X STD SCIENCE PRACTICALS - PHYSICS

Exp No: 1 DETERMINATION OF WEIGHT OF AN OBJECT USING THE PRINCIPLE OF MOMENTS

Aim:

To determine the weight of an object using the principle of moments

Apparatus required:

A metre scale, a knife edge, slotted weights, thread

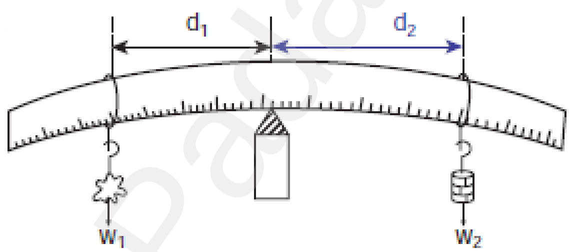
Formula:

$$\text{Unknown weight, } W_1 = \frac{W_2 \times d_2}{d_1} \text{ kg}$$

where W_2 is the weight in the wieght hanger(kg)

d_1 is the distance of known wieght(m)

d_2 is the distance of unknown wieght(m)



Procedure:

- ✓ A metre scale is supported at its centre of gravity by a knife edge.
- ✓ A known weight W2 and an unknown weight W1 are suspended from either side of the scale using the weight hangers.
- ✓ Fix the position of one weight hanger and adjust the position of the second weight hanger such that the scale is in equilibrium.
- ✓ Measure the distance d1 and d2 of the two weight hangers from the centre of the scale.
- ✓ The experiment is repeated for different positions of the unknown weight. Measure the distances.

Observation:

S.No	Weight in the wieght hanger, W_2 (kg)	Distance of known wieght, d_2 (m)	Distance of unknown wieght, d_1 (m)	$W_2 \times d_2$ (kg m)	Unknown weight, $W_1 = \frac{W_2 \times d_2}{d_1}$ kg
1	0.050	0.2	0.130	0.01	0.0769
2	0.100	0.2	0.255	0.02	0.0784
3	0.150	0.2	0.375	0.03	0.0800
Mean					0.0784

Calculation:

Moment of a force can be calculated using the formula

Moment of the force = Force x distance

Anticlock wise moment by unknown weight = $W_1 \times d_1$

Clockwise moment by known weight = $W_2 \times d_2$

$W_1 \times d_1 = W_2 \times d_2$

Unknown weight = $W_1 = \frac{W_2 \times d_2}{d_1}$

1. $W_2 = 0.050$ kg

   $d_2 = 0.2$ m

   $d_1 = 0.130$ m

   $W_2 \times d_2 = 0.050 \times 0.2 = 0.01$ kgm

   $W_1 = \frac{W_2 \times d_2}{d_1} = \frac{0.01}{0.13} = 0.0769$ kg

2. $W_2 = 0.100$ kg

   $d_2 = 0.2$ m

   $d_1 = 0.255$ m

   $W_2 \times d_2 = 0.100 \times 0.2 = 0.02$ kgm

   $W_1 = \frac{W_2 \times d_2}{d_1} = \frac{0.02}{0.255} = 0.0784$ kg

3. $W_2 = 0.150$ kg

   $d_2 = 0.2$ m

   $d_1 = 0.375$ m

   $W_2 \times d_2 = 0.150 \times 0.2 = 0.03$ kgm

   $W_1 = \frac{W_2 \times d_2}{d_1} = \frac{0.03}{0.375} = 0.0800$ kg

$$\text{Mean} = \frac{0.0769 + 0.0784 + 0.0800}{3} = \frac{0.2353}{3} = 0.0784 \text{ kg}$$

Result:

Using the principle of moments, the weight of the unknown body, $W_1 = 0.0784$ kg

Exp.No: 2 DETERMINATION OF FOCAL LENGTH OF A CONVEX LENS

Aim:

To determine the focal length of a convex lens using

1. Distant object method 2. u v method

Apparatus required:

A convex lens,stand,wire gauze object,screen and measuring scale

Formula:

$$f = \frac{uv}{u+v} \text{ cm}$$

where

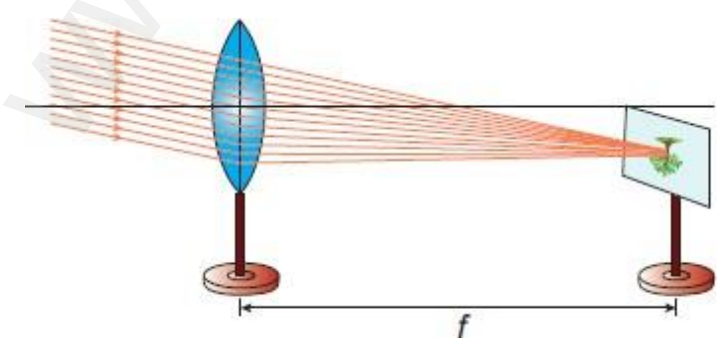
f is the focal length of the convex lens(cm)

u is the distance between the object and the lens(cm)

v is the distance of the image from the convex lens(cm)

