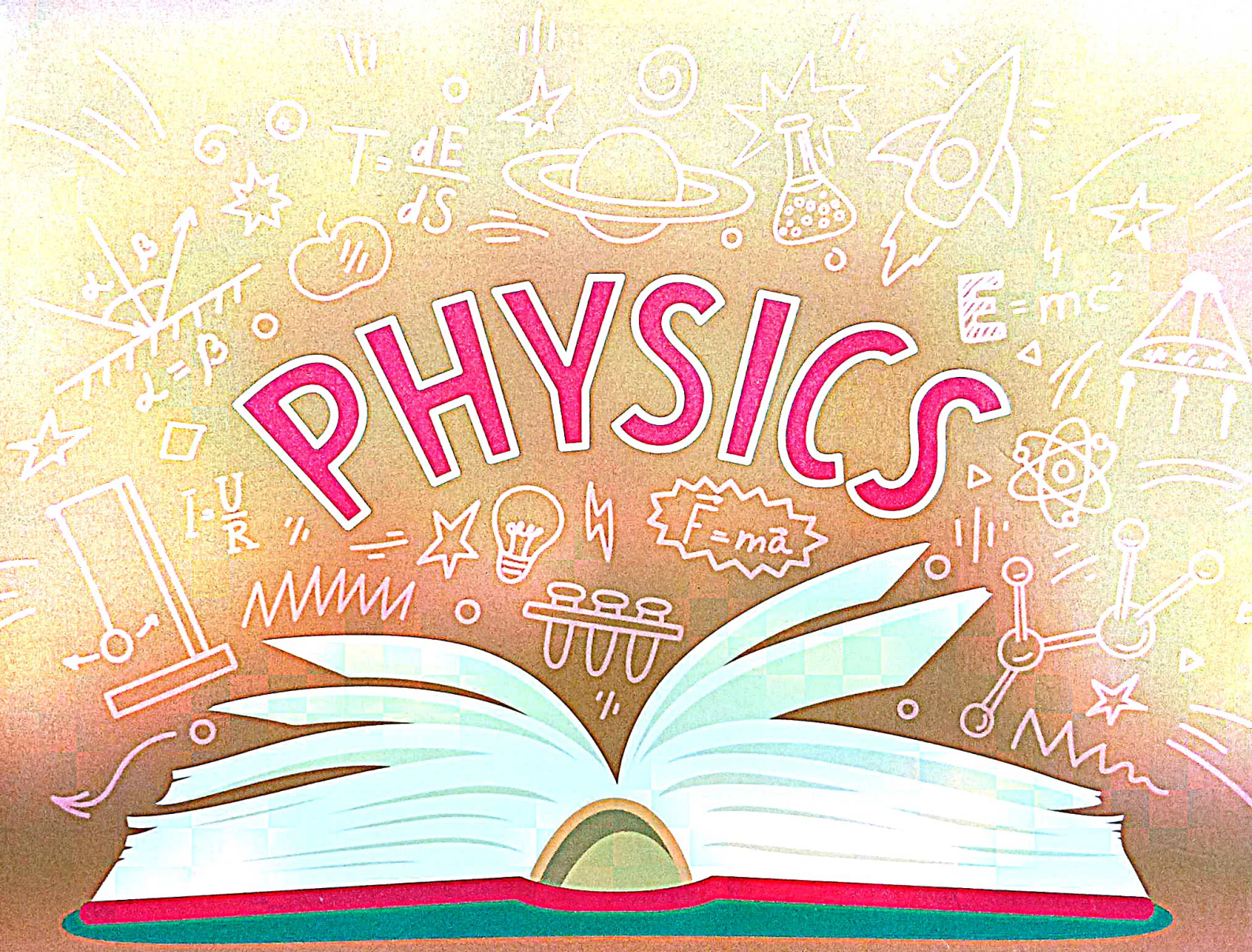
Enduring Value

classmate



Practical Exercise Book

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Expt. No. EXPERIMENT - 01 Date

Page No. 01

- **Aim:-** To determine refractive index of a glass slab using a travelling microscope.

Apparatus Required:-

- Three glass slab of different thickness but same material.
- A travelling microscope.
- Lycopodium powder.
- A slab of piece of transparent material with rectangular faces.

- **Theory:-**

To determine refractive index of a glass of a glass slab using a travelling microscope 2.

- **Diagram:-**

To determine refractive index of a glass of a glass slab using a travelling microscope 2.

- **Procedure:-**

Adjustment of travelling microbes:-

1. Place the travelling microscope (m) on the table near a window so that sufficient light fallen on it.

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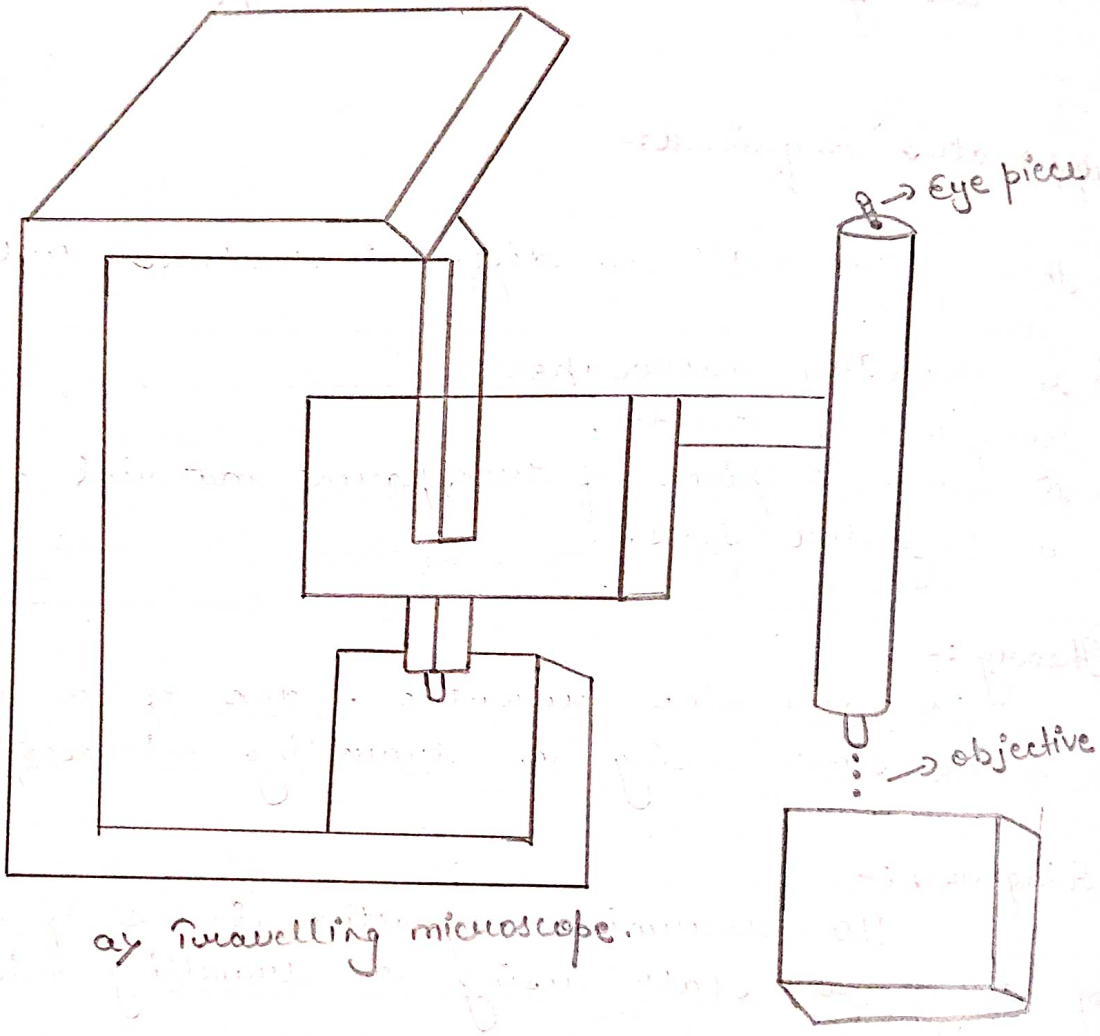


a) Travelling microscope.

