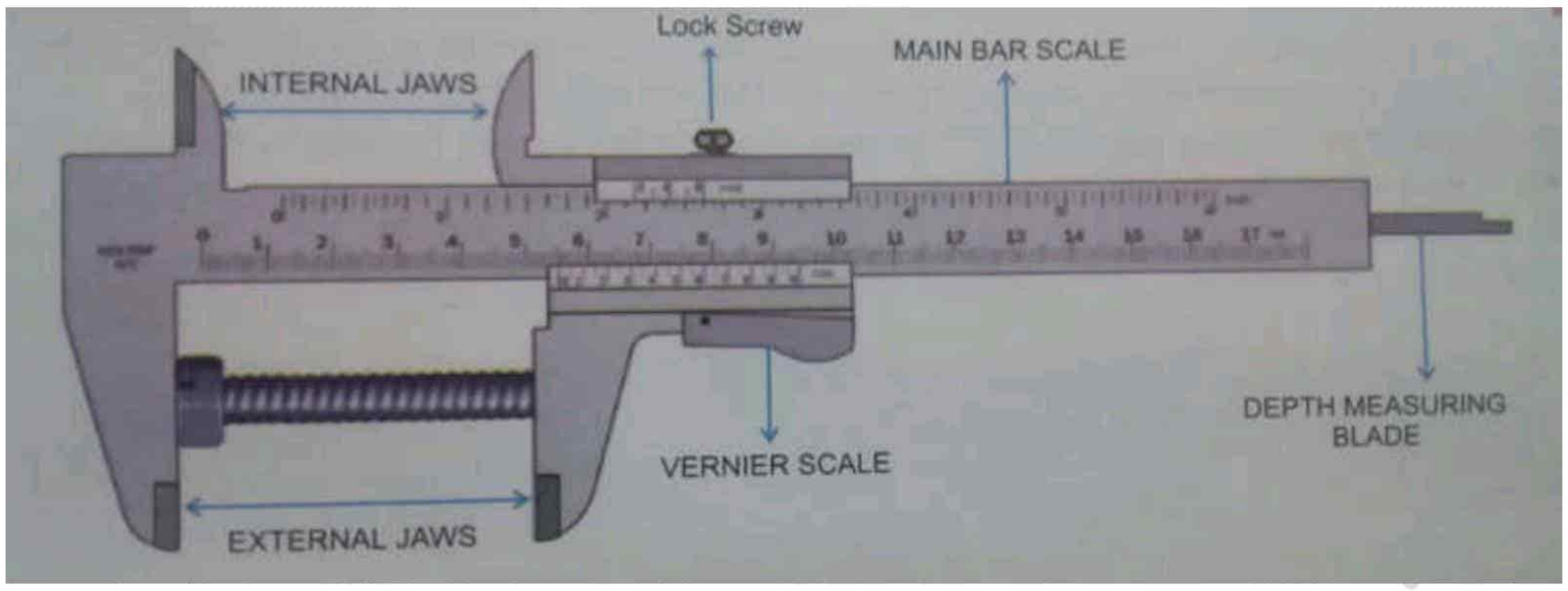
PRACTICAL NOTES PHYSICS INTER PART 1 AND 2 By Asad Abbas (LECTURER PHYSICS)

Contents

Experiment No 1: To Find the Volume of Cylinder by Using Vernier Calipers

Apparatus: Vernier calipers, solid cylinder

Figure:



Procedure:

i. First of all I measured the least count of the vernier calipers.
ii. I checked the zero error of the vernier calipers and zero correction which was nil.
iii. Then I placed the cylinder lengthwise between the lower jaws of vernier calipers and estimated its length from the main and Vernier scales. I took three observations for length.
iv. Then I placed the cylinder diameter wise between lower jaws and took three observations for diameter by applying the same procedure.
v. I found out the mean values of length and diameter and find the mean radius.
vi. Finally I calculated the volume of the cylinder by applying the formula $V = \pi r^2 L$.

Observations and calculations:

$$least\ count = \frac{smallest\ division\ on\ t\ \ e\ main\ scale}{Total\ number\ of\ division\ on\ t\ \ e\ vernier\ scale}$$

$$least\ count = \frac{1\ mm}{10} = 0.1\text{ mm} \quad \text{or} \quad 0.01\text{ cm}$$

Zero error = Nil zero correction = Nil

No of obs	Quantity to be measured	Main scale reading X (cm)	Number of vernier division coinciding with any main scale division (n)	Fraction to be added (n x L.C) (cm)	Total reading R= X+ nxL.C (cm)
1	Length (L)	3.2	7	0.07	3.27
2		3.2	8	0.08	3.28
3		3.2	9	0.09	3.29
1	Diameter (D)	1.1	5	0.05	1.15
2		1.1	5	0.05	1.15
3		1.1	5	0.05	1.15

$$Mean\ lengt\ = \frac{3.27+3.28+3.29}{3} = 3.28\text{ cm}$$

$$Mean\ diameter = D = \frac{1.15+1.15+1.15}{3} = 1.15\text{ cm}, \quad \text{Radius } r=D/2= 0.575\text{ cm}$$

$$V = \pi r^2 L == (3.14)(0.575)^2 \text{x } 3.28 \qquad \text{Volume= } V = 3.40\text{ cm}^3$$

Result: The volume of cylinder is 3.40 cm^3

Experiment No 2 To Find The Diameter And Area Of Cross Section Of Wire By Screw Gauge

Apparatus : Micrometer screw gauge, wire

Figure:

Procedure:

i. First of all I measured the least count of screw gauge.
ii. Then I checked the zero error of screw gauge and hence find the zero correction which was nil.
iii. Then I placed the wire between the studs of the screw gauge and turned the screw gently till the studs come in contact with wire.
iv. Then I measured the diameter of the wire by using main and circular scale as D = X+(n*L.C).
v. Then I measured the diameter at two more points of the wire and took mean value and mean radius.
vi. Finally I computed the area of the wire by using the formula $A=\pi r^2$

Observations and calculations:

$$least\ count = \frac{smallest\ division\ on\ t\ \ e\ linear\ scale}{Total\ number\ of\ division\ on\ t\ \ e\ circular\ scale}$$

$$Least\ count = \frac{1\ mm}{100} = 0.01\text{ mm} \quad \text{or} \quad 0.001\text{ cm}$$

No of obs	Linear scale reading X (mm)	Circular scale reading (n)	Fraction to be added = n*L.C (mm)	Diameter D= X+ n*L.C (mm)
1	0	48	0.48	0.48
2	0	49	0.49	0.49
3	0	48	0.48	0.48

$Mean\ diameter = \frac{0.48+0.49+0.48}{3}$ = 0.483 mm

Radius=r=D/2= 0.483/2= 0.24 mm

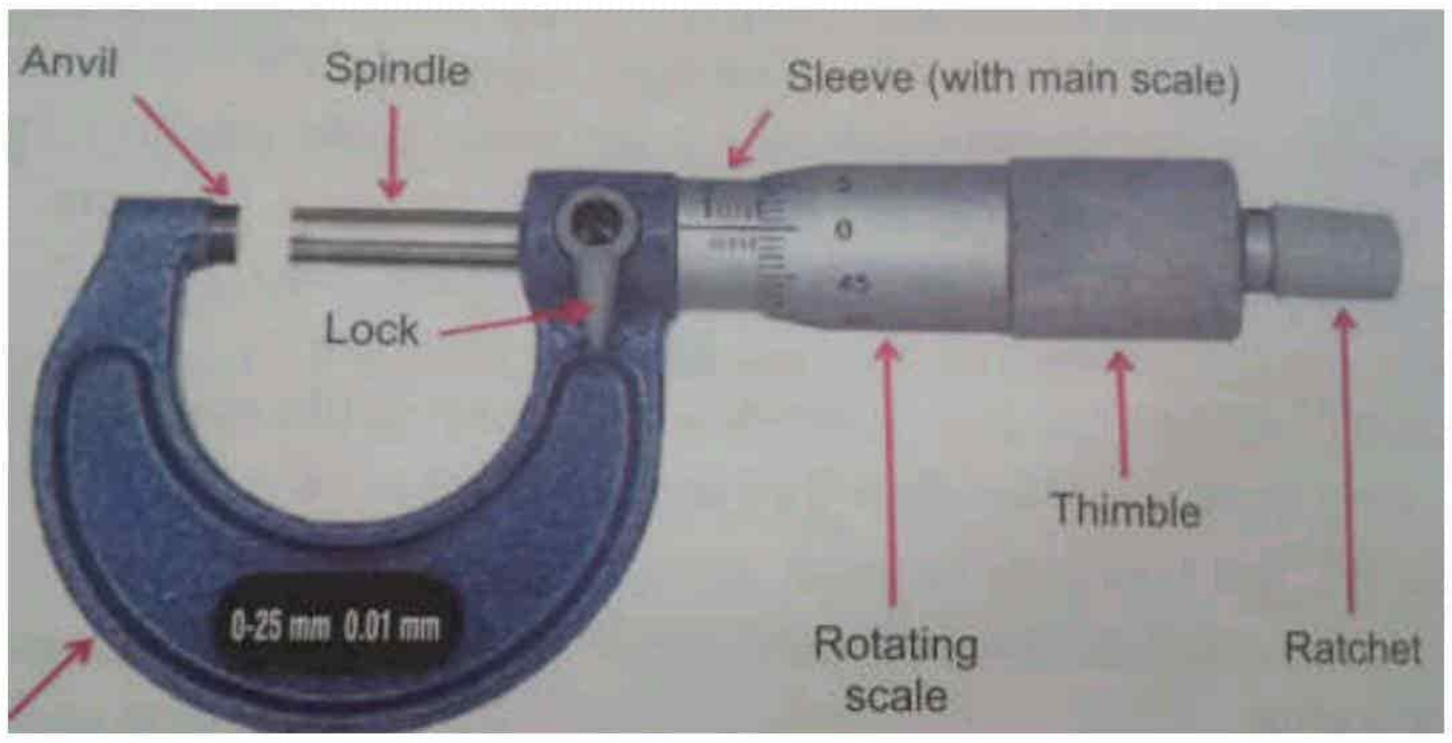
Area = 3.14 $(0.24)^2$ = 0.18 mm^2

Result: Area of Sphere is 0.18 mm^2

Experiment No 03 To Find The Volume Of Sphere By Screw Gauge

Apparatus : Micrometer screw gauge, wire

Diagram:



