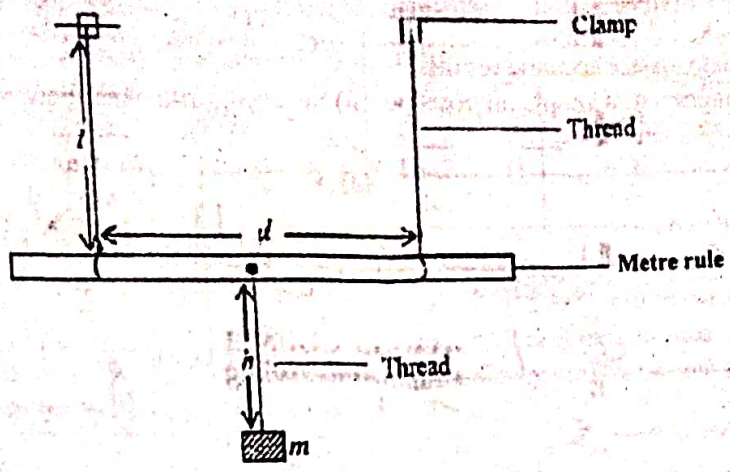


1.(a)

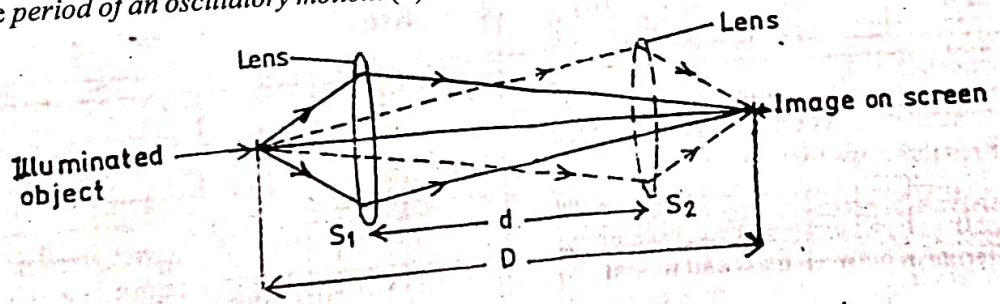


You are provided with a set of masses, two metre rules, a piece of thread, two retort stands and clamps, a stop watch, split corks and a weighing balance.

Use the diagram above as a guide to perform the experiment.

- (i) Measure and record the mass,  $M$ , of the metre rule.
  - (ii) Suspend the metre rule, whose mass has been measured, by means of two vertical strings of equal lengths,  $l = 70$  cm.
  - (iii) Make the separation between the threads,  $d = 80$  cm.
  - (iv) Suspend a mass  $m = 20$  g from the mid-point of the metre rule by means of a thread such that the distance between the mass and the rule,  $h = 15$  cm.
  - (v) Displace the ends of the metre rule in a horizontal plane in opposite directions. Release the rule to perform horizontal oscillations.
  - (vi) Determine the time,  $t$  for 20 oscillations.
  - (vii) Evaluate the period  $T$ ,  $T^2$  and  $T^2$ .
  - (viii) Repeat the procedure for four other values of  $m = 30$  g,  $50$  g,  $70$  g and  $100$  g keeping the values of  $h$ ,  $d$  and  $l$  constant. In each case, determine  $t$  and Evaluate  $T$ ,  $T^2$  and  $T^2$ .
  - (ix) Tabulate the results.
  - (x) Plot a graph with  $T^2$  on the vertical axis and  $m$  on the horizontal axis.
  - (xi) Determine the slope,  $s$ , of the graph.
  - (xii) State two precautions taken to ensure accurate results.
- (b) (i) Define the *period of an oscillatory motion*. (ii) State two differences between *mass* and *weight*.

2.



You are provided with an illuminated object, a lens, a screen, a lens holder and a metre rule.

Use the diagram above as a guide to perform the experiment.

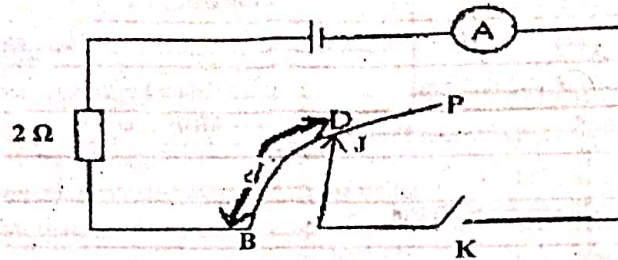
- (i) Determine the approximate focal length,  $f$ , of the lens by focusing a distant object on the screen.
- (ii) Place the illuminated object and the screen a distance  $D = 100$  cm apart.
- (iii) Place the lens at a position  $S_1$  to obtain a sharp image of the object on the screen. Note  $S_1$ .
- (iv) Move the lens to a position  $S_2$  to obtain another sharp image of the object on the screen. Note  $S_2$ .
- (v) Measure the distance,  $d$ , between  $S_1$  and  $S_2$ .
- (vi) Evaluate  $D^{-1}$ ,  $D^2$ ,  $d^2$  and  $\frac{d^2}{D^2}$ .
- (vii) Repeat the procedure for four other values of  $D = 90$  cm,  $85$  cm,  $80$  cm and  $70$  cm.