2. Adjust the travelling screws so that the base of the microscope become horizontal.

3. Make microscope horizontal. Adjust the position of the eye piece so that the cross wires are clearly visible.

4. Determine the vernier constant of the vertical scale of the microscope.

Other Steps :-

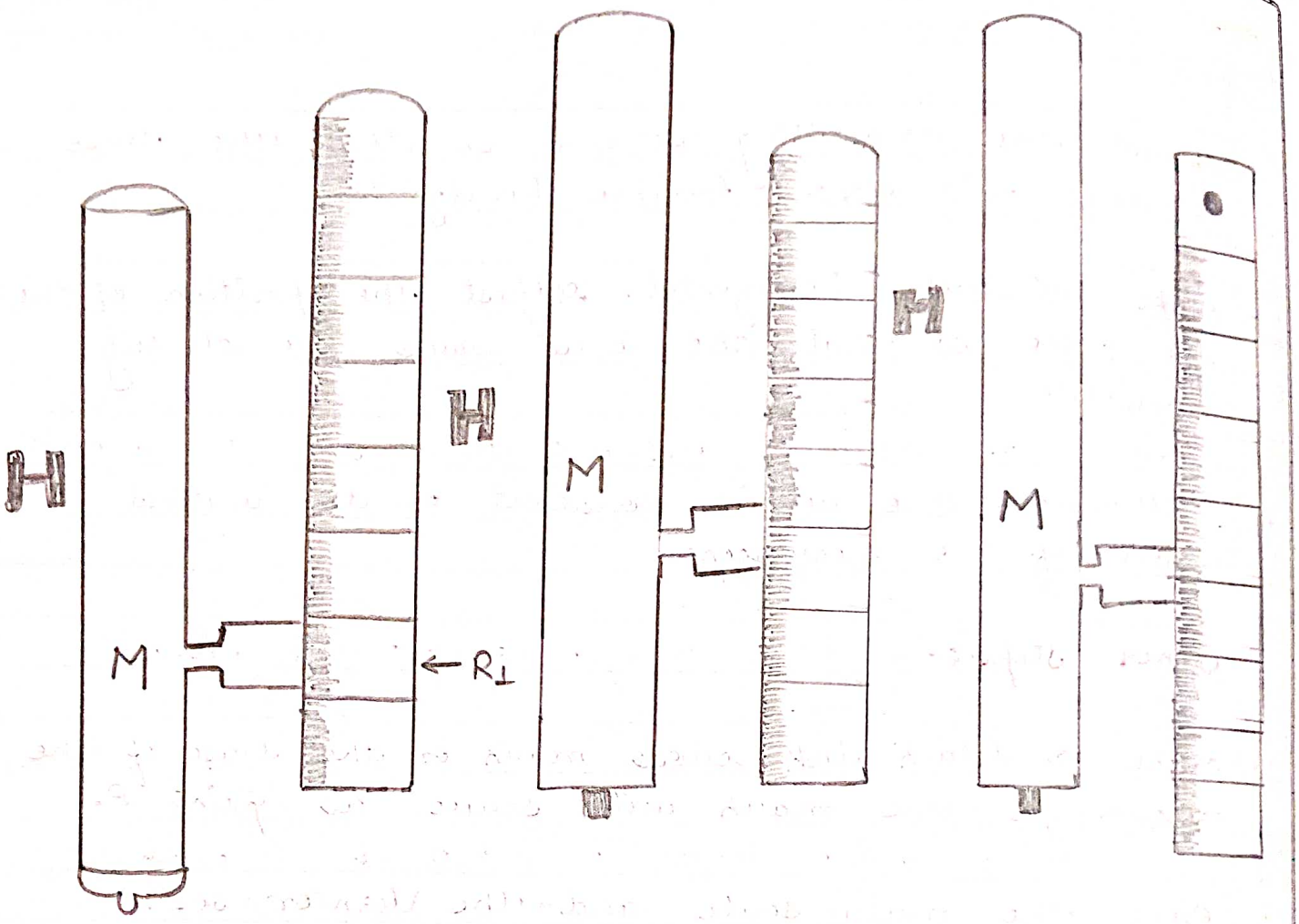
5. Make a black ink cross mark on the base of the microscope the mark will serve as point P.

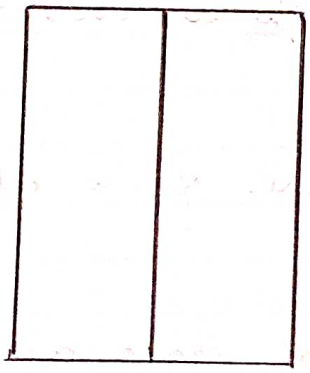
6. Note the main scale and the Vernier scale reading (R) on the vertical scale.

7. Place the glass slab of least thickness over the mark P.

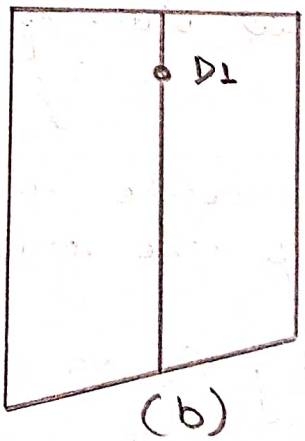
8. Raise the microscope upwards and focus it on image P of the cross mark.

9. Note the reading R_2 on the vertical scale as before (step).

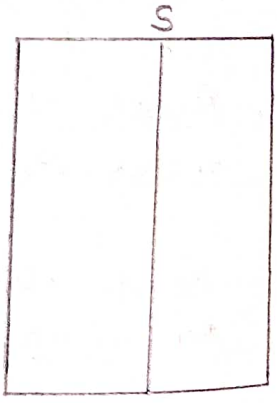




(a)



(b)



(c)

Real and apperent thickness

10. Sprinkle a few particles of sodium powder on the surface of the glass slabs.

11. Raise the microscope further. Upload and focus it on the the particle near S.

12. Note the reading R_3 on the vertical scale again (step 7).

13. Repeat above step R_3 on the vertical other glass slab of more thickness.

14. Record observation in labour grain as given below.

- Observation and Calculation :-

  Vernier constant least counts for vertical scale of microscope.

$$\text{Mean}(n) = \frac{n_1 + n_2 + n_3}{3}$$

- Results :-

  The ratio $\frac{R_3 - R_1}{R_3 - R_2}$ is constant.

It gives the refractive index of the material of the glass slab.

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Sl. no.	Reading on vtel scale when microscope is fece--don			Real thickness $(R_3 - R_1)$ cm	Apparent thickness $(R_3 - R_2)$ cm	Refractive index $n = \frac{R_3 - R_1}{R_3 - R_2}$
	cross mark without slap R_1 (cm)	Crossmark with slap R_2 (cm)	eycaudim Pendon R_3 (cm)			
1.	4.35	5.078	6.2	1.85	1.122	
2.	4.46	5.128	6.05	1.59	1.87	

- Precaution :-

(i) In microscope the parallel should be properly removal.

(ii) The microscope should be moved in upper direction only to avoid back last error.

- Sources of errors :-

The microscope scale may be properly carifuated.

Date _____

Expt. No. _____ EXPERIMENT - 02 Page No. 05

- Aim :- To find the focal length of a concave mirror by using u-v method.

- Material used :-

1. Concave mirror.
2. Screen.
3. Meter Scale.
4. Stand.
5. Illuminated wire gauze.

- Procedure :-

– Fix the concave mirror on the stand and now put the stand in front of the screen in such a way that the image of the object should be visible on screen.

– Measure difference b/w mirror and the screen using a metre scale. The length b/w screen and mirror is the focal length (f) of the mirror.

– Now place the mirror in front of an illuminated wire gauze and it could act as an object.

Now fix the mirror at the distance you home which is equal to 1.5 of from the wire gauze.

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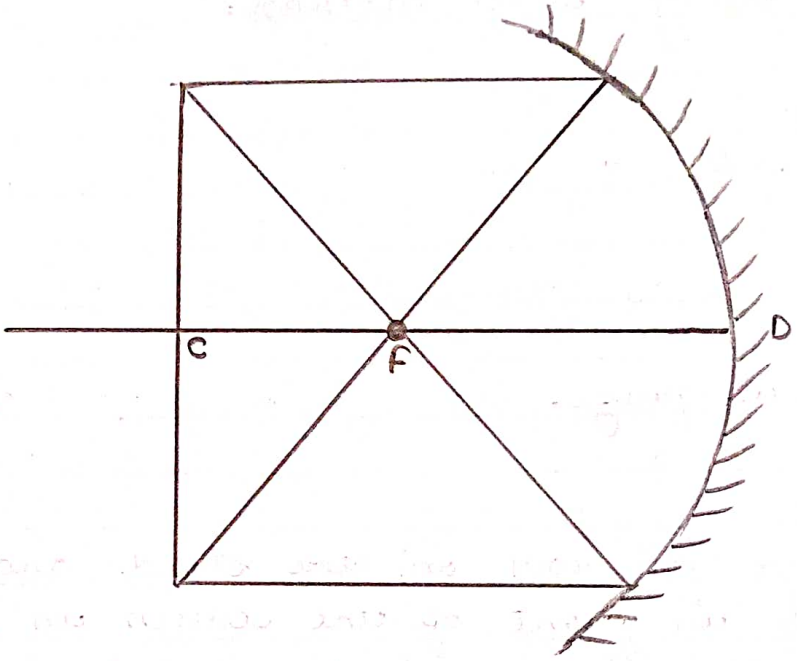

F = main focus
PF = focal length
cp = Radius of mirror.

- Place the screen in front of a mirror in such a way. That the reflection of the image lies on the screen. (V)

- Record the values of u and v in a tap water format.

- Now calculated the focal length of a concave mirror by using the reflection of $uv/(u+v)$

- Repeat the experiment to obtain different values of you and each time measure we and record in the table.

• Calculation :-

Spherical mirror are those whose spherical surface from part of hollow sphere:

Spherical mirror are of two type:-

Concave mirror in which the reflection of light take places from the inner hollow surface.

Convex mirror in which the reflection of light takes place from the other bulb surface.