Procedure:

i. First of all I measured the least count of screw gauge.
ii. Then I checked the zero error of screw gauge and hence find the zero correction which was nil.
iii. Then I placed the solid sphere between the studs of the screw gauge and turned the screw gently till the studs come in contact with the solid sphere.
iv. Then I measured the diameter of the solid sphere by using main and circular scale as D = X+(n*L.C).
v. Then I measured the diameter at two more points of the sphere and took mean value and mean radius.
vi. Finally I computed the volume of the sphere by using the formula $V = \frac{4}{3}\pi r^3$.

Observations and calculations :

$$least\ count = \frac{smallest\ division\ on\ t\ \ e\ linear\ scale}{Total\ number\ of\ division\ on\ t\ \ e\ circular\ scale}$$

$$Least\ count = \frac{1\ mm}{100} = 0.01\text{ mm} \quad \text{or} \quad 0.001\text{ cm}$$

No of obs	Linear scale reading X (mm)	Circular scale reading (n)	Fraction to be added = n*L.C (mm)	Diameter D= X+ n*L.C (mm)
1	4	41	0.41	4.41
2	4	43	0.43	4.43
3	4	42	0.42	4.42

$$Mean\ diameter = \frac{4.41+4.43+4.42}{3} = 4.42\text{ mm}$$

Radius=r=D/2=4.42/2= 2.24 mm

$$V = \frac{4}{3}\pi r^3 = 4/3 * 3.14\ (2.24)^3 =$$

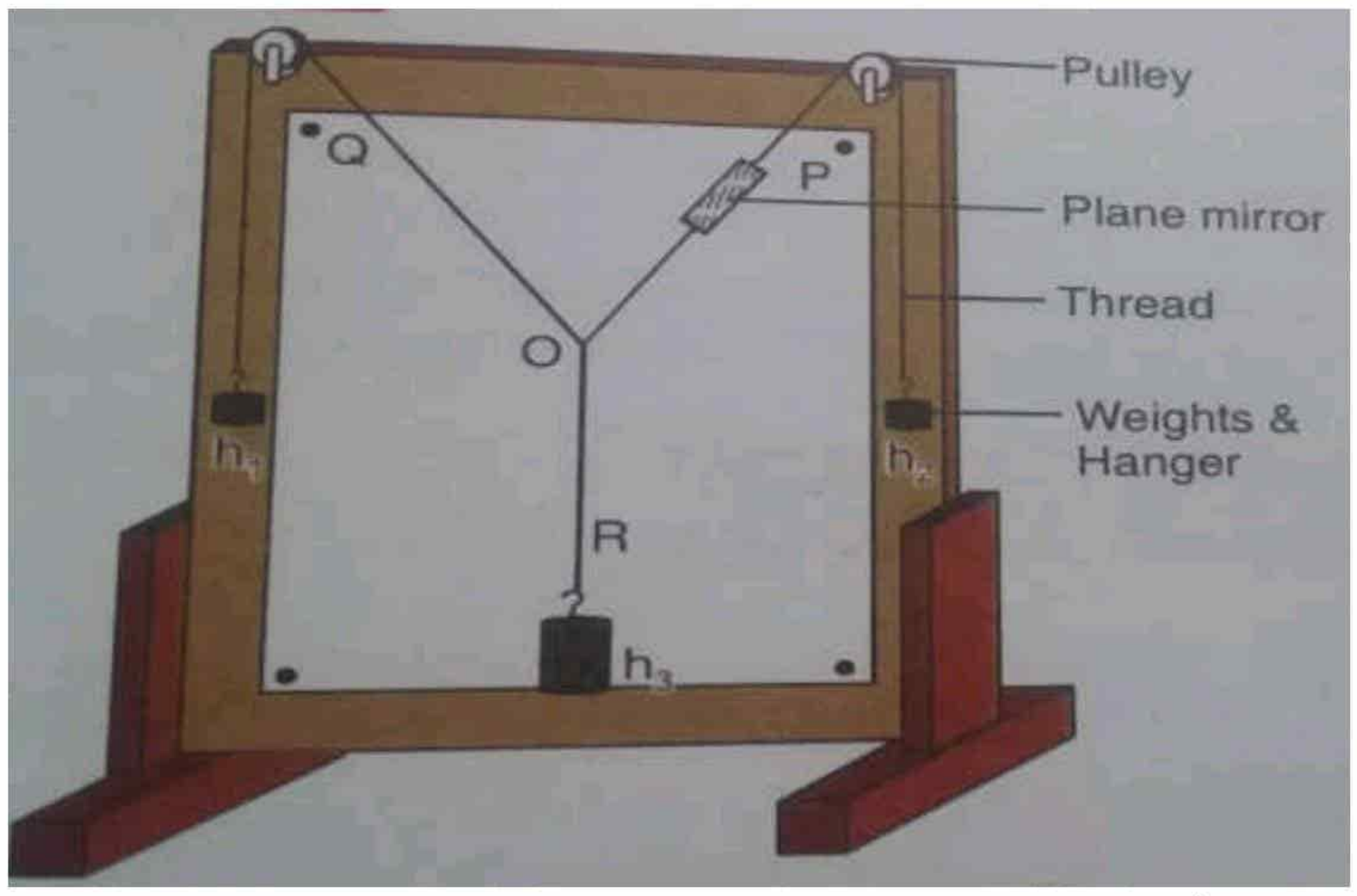
$$Volume\ of\ sp\ \ ere = 46.2\text{ mm}^3$$

Result: volume of sphere is 46.2 mm^3

Experiment 04: To Find The Unknown Weight Of Body By The Method Of Vector Addition Of Forces

Apparatus: Gravesend apparatus, mirror strip , unknown weight , weight with hangers, thread

Figure:



Procedure:

i. First of all I set the Gravesend apparatus in vertical position and oiled the pullyeys .
ii. Then I fixed a blank sheet of paper on the board by drawing pins.
iii. I took three pieces of thread of suitable lengths and knot them at one end.
iv. Then I attached two hangers on other ends of the two threads and passed them over the pulleys and attached unknown weights(W) with the third thread.
v. Then I started adding weights in the side way hangers till the knot appeared at the centre of the paper and noted all weights in the hangers.
vi. Then I placed a mirror strip under each thread removing parallax marked two points on the sheet on both sides of mirror strip.
vii. Then joined the marked points to get lines OA, OB and OC showing **F1**, **F2**, and **W** respectively.
viii. Then I selected a suitable scale and cut the lengths OA, OB, OC showing **F1, F2**, and **W**.
ix. Then joined OD representing the resultant **R** which represents the value of unknown weight according to the scale under 2^{nd} condition of equilibrium.
x. I repeated the experiment thrice by changing weights in the hanger

Observations and calculations:

Scale: 1cm = 50 gm-wt

No of obs	Forces		Lengths		Resultant	Unknown weights
	F1 (gm-wt)	F2 (gm-wt)	OA (cm)	AD (cm)	OD=R (cm)	W= Rx scale W= Rx50 gm-wt
1	150	150	3	3	4.9	4.9*50=245
2	200	200	4	4	5	5*50= 250
3	250	250	5	5	5.1	5.1*50= 255

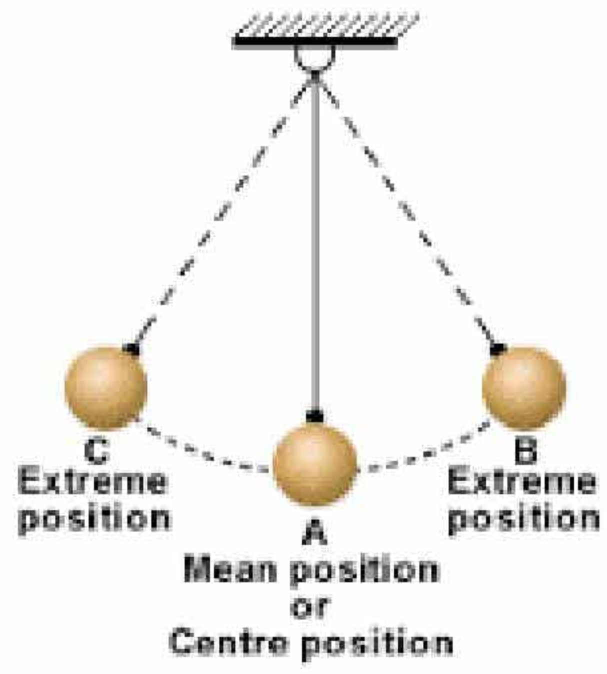
Mean value of Weight = $W = \frac{245+250+255}{3} = 250$ gm-wt

Result: Mean value of Weight is 250 gm-wt

Experiment 05 (A): For Simple Pendulum Verify That Time Period Is Independent Of Amplitude.