In each case, evaluate  $D^{-1}$ ,  $D^2$ ,  $d^2$  and  $\frac{d^2}{D^2}$ .

(viii) Tabulate the results.

- (ix) Plot a graph with  $\frac{d^2}{D^2}$  on the vertical axis and  $D^{-1}$  on the horizontal axis.  
 (x) Determine the slope,  $s$ , of the graph.  
 (xi) Given that  $s = 4k$ , determine  $k$ .  
 (xii) State two precautions taken to ensure accurate results.  
 (b) (i) Draw and label the ray diagram of a simple microscope. (ii) State two differences between a *real image* and a *virtual image*.

3(a)



You are provided with an accumulator, an ammeter, a  $2\Omega$  resistor, a key,  $K$ , a resistance wire  $BP$ , a crocodile clip,  $J$  and other necessary materials.

- (i) Connect the circuit as shown in the diagram above.  
 (ii) Use the crocodile clip to hold the resistance wire at  $D$  such that  $BD = d = 80\text{ cm}$ .  
 (iii) Close the key, read and record the ammeter reading,  $I$ . Evaluate  $I^{-1}$ .  
 (iv) Repeat the procedure for four other values of  $d = 70\text{ cm}, 50\text{ cm}, 40\text{ cm},$  and  $30\text{ cm}$ . In each case, record and evaluate  $I^{-1}$ .  
 (v) Tabulate the results.  
 (vi) Plot a graph with  $d$  on the vertical axis and  $I^{-1}$  on the horizontal axis.  
 (vii) Determine the slope,  $s$ , of the graph.  
 (viii) State two precautions taken to ensure accurate results.  
 (b) (i) State two factors on which the sensitivity of a moving-coil galvanometer depends. (ii) A resistance wire of diameter  $0.6\text{ cm}$  has a resistivity of  $1.0 \times 10^{-6}\ \Omega\text{m}$ . What length of the wire would be needed to make a  $4\ \Omega$  resistor?

### ANSWERS TOWASSCE SC 2021 PHYSICS 3 PRACTICAL ALTERNATIVE A

a(i)  $M = 50.0\text{cm}$

(ix) S/N	m(g)	t(s)	$T = \frac{1}{20}(s)$	$T^2(S^2)$	$T^{-2}(S^{-2})$
1.	20.0	30.00	1.50	2.2500	0.4444
2.	30.0	32.00	1.60	2.5600	0.3906
3.	50.0	35.00	1.75	3.0625	0.3265
4.	70.0	37.00	1.85	3.4225	0.2922
5.	100.0	40.00	2.00	4.0000	0.2500

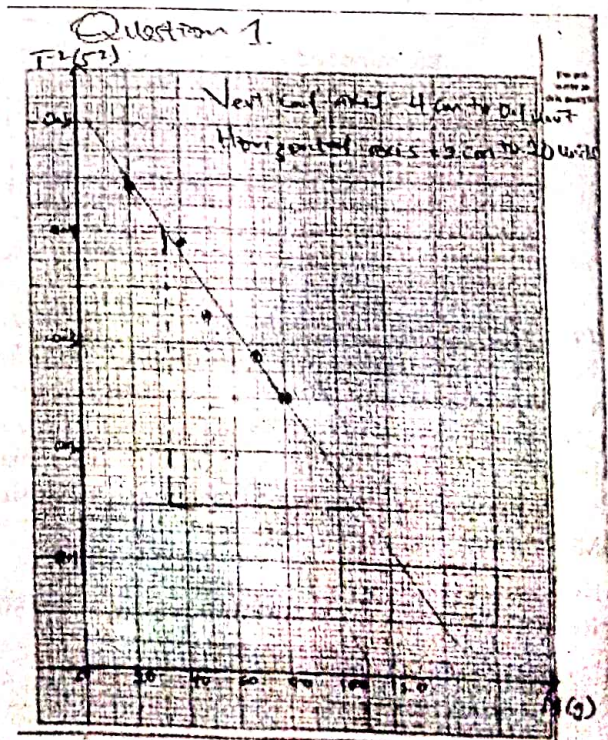
(xi) Slope,  $s = \frac{\Delta T^2}{\Delta m} = \frac{0.15 - 0.4}{112 - 34} = \frac{-0.25}{78} = -0.0032$

(xiii) Precautions: - Avoided parallax error while reading the metre rule; - Ensured threads were firm.