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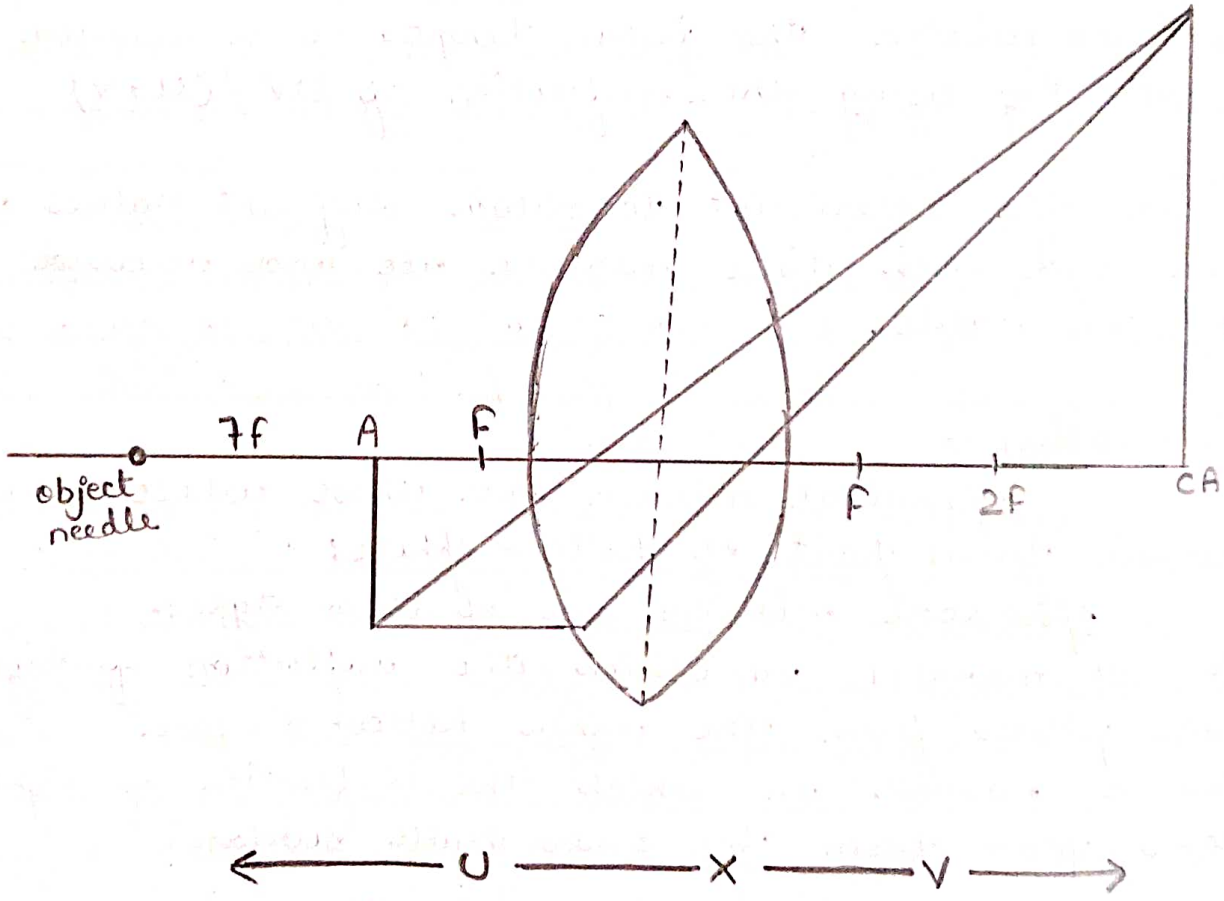

→ Focal length of convex lens.

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Expt. No. _____ **EXPERIMENT-03** Page No. 07

- **Aim :-** To find the focal length of convex lens by plotting graphs b/w u and v or b/w 1/u and 1/v.

- **Apparatus Required :-**

- An optical bend with three uprights.
- A convex lens with lens holder.
- Two optical needles.
- A knitting needle.
- A half meter scale.

- **Theory :-**

The relation between u, v and for a convex lens is $\frac{1}{f} = \frac{1}{v} \cdot \frac{1}{u} = \frac{1}{c} = \frac{u-v}{uv}$

$$\Rightarrow F = \frac{uv}{v-v}$$

where, F = focal length of convex lens.
u = Distance of object needles from optical centre of the lens.

- **Procedure :-** To find rough focal length.

1. Mount the concave mirror in mirror holder.
2. Go out in the open and face the mirror towards distant tree or building.
3. Obtain the image of the tree on the building on a white painted wall and move the mirror forward and backward to get a sharp image on the wall.

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4. Measure the distance b/w the mirror and the wall this will be equal to the rough focal length of the mirror.

5. Clamp the holder with lens in a fixed upright and keep the upright at 50 cm mark.

6. Adjust the lens such that its surface is vertical and perpendicular to the length of the optical bench.

7. Keep the upright fixed in this position throughout.

8. Take the tube optical move needle as object needle mount in outer laterally moveable upright near zero end.

9. Take the thin optical move the object needle upright and clamp 27 at a distance needle 1.5 an times the obtain focal length of the lens.

10. Adjust height of the object needle to make its tip lie on, horizontal line through the optical centre of the lens.

11. Note the position of the index mark on the base of the object needle upright.

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S.No OBJECTS	Position of			observed distance		correct distance		$\frac{1}{u}$ cm^{-1}	$\frac{1}{v}$ cm^{-1}
	obj. Needle A (cm) 2a	Lens O (cm) 2b	Image (cm) (3a)	OA = u (cm) (3a)	OC = V (cm) (3b)	u cm 4a	v cm 4b	5	6
1.	14.5	50	90	15.5		36	40	0.027	0.025
2.	17	50	91.6	20.5		33	42.1	0.029	0.023
3.	145	50	94.6	25.5		31	44	0.032	0.022
4.	20.7	50	95.4	24.5		29.8	44.9	0.032	0.022

To set the image needle:-

12. With left eye closed see with the right open eye from the other end of the optical bench. An erected and enlarged image of the image of the image must lie in the middle on the lens.

13. Mount the thick optical needle in the fourth upright near the other end of the optical bench.

14. Adjust the height of the image needle so that it's tip is seen in the line with the tip is the other end of the optical bench.

15. Move the eye towards right the tips will get seperated the image tip and the image needle tip have parallax.

16. Remove the parallax tip do tip.

17. Note the position of the index mark on base of the image needle upright.

18. Record the position of the lens, the object needle and the image needle in the table against observation 2.

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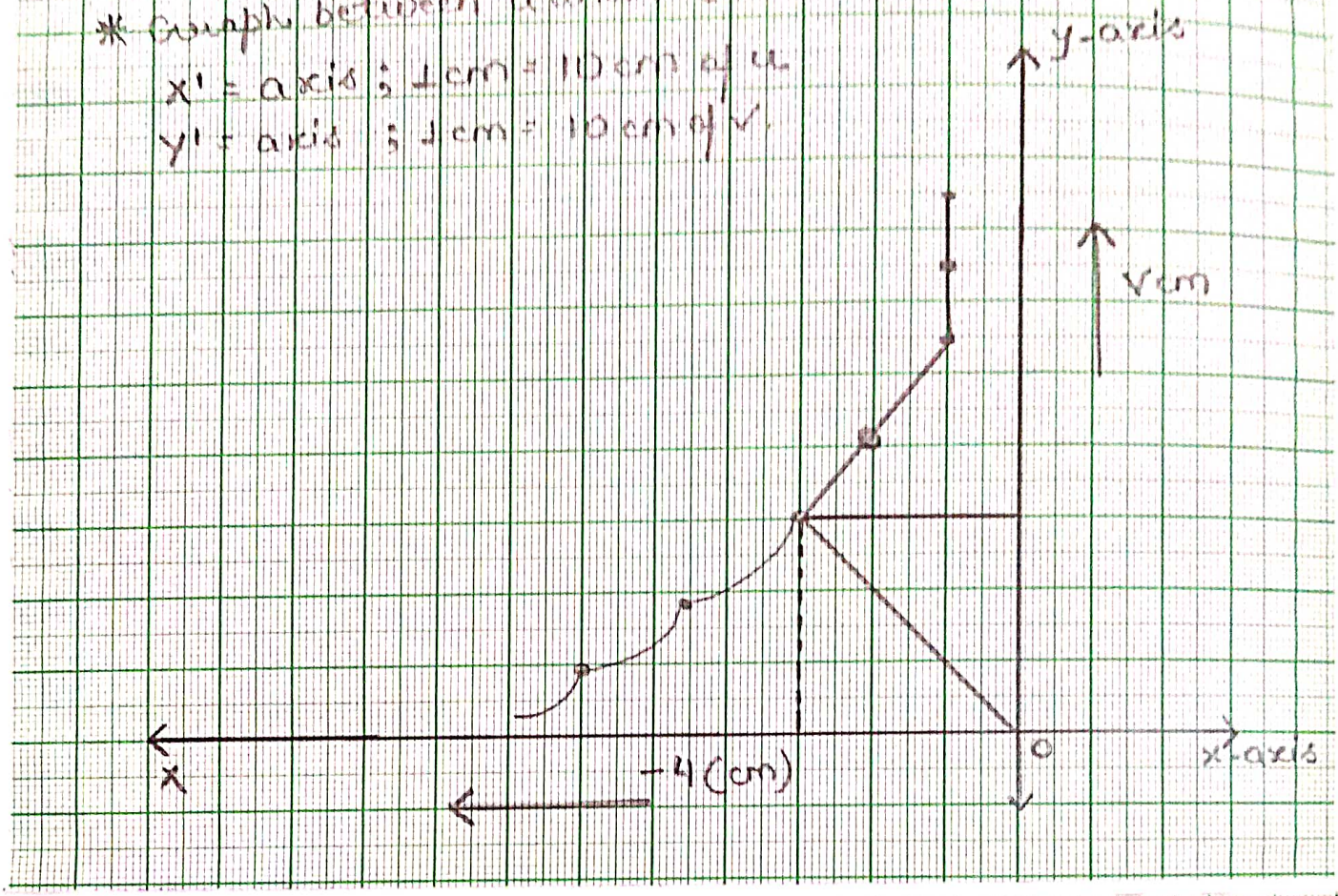
* Graph between u and v graph.