Apparatus: Iron stand, bob of different masses, cork, vernier calipers, chalk, stop watch

Diagram:



Procedure:

i. First of all I found the length of pendulum by measuring the mean diameter and radius of bob by vernier caliper
ii. Then calculated the value of length by adding string length and radius of diameter
iii. Then at different amplitudes, I calculated the value of time for 20 vibrations
iv. Then I noted that time period is same for every amplitude
v. Then I concluded that time period is independent of amplitude

Observations and calculations:

Mean diameter of bob=D = 2.2 cm

Mean radius of bob=r= 1.1 cm

Length of pendulum = l= l'+r= 88.9+1.1= 90 cm

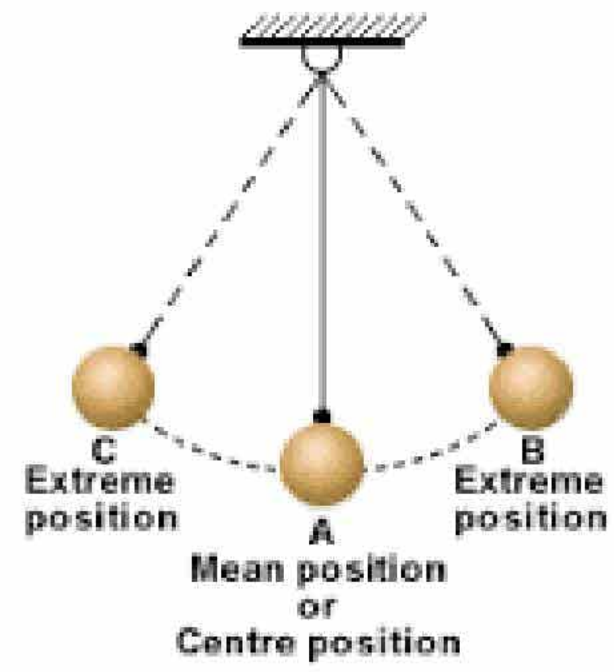
No of obs	Amplitude X (cm)	Length of pendulum l (cm)	Time for 20 vibrations t(sec)	Time period T=t/20
1	5	90	38	1.9
2	7	90	38	1.9
3	10	90	38	1.9

Result: Same value of time period at different amplitude shows that time period is independent of amplitude of oscillation

Experiment 05 (B): For Simple Pendulum Verify That Time Period Is Independent Of Mass Of Bob.

Apparatus : Iron stand , bob of different masses , cork, vernier calipers, chalk , stop watch

Figure :



Procedure :

i. I took bobs of three different masses
ii. Then I splitted the cork into two pieces.
iii. I took a thread nearly 1m long.
iv. Placed the cork in the iron stand and clamped it.
v. Passed one end of the thread through the cork and tie the other end with the a bob.
vi. Marked the mean position of the bob on the floor by a chalk.
vii. Then measured the time for 20 vibrations by stop watch and then calculate time period.
viii. Then I attached the other two bobs one by one and calculated the time period for these bobs without changing the lengths.
ix. Finally constructed the observations table.

Observations and calculations:

Mean diameter of bob=D = 2.2 cm Mean radius of bob=r= 1.1 cm

Length of pendulum = l= l'+r= 88.9+1.1= 90 cm

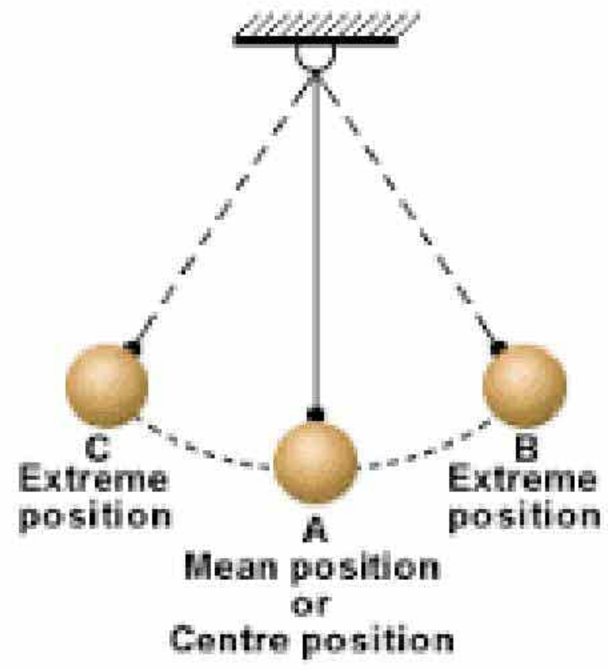
No of obs	Mass of bob (gm)	Length of pendulum l (cm)	Time for 20 vibrations t(sec)	Time period T=t/20
1	5	90	38	1.9
2	10	90	38	1.9
3	15	90	38	1.9

Result: Same value of time period at different amplitude shows that time period is independent of mass of bob

Experiment 05 (C): For Simple Pendulum Verify Time Period Is Proportional To The Square Root Of Its Length

Apparatus : Iron stand , bob of different masses , cork, vernier calipers, chalk , stop watch

Diagram:



Procedure :

i. First of all I measured the diameter and the radius of the bob byverniercalipers .
ii. I cut the cork into two pieces.
iii. Then I took nearly 1.5 m long cotton thread tied its one end with the hook of the bob and passed the other end through the splitted cork and clamped the cork in the iron stand.
iv. Marked the mean position of the pendululm by chalk on the floor.
v. Measured the length of the pendulum l= l'+r
vi. Gave the pendulum small amplitude of oscillations and noted the time period for 20 vibrations and then time period.
vii. Then I increased the length of pendulum in steps of 10cm and recorded two more observations.

Observations and calculations:

Mean diameter of bob=D = 2.2 cm

Mean radius of bob=r= 1.1 cm

Length of pendulum = l= l'+r= 88.9+1.1= 90 cm

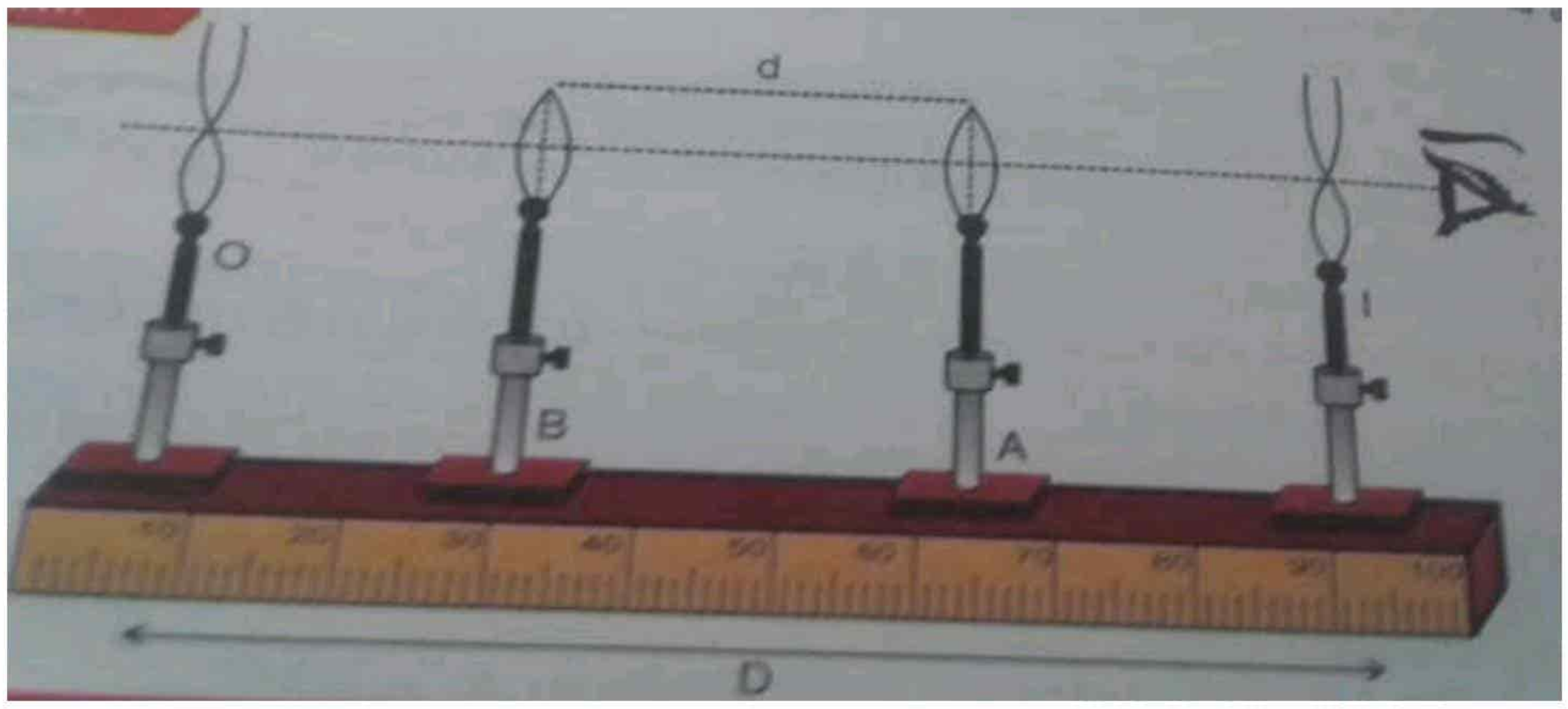
No of obs	Length l' (cm)	Length of pendulum l=l'+r (cm)	Time for 20 vib t(sec)	Time period T=t/20	$\frac{T}{\sqrt{l}}$= constant
1	78.9	80	34	1.7	0.2
2	88.9	90	38	1.9	0.2
3	98.9	100	40	2	0.2