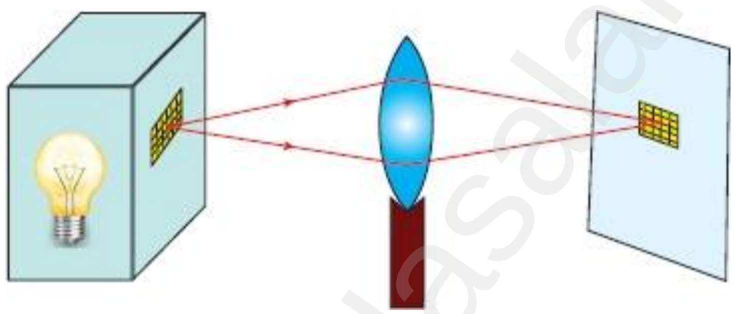
1. Distant Object Method:

- ✓ Fix the given convex lens vertically on the stand and place it on the table near an open window of the laboratory.
- ✓ Locate a distant object (tree or building) through the open window.
- ✓ Place the screen behind the convex lens and adjust the position of the convex lens and the screen so as to get a sharp, inverted and diminished image.
- ✓ Measure the distance between the screen and the convex lens with the help of the measuring scale.
- ✓ This distance is equal to the approximate focal length of the convex lens (f)



2. uv - Method:

- ✓ Fix the given convex lens vertically on the stand and place it on the table.
- ✓ Placethe wire gauze object on the left side of the convex lens (say at a distance greater than 2f).
- ✓ Measure the distance between the object and the lens (u).
- ✓ Place the screen on the right side of the convex lens and adjust its position to get a sharp, inverted and diminished image.
- ✓ Measure the distance between the screen and the lens (v).
- ✓ Repeat the same procedure, by changing the distance of the object (u) and tabulate your observations.



Observation:

Focal length of the convex lens(By distant object method) is f = 20 cm

2f = 40 cm

S.No	Size of the Image	Position of the object	Distance between the object and the lens (u) cm	Distance between the screen and the lens (v) cm	Focal length of convex lens, $f = \frac{uv}{u+v}$ cm
1	Diminished	u > 2f	45	38	20.60
2			43	39	20.45
3	Same size	u = 2f	40	40.5	20.12
4	Magnified	u < 2f	39	43.5	20.56
5			37	47	20.70
				Mean	20.49

Calculation:

$$f = \frac{uv}{u+v} \text{ cm}$$

1. u = 45 cm, v = 38 cm $f = \frac{45 \times 38}{45 + 38}$ $= \frac{1710}{83} = 20.60$	2. u = 43 cm, v = 39 cm $f = \frac{43 \times 39}{43 + 39}$ $= \frac{1677}{82} = 20.45$
3. u = 40 cm, v = 40.5 cm $f = \frac{40 \times 40.5}{40 + 40.5}$ $= \frac{1620}{80.5} = 20.12$	
4. u = 39 cm, v = 43.5 cm $f = \frac{39 \times 43.5}{39 + 43.5}$ $= \frac{1696.5}{82.5} = 20.56$	5. u = 37 cm, v = 47 cm $f = \frac{47 \times 37}{47 + 37}$ $= \frac{1739}{84} = 20.70$
$\text{Mean} = \frac{20.60 + 20.45 + 20.12 + 20.56 + 20.70}{5} = \frac{102.43}{5} = 20.49 \text{ cm}$	

Result:

The focal length of the given convex lens

1. By distance object method f = **20 cm**

2. By 'uv' method f = **20.49 cm**

Exp. No: 3 DETERMINATION OF RESISTIVITY

Aim:

To determine the resistivity of the material of the given coil of wire.

Apparatus required:

A coil of wire, screw gauge, a metre scale, battery, key, ammeter, voltmeter, rheostat and connecting Wires.