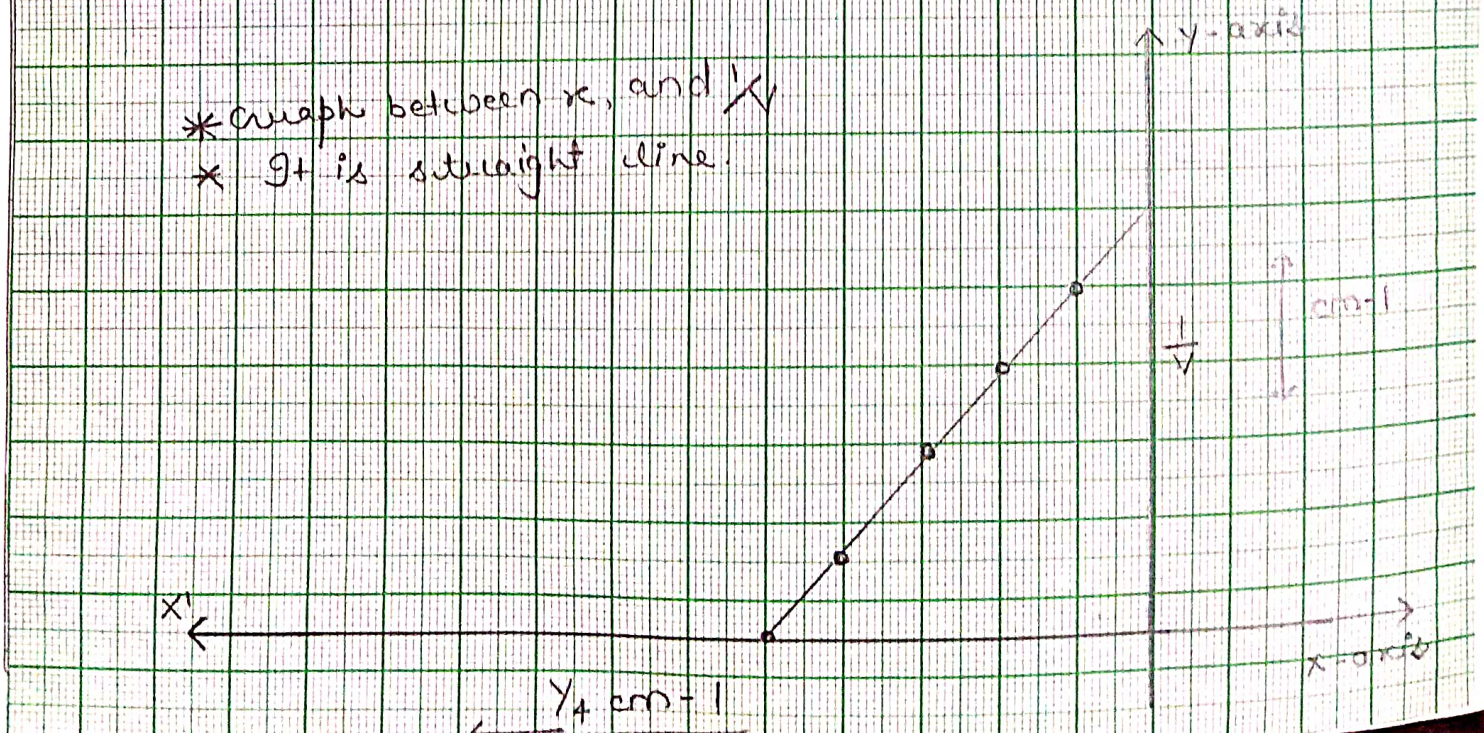
x' = axis ; 1 cm = 10 cm of u

y' = axis ; 1 cm = 10 cm of v.



* Graph between x, and 1/v

* It is straight line.



- **Observation :-**

Rough focal length of given convex lens = 16 cm. Actual length of the knitting needle $x = 22$ cm observed distance b/w the object needle and lens when knitting needle is placed b/w them $y = 22$ cm. Index correction for the object distance u,

$$x - y = 0 \text{ cm}.$$

Index correction for the image distance V,

$$x = 0 \text{ cm}.$$

- **Calculation :- (u-v graph)**

The value of u and v will be same for point. A must be (2F, 2F), because for a convex lens when (u = 2F, V = 2F).

Hence, AB = AC = 2F or OC = OB = 2F,

$$F = \frac{OB}{2} \text{ and } F = \frac{OC}{2}$$

(2.2) 1/u and 1/v graph :-

The focal length $F = 1/OP = 1/OQ$

(2.3) Another u-v graph :-

Draw straight line joining u, with V_1, V_2 and V_2 V_3 with V_3 etc.

These lines will intersect at point K as shown in graph.

then F = OL = OM.

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- Result :-

The focal length of the given convex lens as determined from.

1. Focal length from $f = \frac{uv}{u-v}$
2. The u-v graph = 15.1 cm
3. The u-v graph = 15.2 cm (by u-v method)
4. The $1/u - 1/v$ graph = 15.38 cm.

- Precaution :-

— Index correction for u and v should be applied.
— The object needle should be placed at such as distance that only real, inverted image of it is formed.
— Tips of the object and image needle should be lie at the same height as the centre of the lens.
— Parallax removal may not be perfect.
— The upright may not be vertical.

- Sources of the error :-

a) The upright may not be vertical.

b) Parallax removal may not be perfect.

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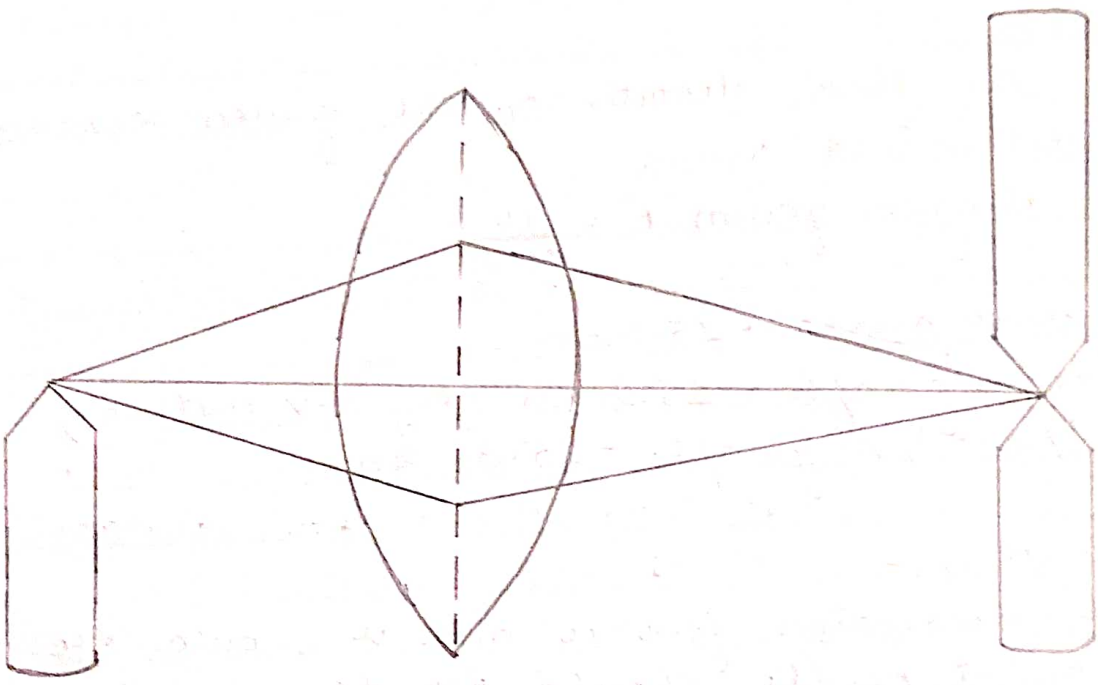