Result: $T \propto \sqrt{l}$ time period is directly proportional square root of length

Experiment 06:To Find the Focal Length of Convex Lens by Displacement Method

Apparatus: convex lens, two needles, meter rod, optical needle up rights for mounting lens and needles, knitting needles

Figure:



Procedure:

i. First of all I measured the approximate focal length of the convex lens.

ii. Then I mounted the lens and two parallax needles on the uprights so that the tips of the needles were at the centre of the lens and along the same horizontal line.

iii. I arranged the object needles o and image needle I at a distance more than four times , the focal length of the lens and noted their positions

iv. Then I placed the lens at a suitable distance from O and removed parallax and noted the position L_1 of the lens.

v. Now without changing the positions of needles O&I moved the lens close to needle I and removed parallax again. Noted the positions of the lens also

vi. Then I calculated the shift of the lens ($d= L_1-L_2$)

vii. Then calculated the focal lengths of the lens by the relation $f=\frac{X^2-d^2}{4X}$ where X is separation between the object and image needles and d is the shift of lens

Observations and calculations:

No of obs	Separations between the needles X (cm)	Displacement of lens $d= L_1-L_2$ (cm)	Focal length of lens $f=\frac{X^2-d^2}{4X}$ (cm)
1	41	10	964
2	43	11	10.04
3	45	12	10.45

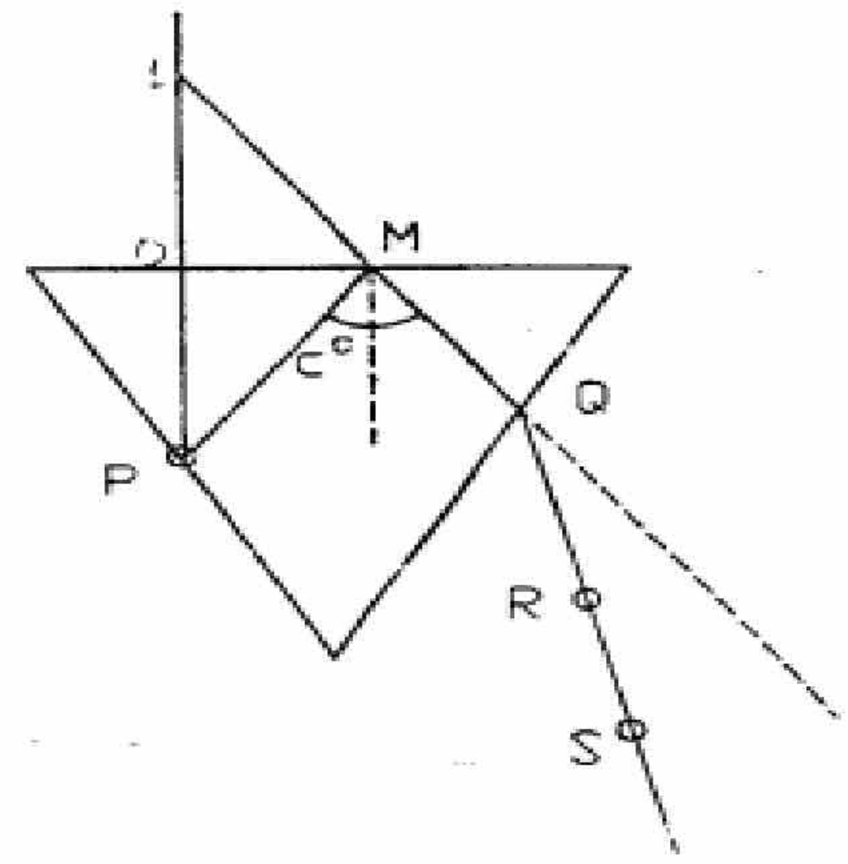
Mean value of focal length = $\frac{9.64+10.04+10.45}{3}$ = 10.04 cm

Result: Mean value of focal length is 10.04 cm

Experiment 07:To Find The Refractive Index Of Glass By Critical Angle Method

Apparatus: Drawing board, glass prism , drawing paper, drawing pins, common pins.

Figure :



Procedure :

i. First of all I fixed the sheet on the drawing board by drawing pins.
ii. Placed the glass prism at the centre of the sheet with edge A towards me as shown in figure and marked the boundary by the pencil .
iii. Fixed a pin P1 at the centre of face AB.
iv. Then I saw the image of P1 through face AC and moved the eye from C towards A till the faintest position of image of P1 is reached.
v. Then I fixed pins P2 and P3 in line with the faintest image of P1.
vi. Draw perpanicular P1M on BC so that P1M=MN.
vii. Joined P2 and P3 and produced it to Point Q on the face AC.
viii. Joined M with Q.
ix. Measured the angle <P1RQ and critical angle Ɵc=1/2 <P1RQ
x. Repeated for two more observations.

Observations and calucaltions:

No of obs	Angle < P1RQ =Ɵ	Critical angle Ɵc= Ɵ/2	Refractive index n=1/sinƟc
1	82	41	1.52
2	80	40	1.55
3	82	41	1.52

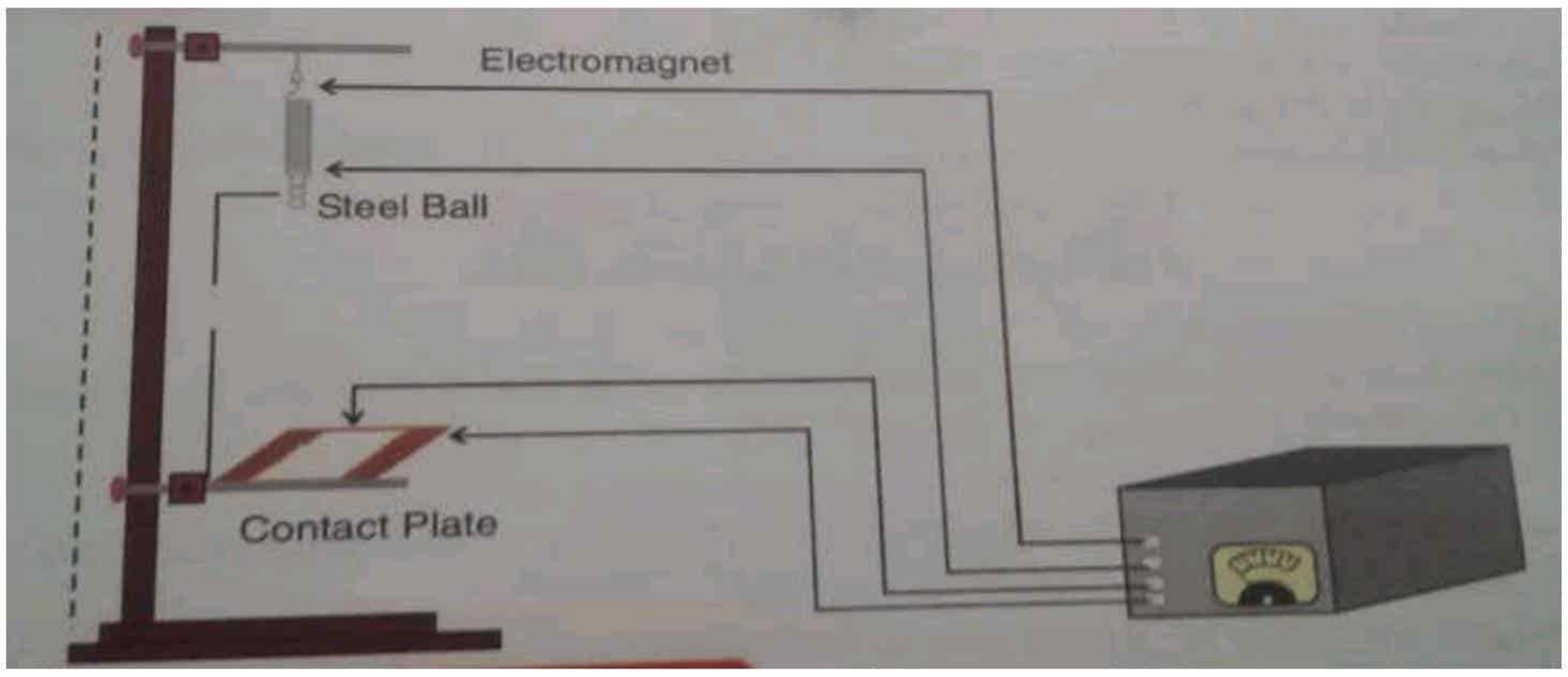
Mean value of n = $\frac{1.55+1.52+1.52}{3} = 1.53$

Result: The value of critical angle is 1.53

Experiment 08: To Find the Value of g by Free Fall Method Using An Electronic Timer/Ticker Timer

Apparatus : Metal ball, vertical scale, electronic timer, electronic free fall apparatus, power supply 3-12 V

Figure :



Procedure :

i. I completed the circuit according to the circuit diagram given in the figure
ii. Then I connected the timer to the main supply and push the reset button. This display showed zero and electromagnet is energized.
iii. Then I took a steel ball and attach it to the lower end of electromagnet
iv. Then I measured the distance S b/w lower side of ball and the drop plate.
v. Then pressed the release button, the ball released and will start falling simulataneously the timer will start counting time and hit the drop plete so that the stop watch opens and the timer stops.
vi. I noted the time recorded by timer twice and find mean time t,
vii. Then I found the value of g by equation $g = \frac{2S}{t^2}$
viii. I repeated the experiment three times and found the mean value of g.

