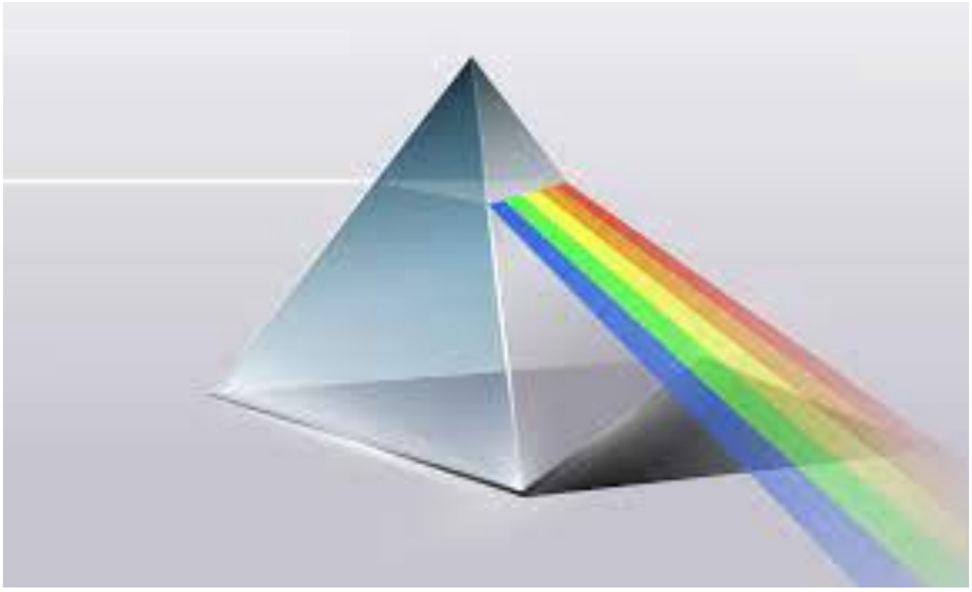
LABORATORY MANUAL

ON

ENGINEERING PHYSICS



OF

FIRST/SECOND SEMESTER

COMMON TO ALL BRANCHES

LABORATORY MANUAL

ON

ENGINEERING PHYSICS

Of

$1^{st}/2^{nd}$ semester of all Engineering Branches of Diploma courses of

Govt. Polytechnic, Balasore, Odisha

CERTIFICATE

This is to certify that Mr/Miss____

Of________________semester , Branch__________________________________bearing

Class Roll no__________________ and S.C.T.E & V.T. Regd.No.____________________

Of ____Institute during the

Year_______________has completed the practical /sessional work in________________

____ (Subject) as per curriculum

Prescribed by S.C.T.E. & V.T., ODISHA.

Lecturer Senior Lecturer Principal

Contents

EXPERIMENT NO.1

DATE:…………………… BRANCH:…………………….

ROLL NO………………. Name of Student:……………………..

Sign of Sr.lect./Lecturer /Lab.asst

AIM OF THE EXPERIMENT:

To measure the cross-sectional area of a wire by using screw gauge.

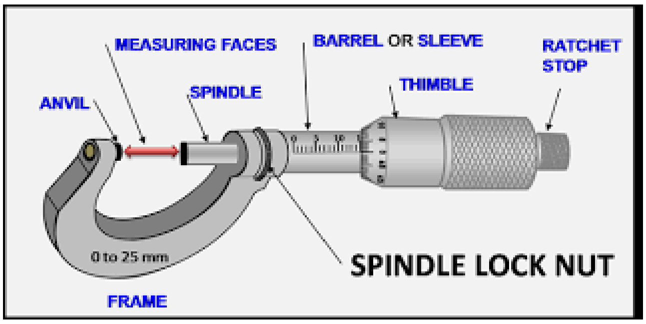
Our Objective

(a) Measure least count by using principle of micrometer screw.

*(b)*Measure diameter of a given wire

(c)Calculate the area of cross-section of the given wire

Material Required: A piece of Wire, Screw gauge, Geometry box



THEORY:

Pitch of the Screw Gauge

The pitch of the screw is the distance moved by the spindle per revolution. To find this, the distance advanced by the head scale over the pitch scale for a definite number of complete rotation of the screw is determined.

The pitch can be represented as;

$$\text{Pitch of the screw} = \frac{\text{Distance moved by screw}}{\text{No. of full rotations given}} \quad \ldots\ldots\ldots\ldots\ldots(1)$$

Least Count of the Screw Gauge

The Least count (LC) is the distance moved by the tip of the screw, when the screw is turned through 1 division of the head scale.