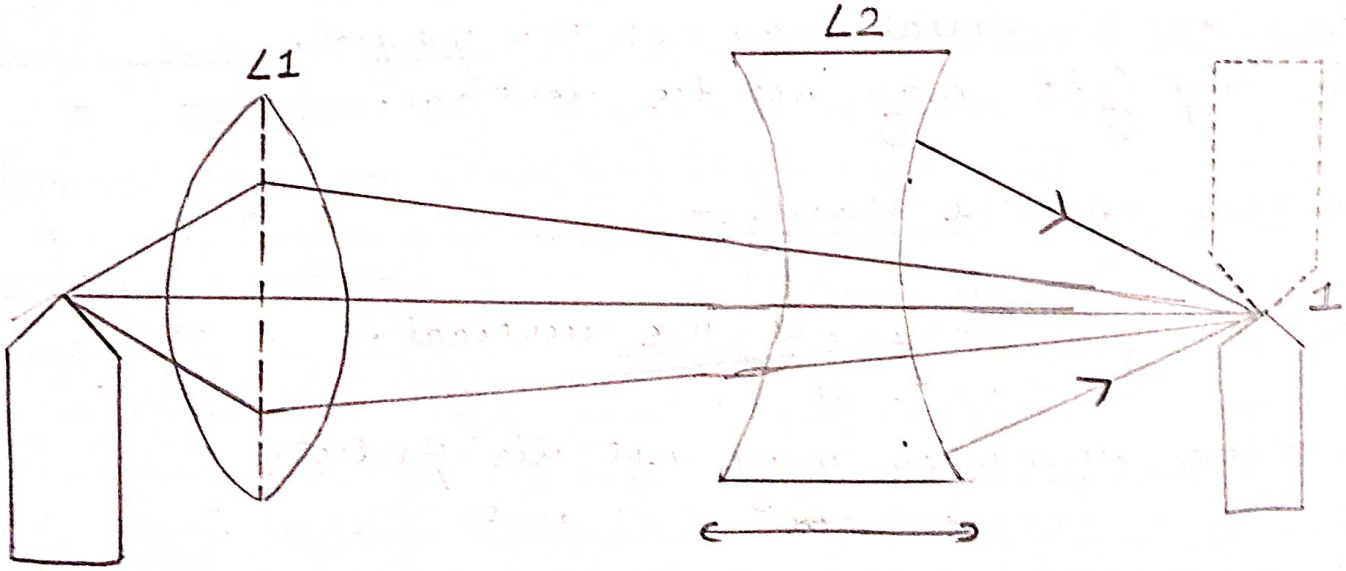

Focal length is a concave lens.

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Expt. No. _____ EXPERIMENT - 04 Page No. 12

- Aim :- To find the focal length of concave lens using a convex lens.

- Apparatus Required :-

- An optical bench with four upright.
- A convex lens.
- A concave lens.
- Two optical holder needs.
- Two lens holder.
- A lentling needle and a half metre scale.

- Theory :- From lens formula

We have $F = \frac{UV}{U-V}$ where, f = focal length of Concave lens.

U = Distance of a 9 gram optical centre of lens 12.

V = Distance of 9 gram optical centre of lens 12.

- Procedure :- To determine rough focal length of convex lens.

1. Mount the convex lens in lens holder.
2. Count in the oper face the lens towards distant tree or building.

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S.No of obj (1)	Position of					observed		corrected		$F = \frac{uv}{u-v}$ (cm) (5)
	O	4a	I	Igat	I	4=102	V=102	u	v	
	cm 2a	0 cm 2b	OL cm 2c	cm 2d	cm 2e	cm 3a	cm 3b	cm 4a	cm 4b	
1.	34.5	50	96.5	12.5	91.2	23.8		14.5	13.8	$F_1 = 25.52$
2.	32.9	50	91.4	78.7	94.8	39		4.7	11.2	$F_2 = 23.4$
3.	32	50	95	81.5	98.7	45		11.8	11.3	$F_3 = 23.21$

3. Obtain the image of the tree on the building on a white painted wall and the lens forward backward to get a sharp image on the wall.
4. Measure the distance b/w the lens and the wall this will be equal to the rough focal length of the mirror.

To set the convex lens :-

5. Follow step 2 to 4 of experiment to set the object needle.
6. Follow step 5 to 8 of experiment to set the image needle at d.
7. Follow step 2 to 27 of experiment to set the concave lens.
8. Set the concave lens surface in same manner of concave lens surface with principle areal of the lens coinciding.

To set the image needle at 9.

9. Repeat step 4 to 5 of the expression experiment.

- Observation :- Rough focal length of convex lens actual length of the knitting needle observed distance b/w the concave lens and image needle when knitting needle is placed b/w then u=

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Index correction of u as $v = x - y$.

- Calculation :-

1. Find the difference of position of d_2 and 9 and write it as observed u in column 3a.

Find difference of position of d_2 and 9 and write it as observed v in column 3b.

Apply index correction and write corrected values of u and v in column 1a and 1b.

Calculated $f = \frac{uv}{u-v}$ and write in column.

Take mean of different value of as recorded in column 5.

$$\text{Mean } f = \frac{f_1 + f_2 + f_3}{3}$$

$$= \frac{29.52 + 23.4 + 23.4}{3}$$

$$= 25.44 \text{ cm.}$$

- Result :-

To focal length of the given concave lens.

- Precautions :-

1. Focal length of the convex lens should be less than the focal length of concave lens, so that the

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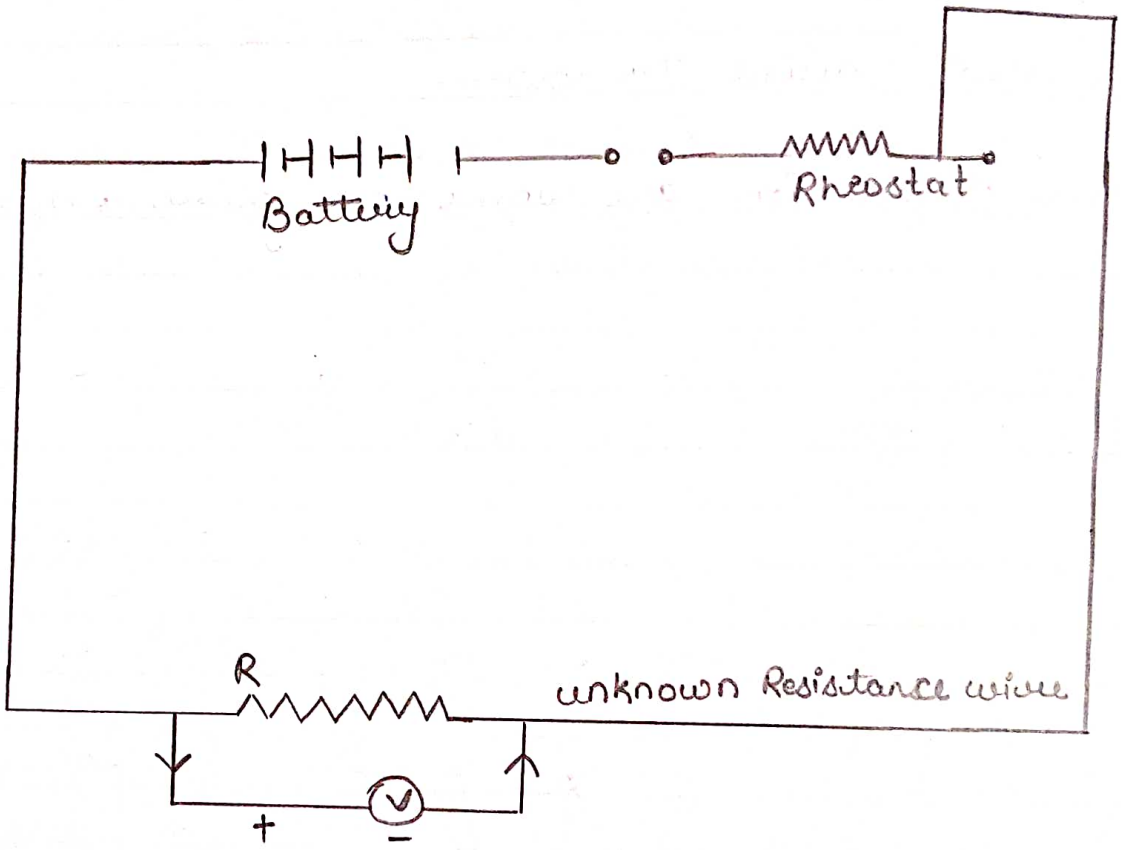
combination is convex lens.

The lens must be clean.

Other precaution are same as given in experiment.



— Circuit Diagram

Date _____

Expt. No. _____ EXPERIMENT - 05 Page No. 16

- Aim :- Determine the resistivity of wires using V-I curve.

- Apparatus Required :-

- Almost 100 cm long resistance wire of about 10 ohm resistance in the form of coil.
- A battery elimination or an accumulator of 2 dry cell (0 to 3V).
- DC voltmeter (range 3V).
- DC ammeter (range 0-3A).
- One plug key.
- Thick connecting wires.
- Sand paper etc.

- Theory :-

a) Working formula :- Ohm's law states that the ratio of potential difference b/w any two points of a conductor to the electric current flowing through it is constant, provided the physical conditions temperature, pressure etc. remain constant.