Observations and calculations

No of obs	Distance b/w bob and gate switch S(cm)	Time of free fall			$t^2_{(sec^2)}$	$g = \frac{2S}{t^2}$ (cmS^{-2})
		$t_{1(sec)}$	$t_{2(Sec)}$	$t=t_1+t_2/2$ (Sec)		
01	60	0.36	0.34	0.35	0.122	979.59
02	70	0.39	0.37	0.38	0.144	972.22
03	80	0.40	0.42	0.40	0.16	980.8

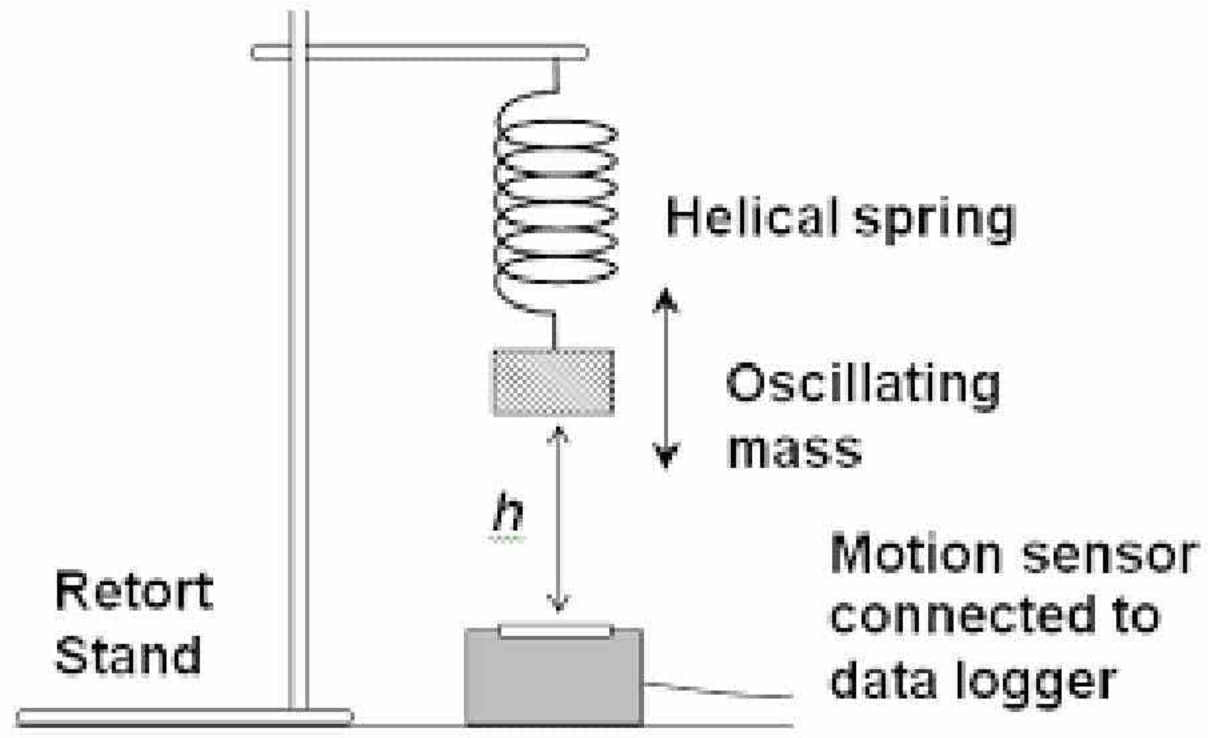
Mean value of g= $\frac{979.59+972.22+980.8}{3}$ =977.54 cm/sec^2

Result: Hence the value calculated by free fall apparatus is 977.54 cm/sec^2

Experiment 09: To Find the Acceleration Due To Gravity by Oscillating Mass Spring System

Apparatus: A helical spring, a set of slotted weights with hanger and point attached

Figure:



Procedure :

i. I suspended a helical spring from the clamp of a heavy stand.
ii. Then I attached a hanger to its lower end
iii. Then I noted the position of the pointer on the scale
iv. Now add a mass m to the hanger and noted the extension x produced in the spring
v. Then I noted the time for 20 vibrations and calculated the time period
vi. Then I calculated the value of g by $g = \frac{4\pi^2 X}{T^2}$
vii. Then I repeated the experiment three times and calculated the mean value of g

Observations and calculations

No of observations	Load F (N) W=mg (N)	Extension in spring X (Cm)	Time for 20 vibrations			Time period T=t/20 (sec)	$T^2(sec^2)$	$g = \frac{4\pi^2 X}{T^2}$ (Cm/sec^2)
			t_1	t_2	$T=t_1+t_2/2$			
01	1	6.8	11.94	12.73	12.33	0.617	0.380	977.2
02	1.5	10.3	14.45	14.02	14.23	0.71	0.507	978.6
03	2	13.8	16.49	16.51	16.50	0.816	0.666	980.8

$$\text{Mean Value of g} = \frac{977.2 + 978.6 + 980.8}{3} = 978.86 cm/sec^2$$

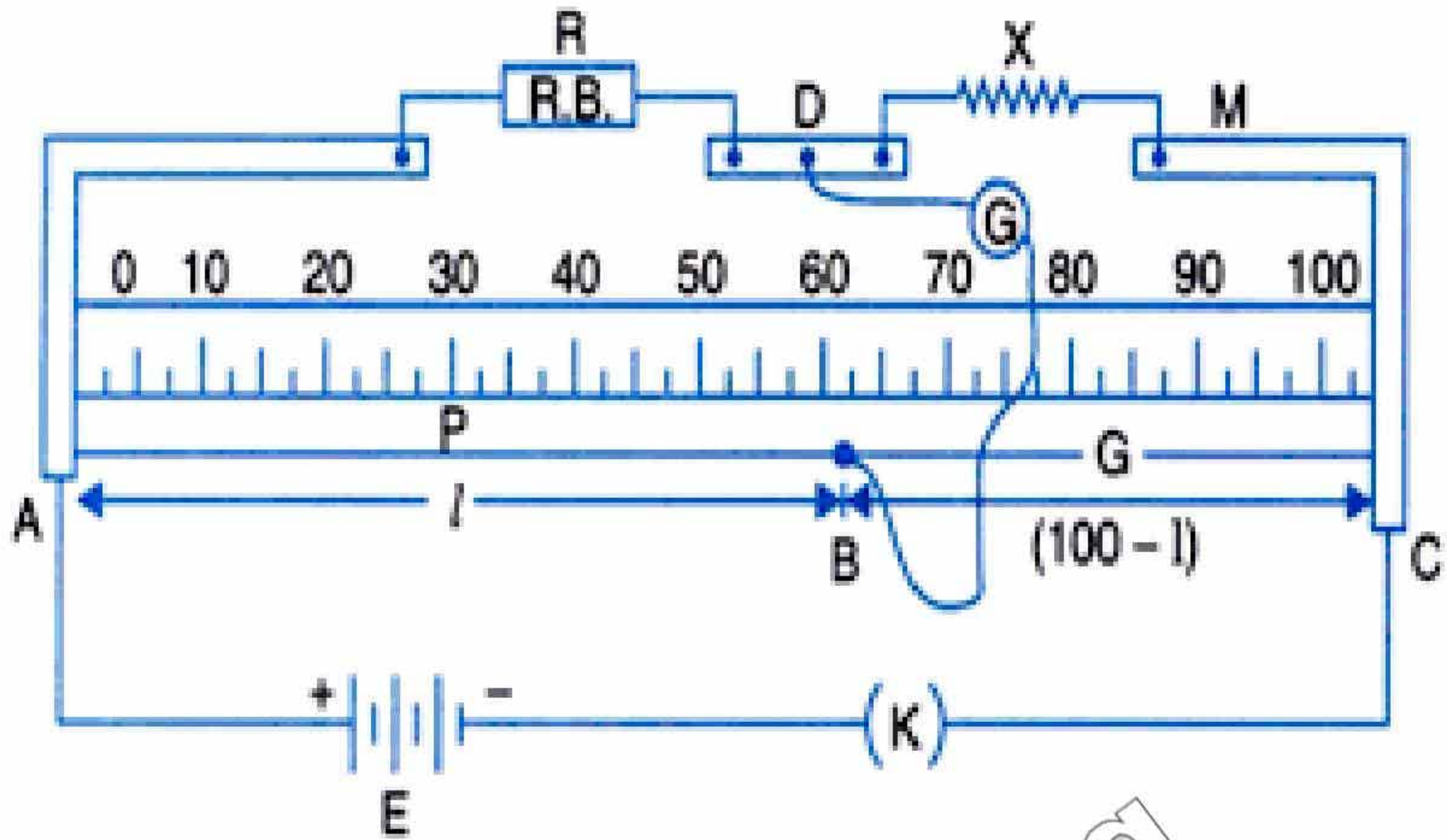
Result: Hence the value calculated by free fall apparatus is $978.86\ cm/sec^2$

Experiment 10: To find the resistance and resistivity of wire of the given wire by slide wire bridge

Apparatus:

Slide Wire Bridge, galvanometer, jockey, battery, resistance box, one way key, screw gauge, wire of unknown resistance and connecting keys

Circuit diagram:



Procedure:

i. First of all I made the connections as shown in circuit diagram
ii. Then I closed the key K and checked the circuit by placing jockey on both ends of wire AC and galvanometer gives opposite deflection for each end so connections were correct
iii. Then I took out resistance R from resistance box and slided the jokey over wire AC till there were no deflection on galvanometer
iv. Then I noted the length of Null point from end A as l1 and l2 =100-l1
v. Similarly I took the 3 readings by taking out different values of resistance from resistance box
vi. Then I calculated the unknown resistance by using formula $X = R\frac{l_2}{l_1}$

No of obs	Resistance from resistance box R(Ω)	Lengths		Unknown resistance
		l_1 (cm)	l_2 (cm)	$\frac{X}{R} = \frac{l_2}{l_1}$ X= $R\frac{l_2}{l_1}$
1	2000	70	30	857.14
2	3000	65	35	1615.38
3	4000	58	42	2896.5
Mean value of resistance of wire X = $\frac{857.14+1615.38+2896.5}{3}$ = 2216 Ω				

Specific resistance or resistivity :
Length of unknown wire= 100 cm
Mean diameter of wire = D= 0.062 cm Mean radius of wire = r= 0.031 cm
Resistivity $=\rho = \frac{XA}{l} = X\pi r^2/l =$ (2216)(3.14) $(0.031)^2/100$ = 0.06 Ω cm.

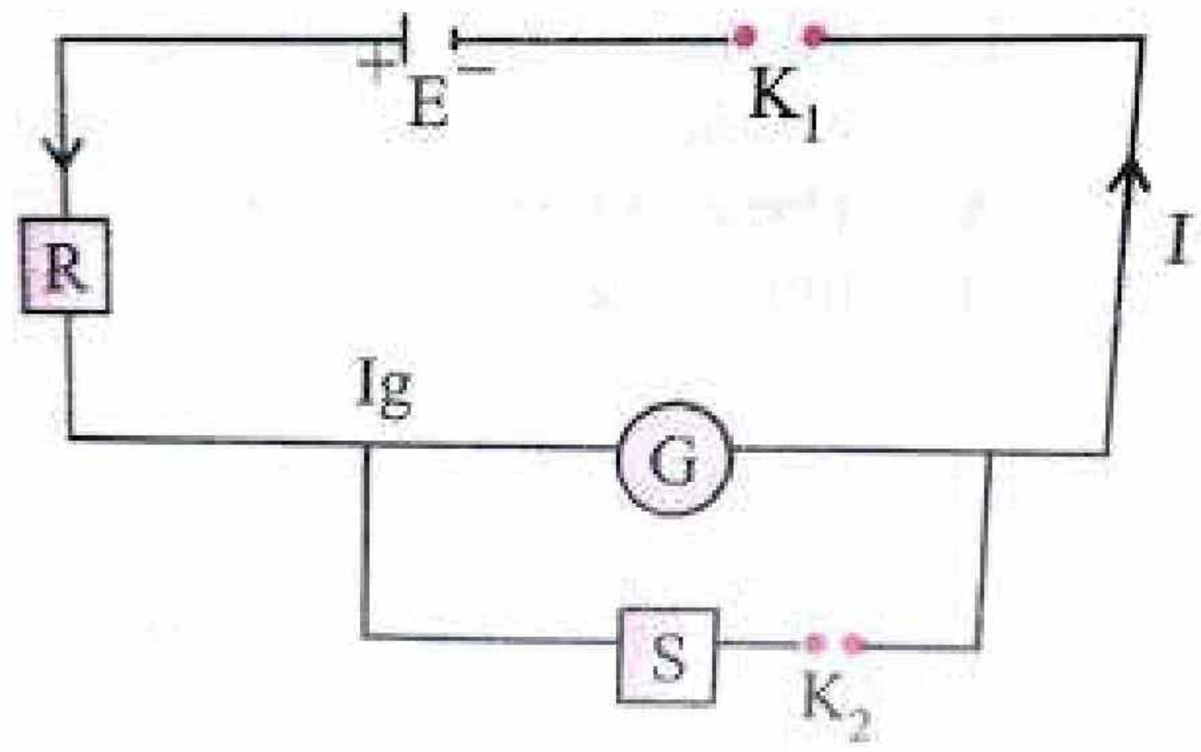
Result: The value of resistance of wire is 2216 ohm and resistivity is 0.06 ohm m

Experiment 11: To Find The Resistance Of Galvanometer By Half Deflection Method.

Apparatus:

Two resistance boxes, one way keys, coil galvanometer, battery 1.5 V and connecting wires

Circuit diagram:



Procedure

i. I made the connections according to circuit diagram
ii. First of all I closed the key K1 and found the zero reading of galvanometer
iii. Then took out a high resistance from high resistance box R and kept the shunt circuit open K2 close the key1 and adjusted the value of R to get a large deflection in galvanometer
iv. Then I inserted the plug in K2 which provided an alternative path to current
v. Then took such resistance S from fractional resistance such that deflection in galvanometer became half
vi. Galvanometer resistance was calculated from eq. $G=\frac{RS}{R-S}$ (Ω)
vii. I repeated experiment thrice and found the mean value

Observations and calculations

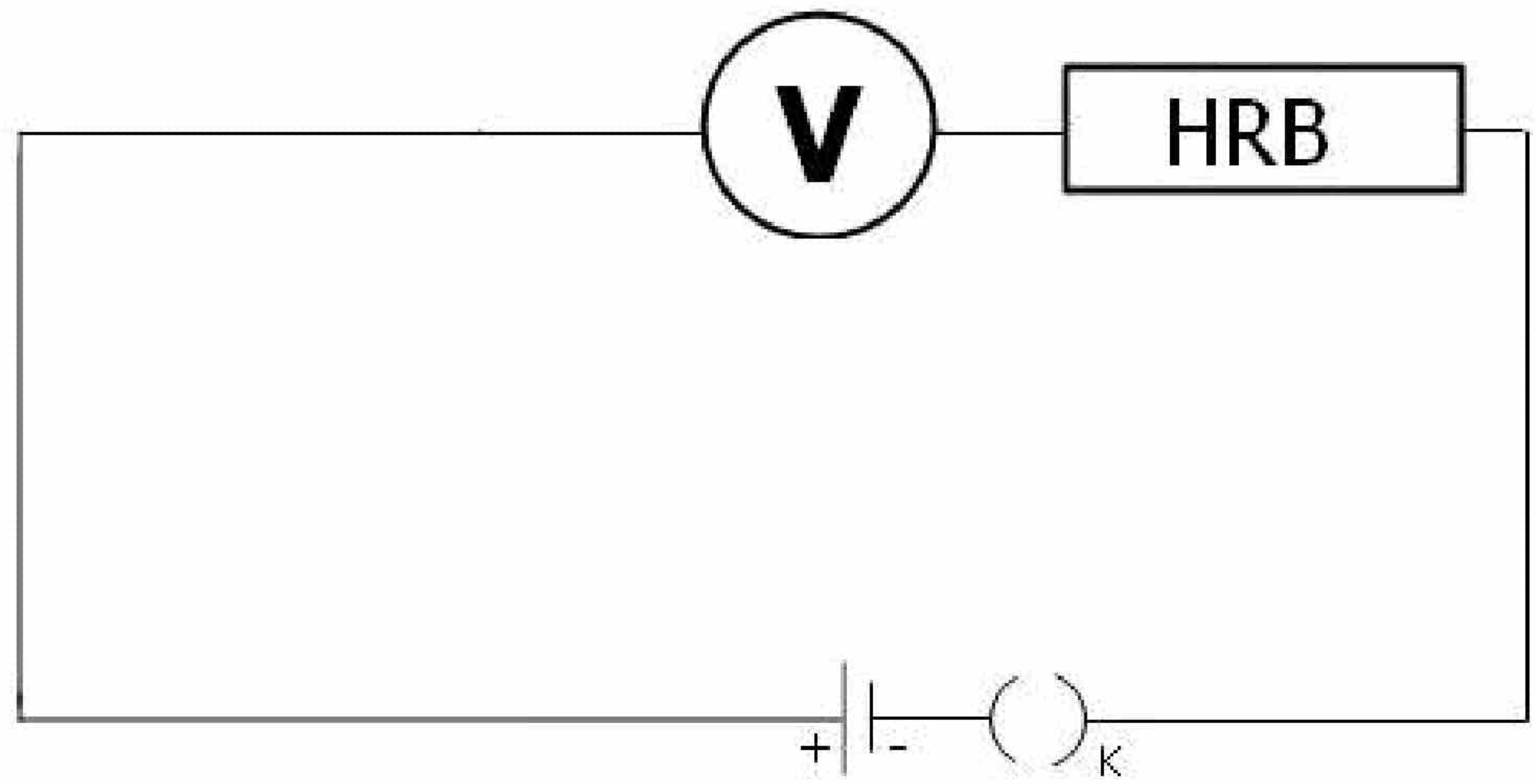
No of obs	Resistance from high resistance box R(Ω)	Deflection (Θ)	Resistance from lower resistance box S(Ω)	Half deflection (Θ/2)	Galvanometer resistance $G=\frac{RS}{R-S}$ (Ω)
1	5000	30	110	15	112
2	5500	28	110	14	112
3	6000	26	110	13	112
Mean value of resistance of $G=\frac{112+112+112}{3}$ = 112 Ω					