The least count can be calculated using the formula;

$$\text{Least count} = \frac{\text{Pitch}}{\text{Total number of divisions on the circular scale}} \quad \ldots\ldots\ldots\ldots\ldots(2)$$

For a 100 division circular Scale

Pitch=1/10=0.1cm

The least count =0.1/100=0.001cm

For a 50 division circular Scale

Pitch=0.5/ 10=0.05cm

Least count=0.05 / 50=0.001cm

This is the smallest length one can measure with this screw gauge

WORKING FORMULA:

The cross-sectional area of a wire $=\pi D^2/4$

OBSERVATION TABLE

TABULATION FOR MEASURING DIAMETER OF THE WIRE

No. of obs.	Pitch in cm	L.C in cm	ICSR (I)	No.of complete rotation(N)	FCSR (F)	Extra division (I-F)	P.S.R in cm (pitch× N)	C.S.R in cm (L.C×I-F)	Observed diameter (P.S.R+C.S.R) in cm	Mean diameter in cm
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

CALCULATION

From the above table ,the diameter of a given wire D=………………….cm

Hence,Cross-sectional area of a wire is $A = \frac{\pi D^2}{4}$=…………………..cm^2

CONCLUSION

Therefore from the above experiment ,the cross-sectional area of a given piece of a wire by using screw gauge is found …………….cm^2

PRECAUTIONS

1. To avoid undue pressure; the screw should always be rotated by ratchet R and not by cap K.

2.The screw should move freely without friction.

3.The zero correction, with proper sign should be noted very carefully and added algebraically.

4.For same set of observations, the screw should be moved in the same direction to avoid back-lash error of the screw.

5.At each place, the diameter of the wire should be measured in two perpendicular directions and then the mean of the two be taken

. 6.Readings should be taken at least for five different places equally spaced along the whole length of the wire.

7.Error due to parallax should be avoided.

Assignment question

1. Define Leastcount of Screw Gauge?
2. How can you determine the no.of complete rotation?
3. Can you measure the radius of a hair by Screw Gauge ?If not Why?
4. Between Slide caliper and screw gauge ,Which instrument will give more accurate measurement and why?
5. Which metal is used to make the screw and why?

EXPERIMENT NO.2

DATE :……………………   BRANCH:……………………..

ROLL NO ………………..   Name of Student:……………………….

Sign of Sr.lect./Lecturer /Lab.asst

AIM OF THE EXPERIMENT:

To measure the thickness and volume of the glasssheet using a screw gauge.

Apparatus/ Materials Required

- Screw Gauge
- Glass sheet
- Geometry box

THEORY

- Pitch: The pitch of the screw gauge is defined as the distance moved by the spindle per revolution which is measured by moving the circular scale over the main scale in order to complete one full rotation.

Pitch of the screw gauge = (distance moved by a screw)/(no. of rotations given)

- Least count: The least count of the screw is defined as the distance moved by the tip of the screw when turned through one division of the head scale.

Least count (LC) of the screw gauge = (pitch)/(total no.of divisions on the circular scale)
Least count of screw gauge = (0.1)/(100) = 0.001cm

Procedure

- Again, insert the sheet between the studs of the screw gauge and determine the thickness at ten different positions.
- Find the average thickness and determine the correct thickness by applying the zero error.

WORKING FORMULA:

Volume of glass sheet=V=L*B*H

Where L=length of glass sheet

B=breadth of glass sheet

H=height/thickness of glasssheet

Observations

Tabulation for Thickness/Height of SHEET

No. of obs.	Pitch in cm	L.C in cm	ICSR(I)	No.of complete rotation(N)	FCSR(F)	Extra division (I-F)	P.S.R in cm(pitch×N)	C.S.R in cm (L.C×I-F)	Observed Height (P.S.R+C.S.R) in cm	Mean Height(H) in cm
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Tabulation for Length of Sheet

Fig.no.	L_1 in cm	L_2 in cm	$L=L_1+L_2/2$ in cm	Mean L in cm

Tabulation for breadth of Sheet

Fig.no.	b_1 in cm	b_2 in cm	$B=b_1+b_2/2$ in cm	Mean B in cm

CALCULATION

Mean Height=----------------cm

Mean Length of sheet=------------cm

Mean Breadth of sheet=------------cm

Volume of glass sheet=length*breadth*height=------------------cm^3

CONCLUSION

Therefore from the above experiment ,the thickness and volume of the sheet by using a screw gauge is -------cm and ---------------cm^3.