$V \propto I$, where, I = current

V = potential difference.

$R = \frac{V}{I}$ constant.

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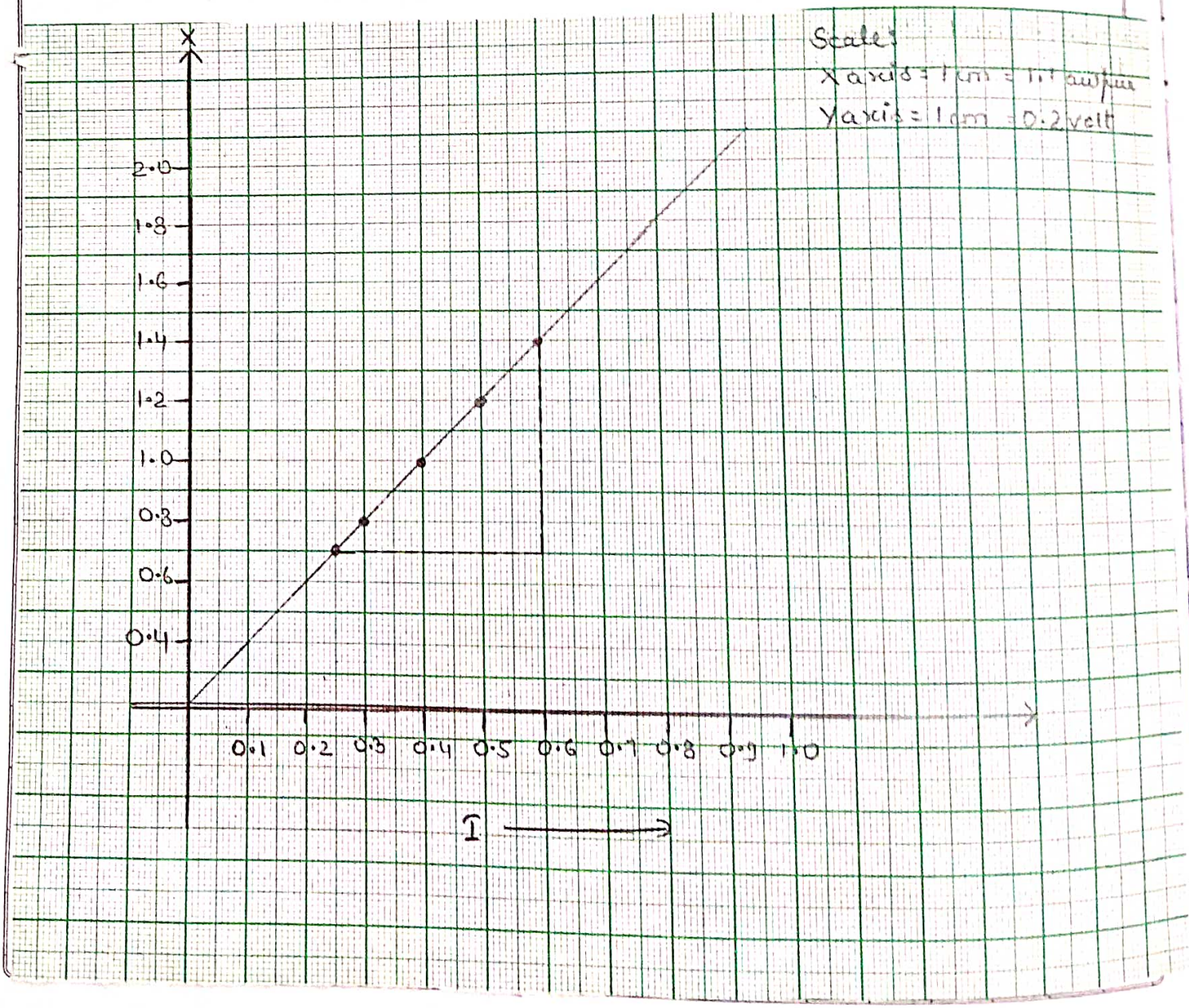
$$\text{Mean} = \frac{1.8 + 2.0 + 2.4 + 2.7 + 1.7 + 1.9}{6}$$

$$= \frac{11.9}{6} = 1.98\ \Omega$$

$$\text{Resistance per km} = \frac{R}{L} = \frac{1.98}{30} = 0.066\ \Omega\ \text{km}.$$



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• Observation :-

1. Range of instruments

Ammeter = 0 to 10A

Voltmeter = 0 to 1V

2. Least count of

Ammeter scale = 0.05 division.

Voltmeter scale = 0.05 division.

3. Zero errors of correction = 0

Zero errors of ammeter = 0

Zero errors of voltmeter = 0

4. Length of the resistance wire L = 30 cm.

• Calculation :-

1. Calculation values of shape of V-I graph slope.

$$= \frac{\Delta V}{\Delta I}$$

$$R = \frac{R_1 + R_2 + R_3 + R_4 + R_5 + R_6}{6}$$

$$= 198\ \Omega$$

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2. Resistance per unit length = $\frac{R}{\ell} = \frac{1.98}{30}$

$= 0.66\ \Omega\ cm^{-1}$

- **Result:-**

Resistance per unit length = $0.666\ \Omega\ cm^{-1}$

- **Precautions:-**

1. The end of the wire should be neat and clean.
2. The connections should be tight.
3. The current should be passed for a short interval of time.
4. A low resistance rheostat must be used.

- **Sources of errors:-**

1. The connections might be loose.
2. High resistance rheostat may be used.
3. The wire may not have uniform thickness.
4. The screw gauze may have fault like backlash error and wrong pitch.

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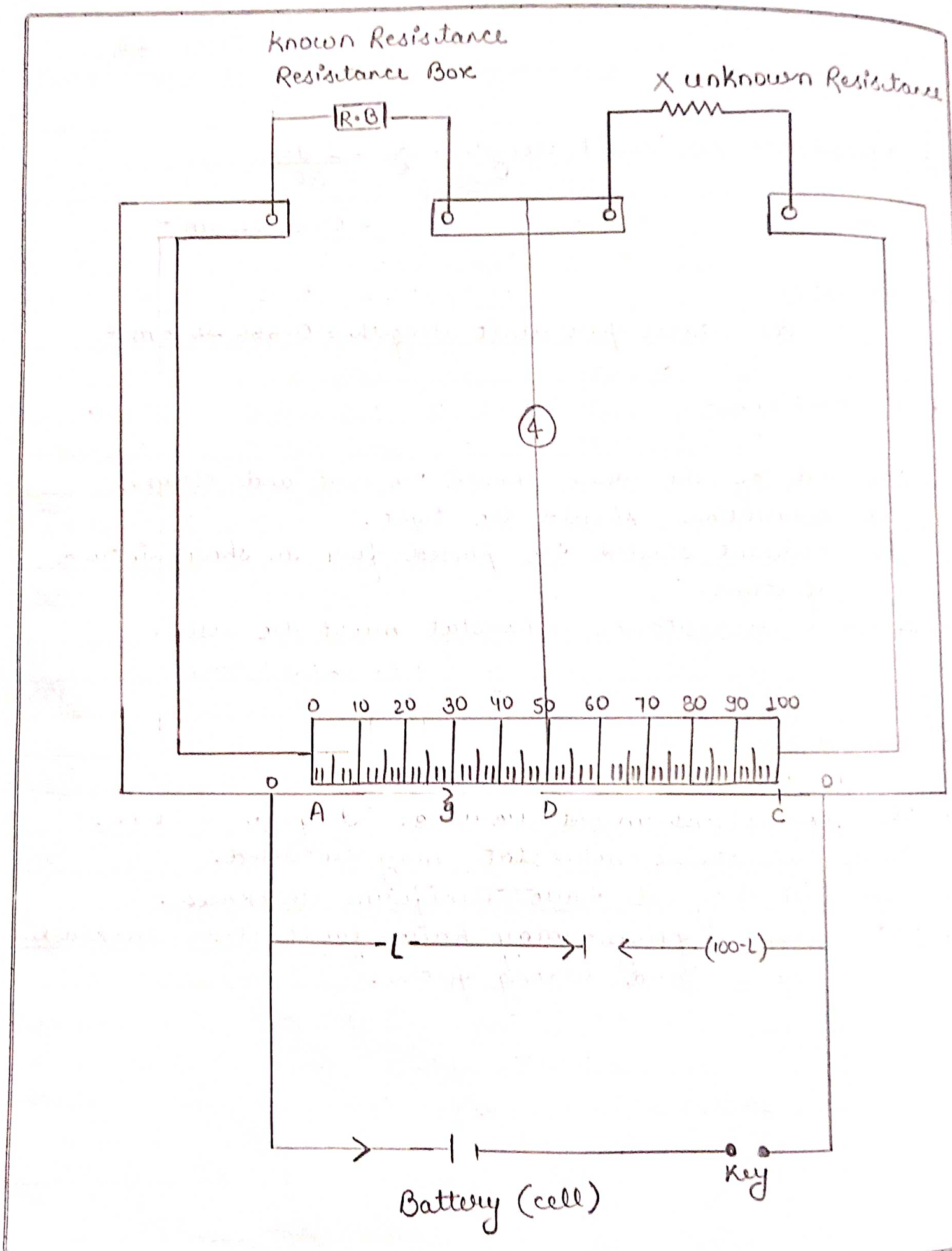
Known Resistance
Resistance Box
R.B
X unknown Resistance
4
0 10 20 30 40 50 60 70 80 90 100
A
g
D
C
L
(100-L)
Battery (cell)
Key

Date _____

Expt. No. _____ EXPERIMENT - 06 Page No. 19

- Aim :- Determine the resistance of a given wire using metre - bridge.