Result: The value of resistance of galvanometer 112 ohm

Experiment 12: To Find the Resistance of Voltmeter by Drawing Graph between R and 1/V

Apparatus:

Voltmeter, battery, resistance box, one way key, connecting wires



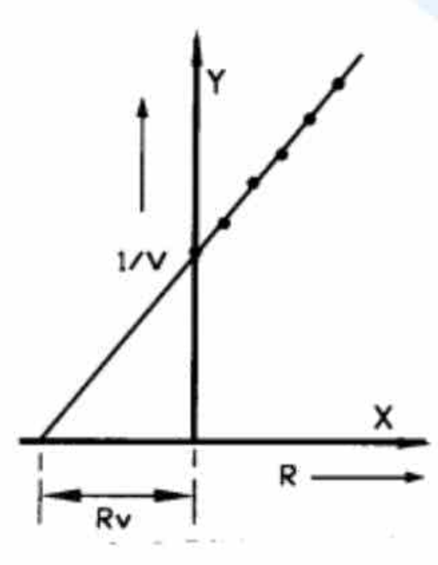
Procedure

i. I made the connections according to circuit diagram
ii. Then I closed the key K and took out a suitable resistance R to get a suitable voltmeter readings V
iii. Then by increasing R in regular steps found the corresponding value of V
iv. Then I calculated the values of 1/V
v. Then I plotted a graph b/w R and 1/V
vi. The graph was straight line and intercept of the straight line on X-axis gave the resistance of the voltmeter

Observations and calculations

No of observations	Resistance from resistance box R(Ω)	Voltmeter reading V(volt)	1/V $(volt)^{-1}$
1	0	3	0.33
2	500	2.6	0.38
3	1000	2.4	0.4
4	1500	2	0.5
5	2000	1.8	0.55
6	2500	1.5	0.64
From graph Resistance of voltmeter = 2700 Ω			

Graph: The graph b/w R and1/V is



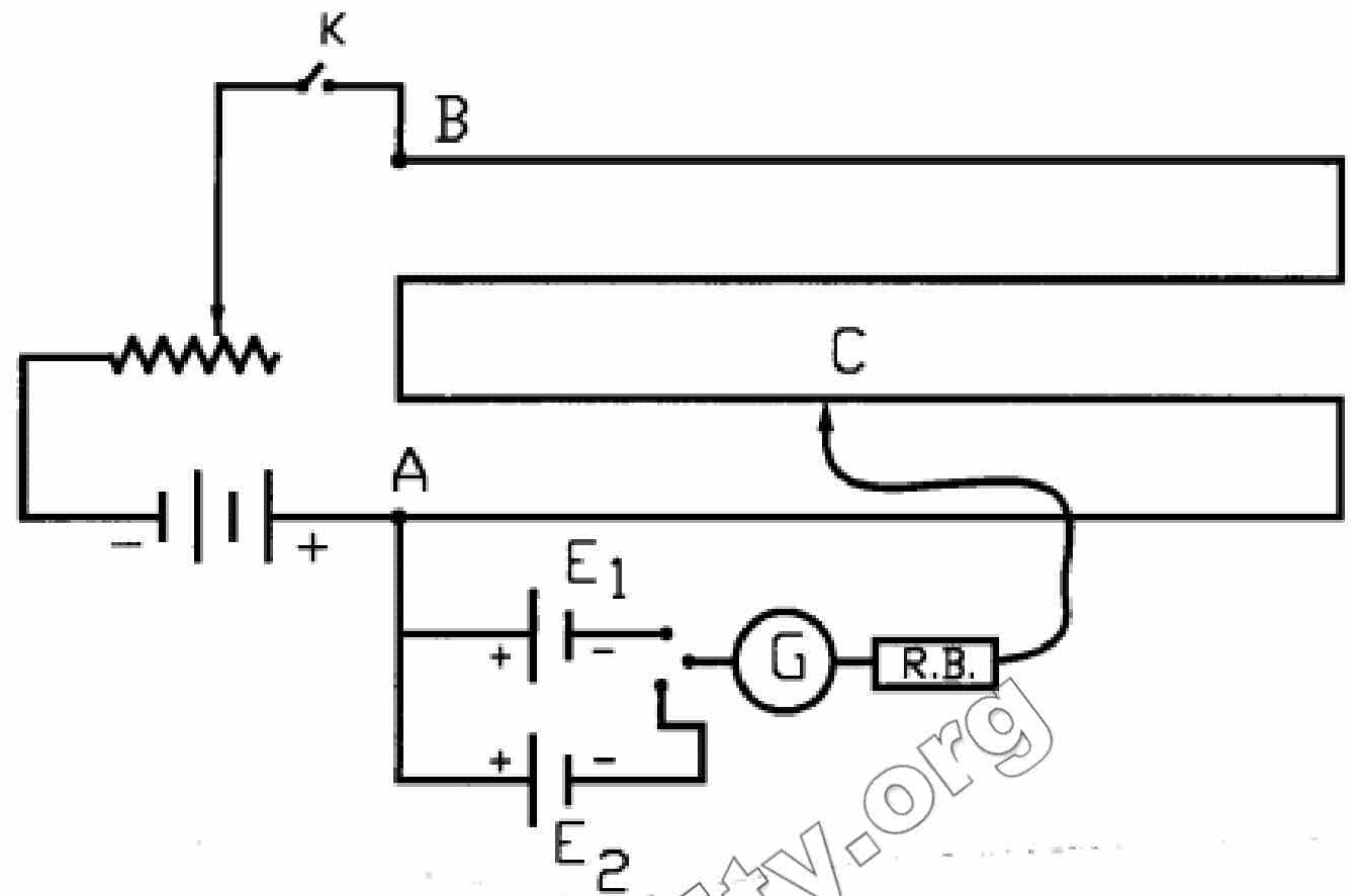
Conclusion: The value of resistance is 2700 ohm.

Experiment 13: To Find theEmfOf Cell By Using Potentiometer

Apparatus:

Potentiometer, battery, cell of unknown emf, Rheostat, galvanometer, connecting wires, two way key, jokey, voltmeter, plug key

Circuit Diagram:



Procedure

i. I made the connections according to circuit diagram

ii. Close key K1 and placed the jokey on the potentiometer wire and found the balancing length L of wire for voltmeter

iii. Then I found the balancing length of l of wire

iv. Then found the emf of cell by using the relation Ex=$E\ \frac{l}{L}$ (volt)

v. I repeated the experiment thrice and took mean value of unknown emf

Observations and calculations

No of obs	Length (AB)= L cm	Balancing length l=AC cm	Ex=$E\ \frac{l}{L}$ (volt)
1	400	190	1.42
2	400	192	1.44
3	400	190	1.42
Mean value of emf Ex= $\frac{1.42+1.44+1.42}{3}$ =1.43 V			

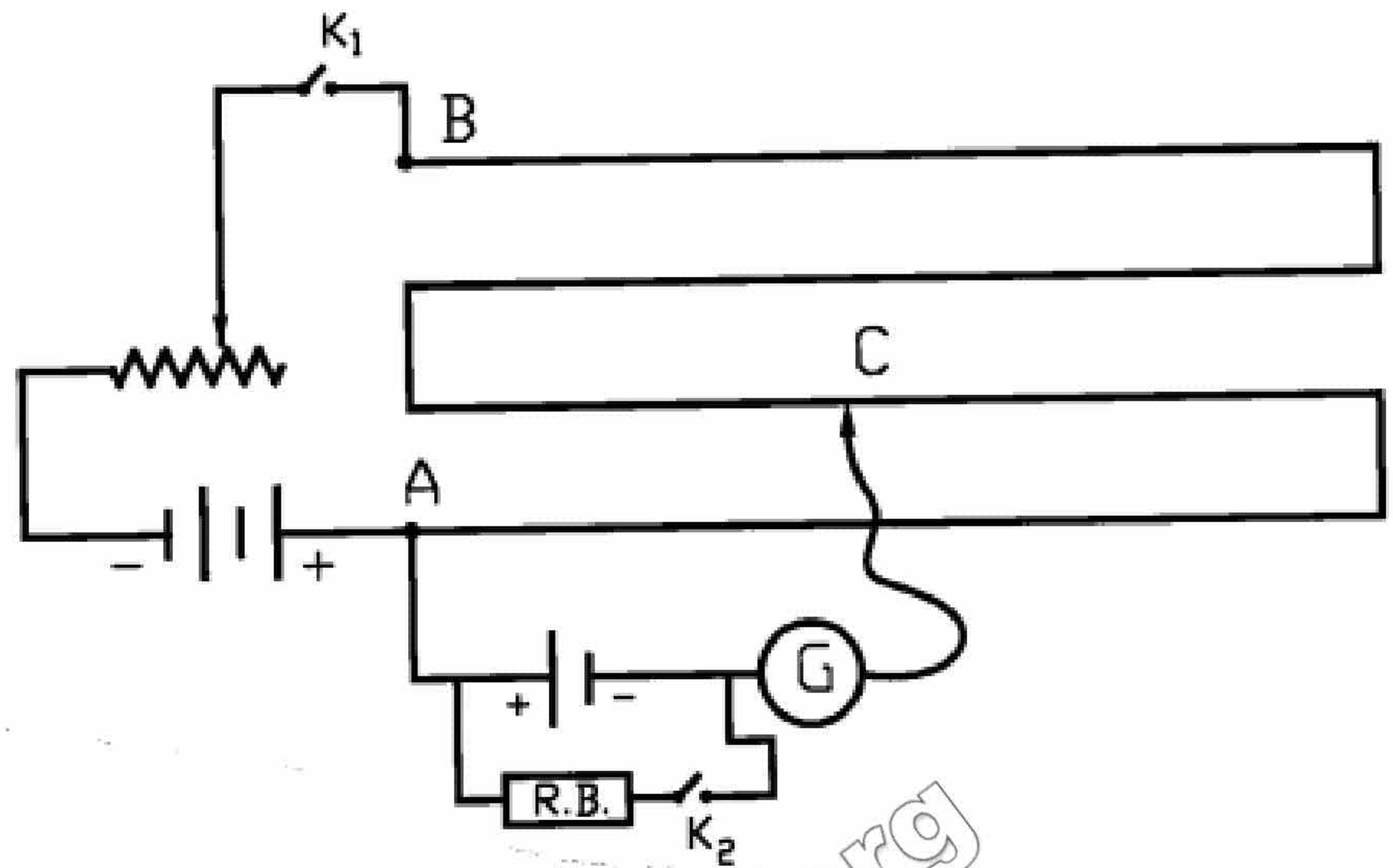
Result: The value of unknown emf is 1.43 volt