PRECAUTIONS

1. To avoid undue pressure; the screw should always be rotated by ratchet R and not by cap K.

2.The screw should move freely without friction.

3.The zero correction, with proper sign should be noted very carefully and added algebraically.

4.For same set of observations, the screw should be moved in the same direction to avoid back-lash error of the screw.

5.At each place, the diameter of the wire should be measured in two perpendicular directions and then the mean of the two be taken

. 6.Readings should be taken at least for five different places equally spaced along the whole length of the wire.

7.Error due to parallax should be avoided.

Assignment question

1. Why the name is Screw Gauge?
2. How can you determine the no.of complete rotation?
3. What is the principle of screw gauge?
4. Explain the reason why the screw used in the screw gauge is known as a micrometre screw.
5. What is the value of the least count in commonly used screw gauge?

E X P E R I M E N T N O . 3

DATE :…………………… BRANCH:………………… …..

ROLL NO ………………. Name of Student:……………………….

Sign of Sr.lect./Lecturer /Lab.asst

A I M O F T H E E X P E R I M E N T :

T o f i n d o u t / t o m e a s u r e t h e v o l u m e o f a s o l i d c y l i n d e r b y u s i n g v e r n i e r c a l i p e r .

Our Objective

- To know the use of the Vernier Calipers.
- To measure the diameter of a small spherical / cylindrical body.
- To measure the length, width and height of the given rectangular block.
- To measure the internal diameter and depth of a given beaker/calorimeter and hence find its volume.

Material Required: A vernier calipers ,solid cylinder ,Instrument box

Theory

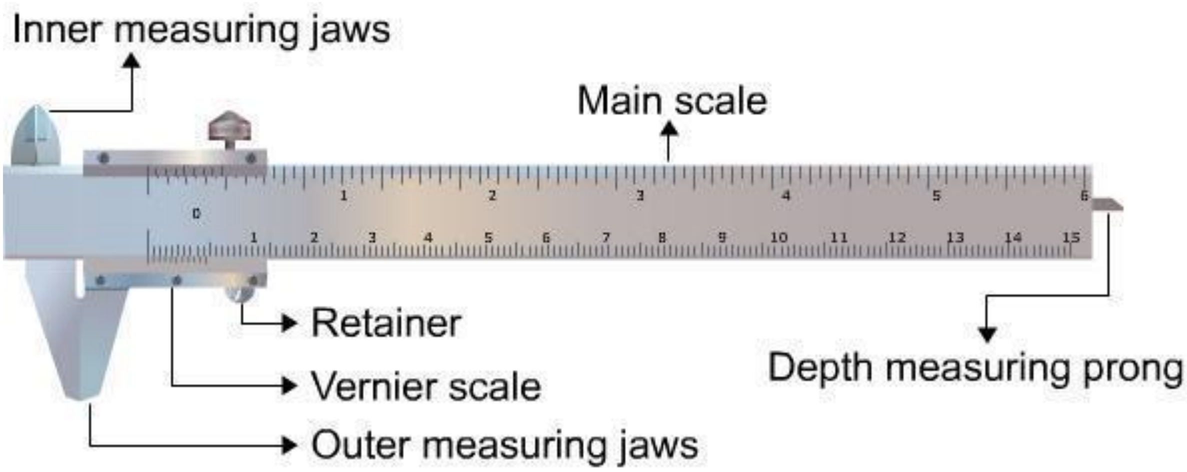
Least Count

The minimum measurement or smallest division of a measuring instrument is called Least count(L.C)

or

$$\text{Least count} = \text{one main scale (MS) division} - \text{one Vernier scale (VS) division}\ldots\ldots\ldots(1)$$

$$\text{Least Count} = \frac{\text{One Main scale(MS) division}}{\text{Number of divisions in Vernier Scale}}$$



i)Least count of Vernier Callipers (Vernier Constant)
10 vernier scale division=9main scale division
1 vernier scale division=9/10 main scale division
=0.9 main scale division