- Apparatus Required :-
  - A metre - bridge
  - A galvano meter
  - A resistance box
  - Jockey and Key
  - Screw gauze
  - Meter scale.
  - Battery
  - Connecting wires
  - Resistance wire
  - Sand paper.

- Theory :-

Meter bridge also known as slide wire bridge is the practical form of wheat stone bridge, since the bridge uses 1 meter long wire, it is so called meter bridge.

- For resistance :-

Referring to the circuit diagrams let R = Resistance from resistance box.

X = Unknown resistance.

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l = balancing length on meter bridge wire

∴ Using the principal,

$$\frac{R}{x} = \frac{l}{100-l}$$

Hence, $x = \left(\frac{100-l}{l}\right) R$.

- Procedure :-

– Draw the circuit diagram is shown and arrange the apparatus accordingly.
– Connect the resistance wire whose resistance is to be measured in right gap b/w C and B.
– Connect the resistance box of low range in the left b/w A and B.
– Take out some resistance from the box and plug the key.
– Now the move jockey attached gently from left to right end of the wire bridge.

- Note :-

Move down the direction in the galvanometer move jockey from left to right will galvanometer gives zero (0) deflection.

That point is called Null point say at O.
– Similarly take set of four such observation by changing the value of R.

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- Observation :-

Length of the given wire (L) = 100 cm

least count of screw gauge = 0.001 cm.

Null point (B) = 48 cm.

- Calculations :-

Pitch of screw gauge = 1 mm.

Zero error = 0.00 mm

Calculation for x = mean $(x) = \frac{1.2 + 1.2 + 1.2}{3}$

$= 1.200\ \Omega$

- Result :-

The value of unknown resistance $x = 1.20$ hm.

- Error percentage :-

$$\text{Error \%} = \frac{(5.0 - 4.0) \times 10^{-8} \times 10}{5 \times 10^{-8}}$$

$= 2.00\ \%$

- Precautions :-

- Connection should be clean and tight.
- Move the jockey gently over the wire & null point determine neatly.
- Wire must be a uniform thickness and should not make a loop.

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- Screw gauze must be free from error.
- Plugs keys and instruments must be cleared.

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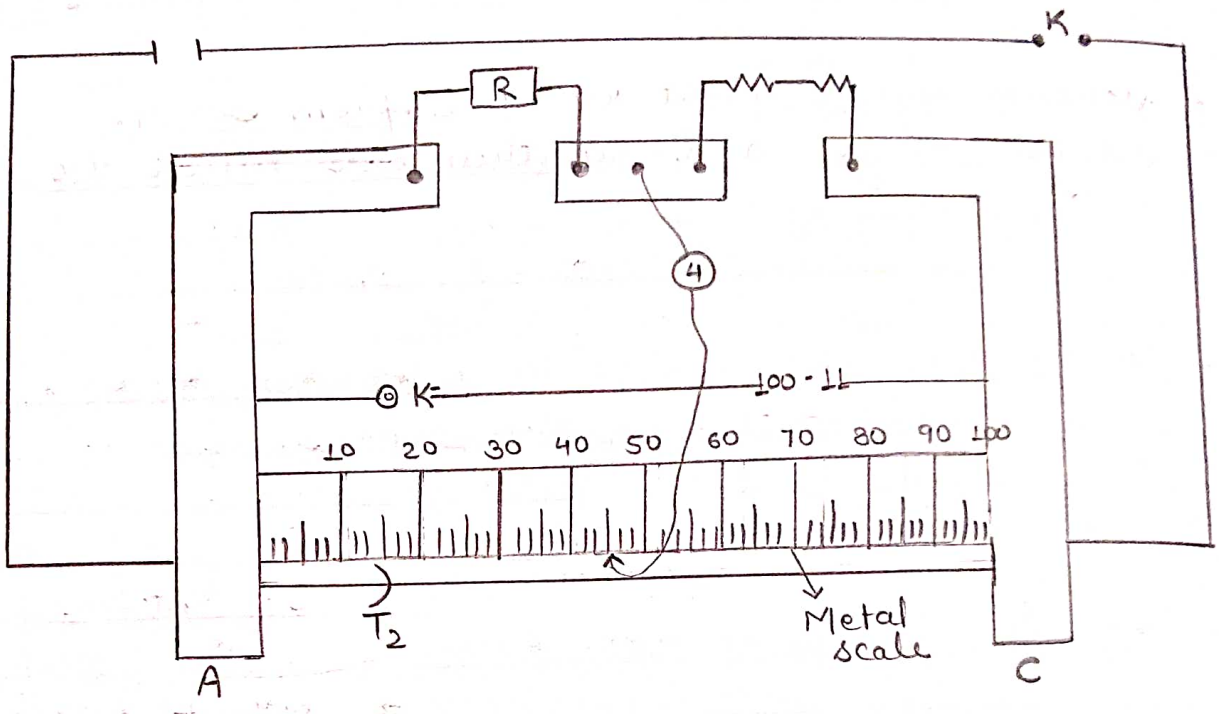
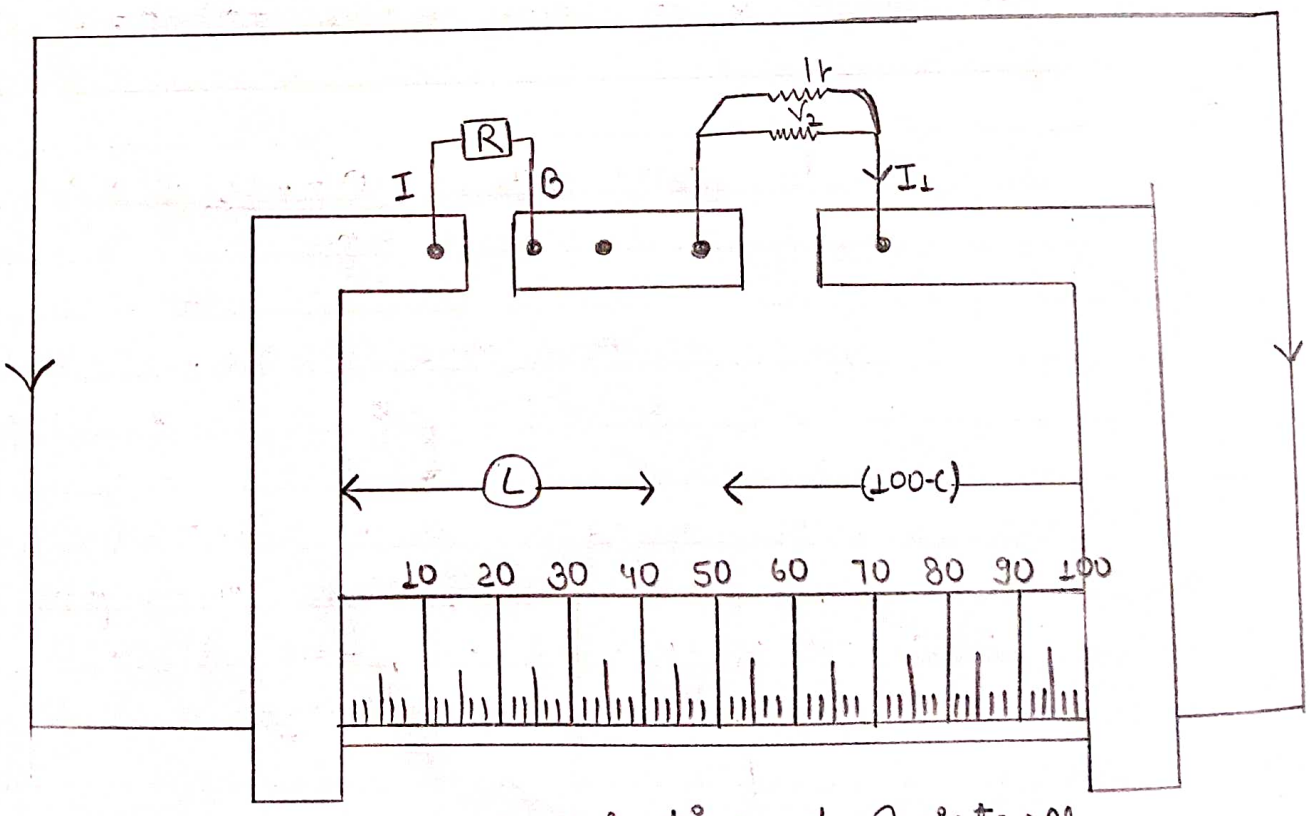


Series Combination of resistance



Parallel Combination of Resistance

Date _____

Expt. No. _____ **EXPERIMENT-07** Page No. 23

- **Aim :-** To verify the laws of combination of series and parallel combination of resistance using a metre bridge.