Formula:

The resistivity of the material of the coil of wire is

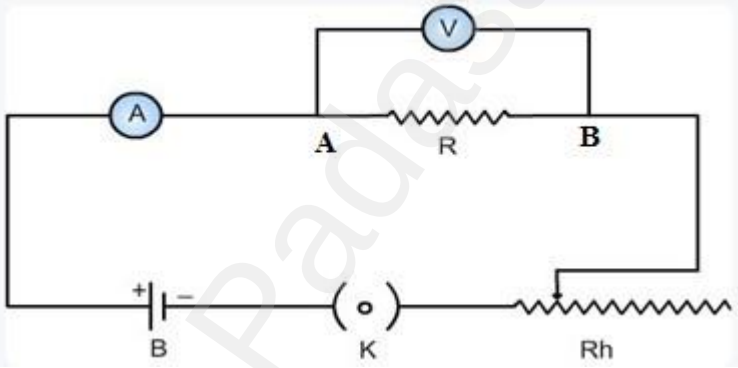
$$\rho = \frac{R\,A}{L}\ \Omega\ m$$

Where A is the area of cross section of the wire (m^2)

L is the length of the coil of wire (m)

` R is the resistance of the coil of wire (ohm)

Circuit Diagram:



Procedure:

- ✓ Connect the battery, ammeter, given wire, rheostat and key
- ✓ in series, as shown in the circuit diagram.
- ✓ Connect the voltmeter in parallel to the unknown resistor.
- ✓ Close the key and hence the circuit is closed.
- ✓ Adjust the rheostat such that the ammeter reads a current of 0.5 ampere.
- ✓ Note down the potential difference across the resistor as shown by the voltmeter.
- ✓ Adjust the rheostat and change the current in steps of 0.5A (that is 0.5A, 1.0A, 1.5A, etc.).
- ✓ For each current, note down the corresponding potential difference as shown by the voltmeter.

- ✓ Tabulate the observations.
- ✓ Measure the diameter of the wire using a screw gauge.
- ✓ Measure the length of the coil using metre scale

Observations:

(i) To find the resistance:

S. No	Ammeter reading-I (Ampere)	Voltmeter reading-V (Volt)	Resistance = V/I (Ohm)
1	0.1	0.5	5
2	0.2	1.0	5
3	0.3	1.5	5
MEAN			5

Calculation:

1. I = 0.1 A, V = 0.5 V R = V/I = 0.5/0.1 = 5 Ω	2. I = 0.2 A, V = 1.0 V R = V/I = 1.0/0.2 = 5 Ω
3. I = 0.3 A, V = 1.5 V R = V/I = 1.5/0.3 = 5 Ω	$\text{Mean} = \frac{5+5+5}{3} = \frac{15}{3} = 5\ \Omega$

(ii) To find the diameter of the wire using screw gauge:

Least count = 0.01mm Zero Correction = 0

S. No	Pitch Scale reading PSR (mm)	Head scale Coincidence HSC (div)	Head scale reading, HSR=HSC xLC (mm)	Total reading = PSR + HSR (mm)
1	0	52	0.52	0.52
2	0	50	0.50	0.50
3	0	54	0.54	0.54
Mean Diameter				0.52

Calculation:

1. HSR = HSC x LC = 52 x 0.01 = 0.52 PSR +HSR = 0+0.52 = 0.52 mm	2. HSR = HSC x LC = 50 x 0.01 = 0.50 PSR +HSR = 0+0.50 = 0.50 mm
3. HSR = HSC x LC = 54 x 0.01 = 0.54 PSR +HSR = 0+0.54 = 0.54 mm	$\text{Mean} = \frac{0.52+0.50+0.54}{3} = \frac{1.56}{3} = 0.52\ \text{mm}$

(iii) To find the resistivity of the material of the wire

Radius of the wire, $r = \frac{\text{diameter}}{2} = \frac{0.52}{2} = 0.26 \text{ mm} = 0.26 \times 10^{-3} \text{ m}$

Area of cross section of the wire, $A = \pi r^2$

$$= \frac{22}{7} \times (0.26 \times 10^{-3})^2 = 0.21245 \times 10^{-6} \text{ m}^2$$

Length of the wire L = 1 m.

Resistivity of the wire, $\rho = \frac{R A}{L} \Omega \text{ m}$

$$= \frac{5 \times 0.21245 \times 10^{-6}}{1} = 1.06225 \times 10^{-6} \Omega \text{ m}$$

Result:

The resistivity of the material of the wire = $\mathbf{1.06225 \times 10^{-6} \ \Omega \text{ m}}$