Experiment 14: To find the internal resistance of cell by using potentiometer

Apparatus:

Potentiometer, galvanometer, jokey, resistance box, two one way keys, battery, connecting wires

Circuit diagram:



Procedure

i. I made the connections according to circuit diagram
ii. Then I placed the jokey at end A of wire and then at end B, and noted the directions of deflections of galvanometer which were opposite at both ends
iii. Then closed the key K1 by keeping K2 open to find balance point on the wire
iv. Then I noted the distance of balance point from end A as l1 and value of this point remained same for rest of experiment
v. Then I closed the key2 and took out resistance R from resistance box and again find balance point and noted the distance of balance point from end A as l2
vi. Then I repeated the experiment for different values of R and calculated the internal resistance of cell by using the relations $r=\frac{l_1-l_2}{l_1}R$

Observations and calculations

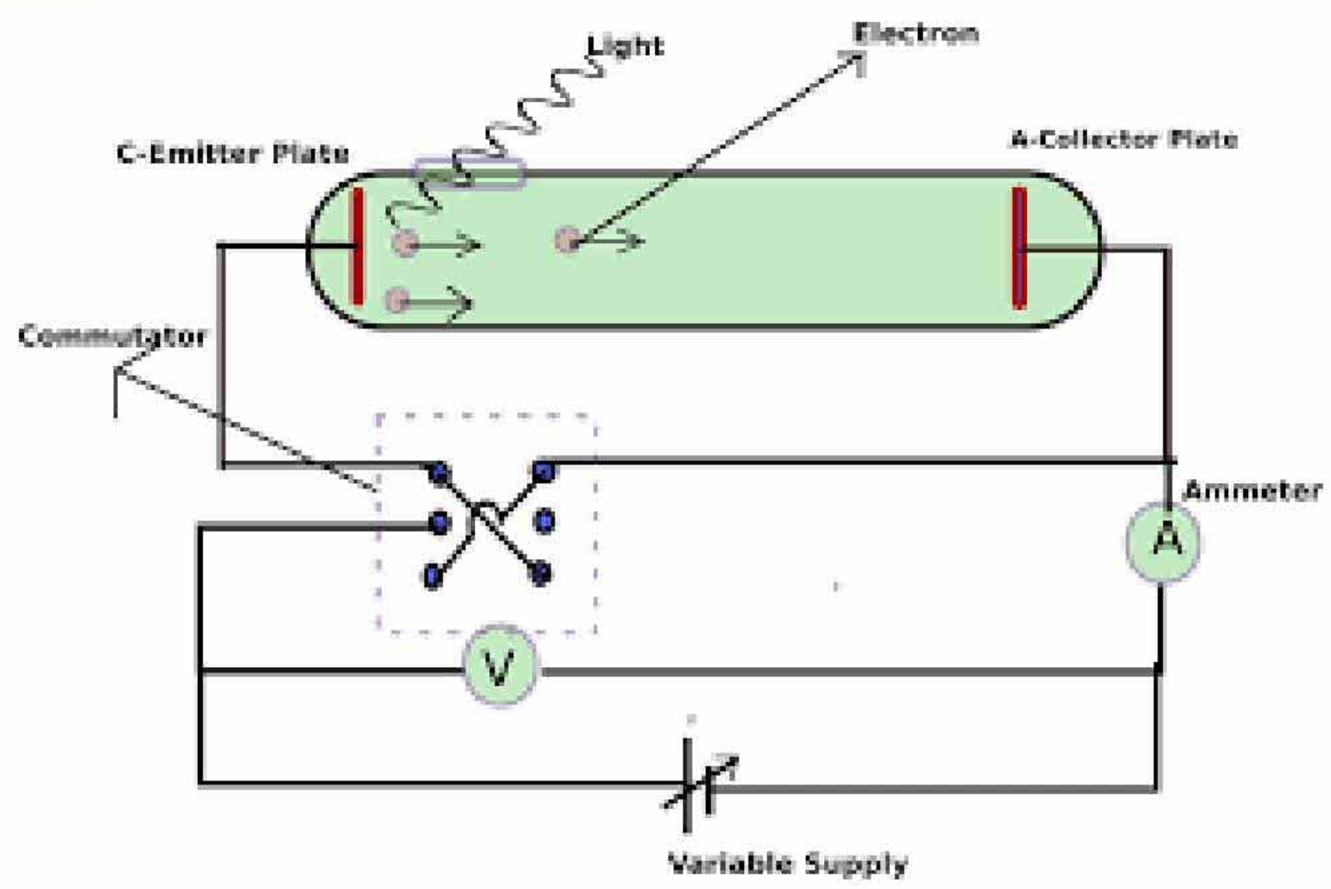
No of obs	Resistance R(Ω)	Length of wire where K2 open l_1 (cm)	Length of wire l_2 (cm)	Internal resistance of cell $r=\frac{l_1-l_2}{l_1}R$
1	20	145	140	0.68
2	25	145	141	0.68
3	30	145	142	0.62
Mean value of $r=\frac{0.68+0.68+0.62}{3}$ = 0.66 Ω				

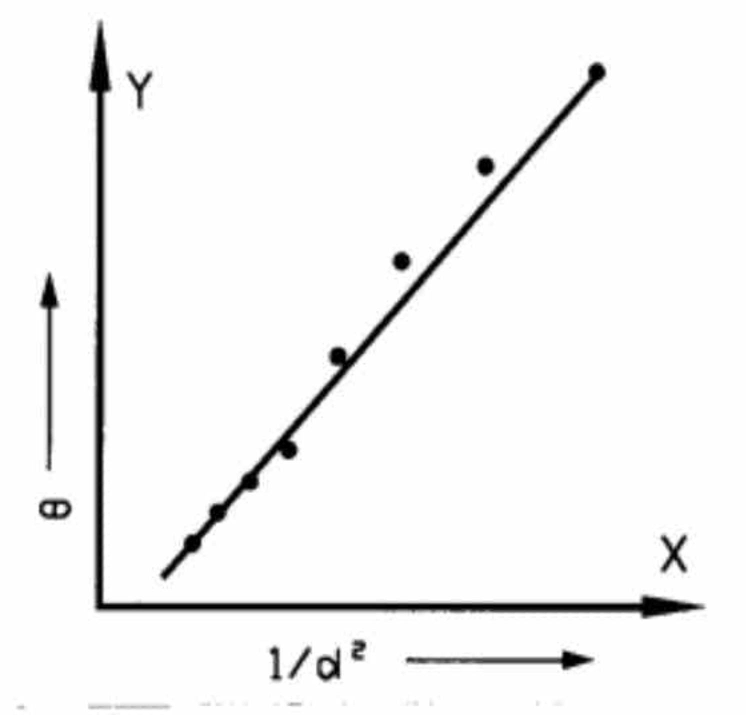
Result: The value of internal resistance is 0.66 ohm

Experiment 15: To study the variation of current with intensity of light using photocell

Battery, galvanometer, photocell, key, rheostat, electric lamp, connecting wires,

Circuit diagram:





Procedure

i. I made connections according to above circuit diagram
ii. Then I placed the photocell facing the electric bulb both which were enclosed in a wooden box fitted with a meter scale
iii. Then I placed the bulb at a distance of 100cm. from the photocell and switch the electric bulb
iv. When light falls on the cathode of photocell, photoelectrons are emitted and micro ammeter shows readings
v. Then I noted the distance of bulb from photocell and deflection current of micro ammeter
vi. Then I decreased the distance d in a regular steps and noted the corresponding values of deflection current
vii. Intensity of light is proportional to $1/d^2$
viii. Then I graph b/w 1/d2 and angle of deflections
ix. The graph was straight line which was concluded that photoelectric current is proportional to the intensity of light $1/d^2$

Observations and calculations

No of obs	Distance of lamp from photocell d(cm)	Deflection	$1/d^2(cm^{-2})$
01	57.5	2	$3.02*10^{-4}$
02	40.3	5	$6.15*10^{-4}$
03	32.7	7	$9.3*10^{-4}$
04	28	10	$15*10^{-4}$
05	24.9	12	$16*10^{-4}$
06	22.6	15	$19.5*10^{-4}$

Result:

Graph shows that photoelectric current is proportional to the intensity of light $1/d^2$

NOTE: ERRORS AND OMISSIONS ARE ACCEPTED

REGARD

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