- **Apparatus Required :-**
  - A metre bridge
  - Galvanometer
  - Resistance box
  - A jockey and connection
  - Two resistance wires
  - Battery

- **Circuit diagram :-**

  Series and parallel combination of resistance are shown in fig.

- **Theory :-**

  The resistance of resistance wire or coil is $r = \frac{100 - L \times R}{L}$

  where, R = Resistance from the resistance box.
  L = length of the metre-bridge from Zero box.

a) When two resistance r_1 and r_2 are connected in series then :-
  - Their combined resistance, $RS = r_1 + r_2$
  - Current flows through each resistance are same.

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Observation Table

Resistance coil	S.No.	Resistance R.B	Length AO=L	Length (cm) (100-L)	Mean Le
r_1 only	1	1.0	40	1.5	1.53
	2	1.5	50	1.5	
	3	2.0	55	1.6	
r_2 only	1	1.0	76	3.7	3.37
	2	1.5	71	3.5	
	3	2.0	60	3.1	
r_1 and r_2 in series	1	1.0	86	5.1	5.80
	2	1.5	80	5.7	
	3	2.0	76	5.9	
r_1 and r_2 in parallel	1	1.0	52	1.4	1.40
	2	1.5	32	1.5	
	3	2.0	46	1.3	

– Voltage varies.

by When two resistance r_1 and r_2 are connected in parallel then :-

– Their combined resistance $1/R_p = \frac{r_1 + r_2}{r_1 + r_2}$.

– Current varies.

– Potential across resistance remains same.

• Procedure :-

– Make the two resistance coil as r_1 and r_2.

– Connect the two coil r_1 and r_2 in series in the right gap and find the resistance of the combination.

– Take suitable arrangement reading for three times.

• Observations :-

For each resistance from the resistance box, we find the value of resistance using the principal.

Of wheat stone bridge the observation table is as :-

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- Calculations:-

— In series combination, theoretical value 4.09 Ω experiment value Rs = 583 ohm.

— In parallel combination :- Theoretical, value 12 ohm.

Experiment value = 5.83 ohm.

- Results :-

while in limits of experimental error. Experimental and theoretical value of Rs for series combination and Rp for parallel combination are same.

Hence, Both laws of resistance are verified.

- Precaution & Series error :-

— Connection should be neat, clean and tight.
— Plugs, Keys and instrument must be clean.
— Wire must be uniform thickness and should not make a loop.
— Null point must be determined correctly.
— Series and parallel combination should be checked properly.

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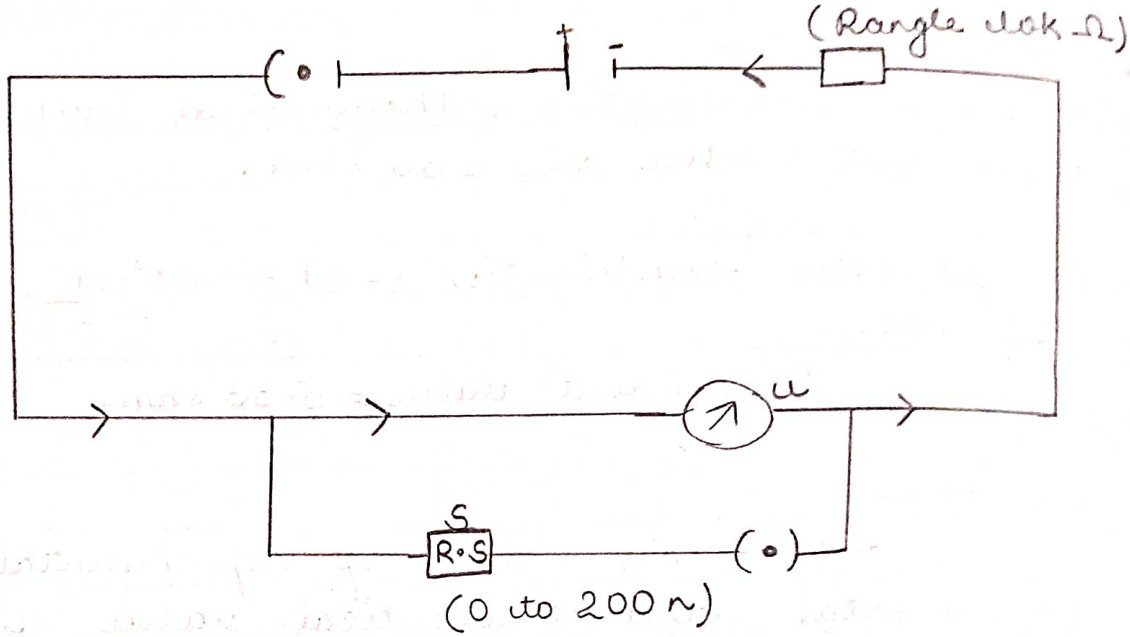

Figure :- Circuit for determination of resistance of galvanometer by half deflection method.

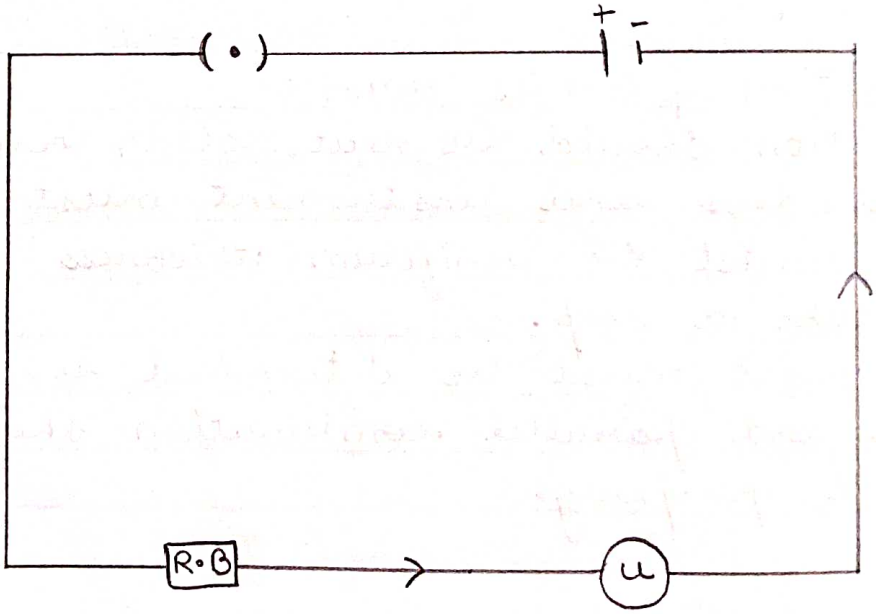

Figure :- Determination of figure of merit of the galvanometer.

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• Aim :- To determine the resistance of a galvanometer by half deflection method.

• Apparatus Required :-

— A whistom type galvanometer.
— A battery or accumulator of 2 volt.
— One resistance box (Range 0 to 10,000 ohm)
— Two one way key.
— Connecting series wires.
— Sand paper etc.

• Theory :-

Using half reflection method, the resistance of galvanometer is given by $G = \frac{R \cdot S}{R - S}$

where, R is the resistance in series with galvanometer and S is the shunt resistance.

• Results :-

Resistance of galvanometer by half deflection method 150Ω.

figure of merit, $K = 0.134 \times 10^{-4}$ amp/division.

• Precautions :-

1. All the connection should be neat and tight, All the plug in the resistance boxes should also to be tight.

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- Resistance of the galvanometer by half deflection method.

S.No	Resistance (R) (ohm)	Deflection in the galvanometer (θ)	Hold. deflection θ/2 division m/L	Required shunt (S) (ohm)	Galvanometer Resistance $4 = \frac{RS}{R-S}\ \Omega$
1.	15,000 Ω	20	10	150	150
2.	19,000 Ω	16	8	140	140
3.	12,000 Ω	24	12	160	160

$4_1 = 150$ $4_2 = 140$ $4_3 = 160$

$$\text{Mean value} = \frac{150 + 140 + 160}{3} = 150\ \Omega$$

- figure of merit

S. No.	Emf of the cell (ε volt)	Resistance (R) Ω	Deflection (n)(g)	Figure of merit $K = \frac{\varepsilon}{(R+4)n}$
1.	4	15,000	20	0.0001243
2.	4	19,000	16	0.0001343
3.	4	12,000	24	0.000134

$$\text{Mean value of } K = \frac{0.0001293 + 0.0001343 + 0.000134}{3}$$

$$= 0.134 \times 10^{-4} \text{ amp/div}$$

2. Deflection in the galvanometer should be as large as possible and should be on even number of division.

3. Value of resistance must be very large compared to the value of galvanometer resistance otherwise, the resistant will not be satisfactory.

4. EMF of the battery or eliminator used should be constant. If the battery is already used, it should be fully charged.

- Sources of error :-

1. The resistance of the coil in the resistance box used may not be exactly same as marked.

2. The plugs in the resistance box may be loose which will produce large error in the observation.

3. The E.M.F of the battery may not be constant.