(b)(i) The period of an oscillatory motion is defined as the time taken by a body to make one complete oscillation.

(b)(ii) Differences between mass and weight

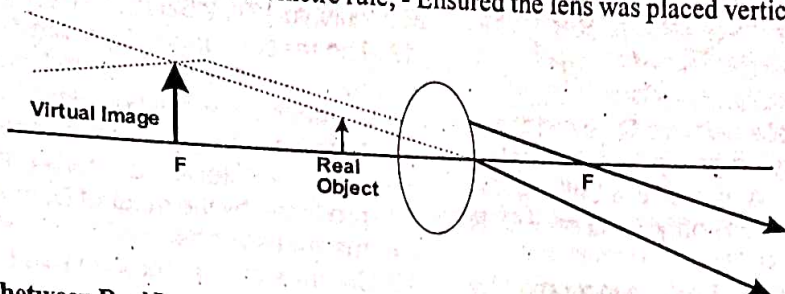
Mass	Weight
i. Mass is a scalar quantity	Weight is a vector quantity
ii. Mass is constant	Weight varies
iii. S.I. unit of mass is kg	S.I unit of weight is N



2.  $F = 20.0\text{cm}$

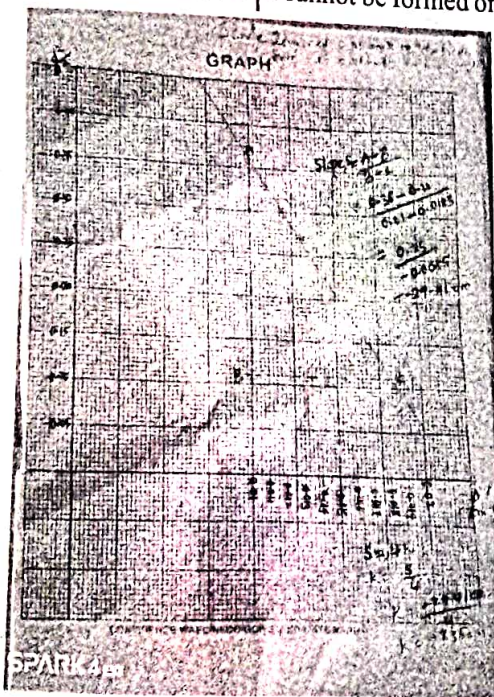
S/N	$\Delta(\text{cm})$	$S^2(\text{cm})$	$S^1(\text{cm})$	$d = S_1 - S_2(\text{cm})$	$\Delta^{-1}(\text{cm}^{-1})$	$\Delta^2(\text{cm}^2)$	$d^2(\text{cm}^2)$	$\frac{d^2}{\Delta^2}$
1	100.00	18.00	78.20	60.20	0.010	10000	3624.04	0.36
2	90.00	18.70	70.50	51.80	0.011	8100	2683.24	0.33
3	85.00	18.80	65.50	46.70	0.012	7225	2180.89	0.30
4	80.00	19.80	61.30	41.50	0.013	6400	1722.25	0.27
5	70.00	21.00	48.50	27.50	0.14	4900	756.25	0.15

(xiii) Precautions: - Avoided zero error on metre rule; - Ensured the lens was placed vertically/erect in its holder.  
 (b)(i)



(bii) Differences between Real Image and Virtual Image

Real Image	Virtual Image
1. It is inverted.	It is erect
2. It can be formed on a screen	It cannot be formed on a screen



(vii) From the graph, Slope,  $s = \frac{\Delta d^2}{\Delta \Gamma^{-1}} = \frac{71 - 20}{3 - 1.75} = \frac{51}{1.25} = 40.8 = 40.8\text{cmA}$  or  $0.408\text{Am}$ .

(xi) Precautions: - Zero error was avoided on the ammeter; - Ensured all terminals/connections were well tightened.

(b) Factors on which the sensitivity of a moving coil galvanometer depends on:

- i. Area of coil;    ii. Number of turns of coil.

(ii)  $p = 1.0 \times 10^{-6} \Omega\text{m}$ ,  $R = 4\Omega$ ,  $r = \frac{d}{2} \Rightarrow d = 0.6\text{cm} = 0.006\text{m}$   
 $r = \frac{0.006}{2} = 0.003$      $A = \pi r^2$

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

$$L = \frac{R \times A}{\rho} = \frac{4 \times 3.142 \times (0.003)^2}{1.0 \times 10^{-6}} = 113.04\text{m}$$

3.(iv)

S/N	$d(\text{cm})$	$I(\text{A})$	$I^{-1}(\text{A}^{-1})$
1.	80.0	0.30	3.333
2.	70.0	0.35	2.857
3.	50.0	0.40	2.500
4.	40.0	0.45	2.222
5.	30.0	0.50	2.000

