & Elmuspace.co.ke

A133