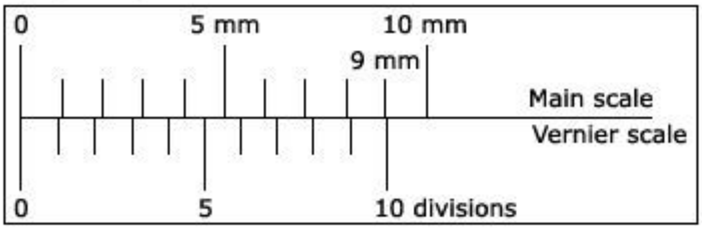
Vernier constant= 1 main scale division – 1 vernier scale division
= (1– 0.9) main scale divisions
= 0.1 main scale division

Vernier constant =0.1mm=0.01cm

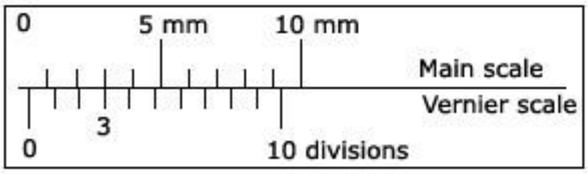
Zero error and its correction

When the jaws A and B touch each other, the zero of the Vernier should coincide with the zero of the main scale. If it is not so, the instrument is said to possess zero error (e). Zero error may be positive or negative zero error.

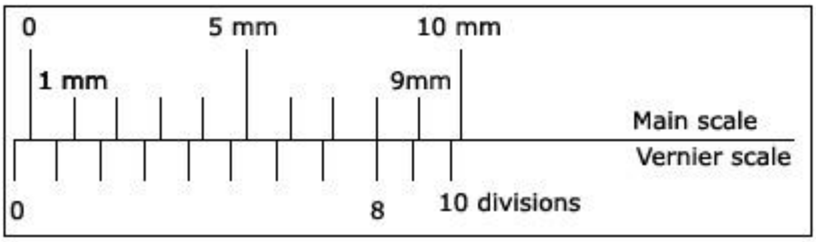
Zero Error



Positive Error



Nagative Error



Positive zero error

when both jaws are touching each other,zero of the vernier scale is shifted to the right of zero of the mainscale is called positive zero error.(This might have happened due to manufacturing defect or due to rough handling).

Negative zero error

when both the jaws are touching each other, zero of the vernier scale is shifted to the left of zero of the main scale is called negative zero error.

WORKING FORMULA:

The volume of a solid cylinder = $V = \frac{\pi D^2}{4} h$

where D = internal diameter of cylinder , h = depth/height of cylinder

PROCEDURE

1. We'll first determine the vernier constant (VC), which is the least count (L.C) of the vernier calliper and record it stepwise as in the equation, L.C = 1 MSD - 1 VSD.
2. Now, bring the movable jaw in close contact with the fixed jaw and find the zero error. Do this three times and record the values. If there is no zero error, then record 'zero error nil'.
3. Open the jaws of the Vernier Calliper and place the sphere or cylinder between the two jaws and adjust the movable jaw, such that it gently grips the body without any undue pressure on it. That done, tighten the screw attached to the Vernier scale.
4. Note the position of the zero mark of the Vernier scale on the main scale. Record the main scale reading just before the zero mark of the vernier scale. This reading (N) is called main scale reading (MSR).
5. Note the number (n) of the Vernier scale division which coincides with the division of the main scale.
6. You'll have to repeat steps 5 and 6 after rotating the body by 90° for measuring the diameter in a perpendicular direction.
7. Repeat steps 4 to 7 for three different positions and record the observations.
8. Now find total reading using the equation, TR = MSR+VSR = N+(n x L.C) and apply the zero correction.
9. Take the mean of the different values of the diameter and show that in the result with the proper unit.

OBSERVATION TABLE:

TABULATION FOR LENGTH/HEIGHT OF A CYLINDER(h)

No. of obs.	L.C (in cm)	Main scale reading(MSR) in cm	Vernier coincidence(v.c)	Vernier scale reading(VSR) in cm=v.c*L.c	Observed reading(MSR+VSR) in cm	Mean height in cm(h)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

TABULATION FOR DIAMETER OF A CYLINDER(d)

No. of obs.	L.C (in cm)	Main scale reading(MSR) in cm	Vernier coincidence(v.c)	Vernier scale reading(VSR) in cm=v.c*L.c	Observed reading(MSR+VSR) in cm	Mean diameter in cm(D)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

CALCULATION:

The length of the given cylinder=………………………..cm

The diameter of given cylinder=…………………………..cm

Now,putting the values in the formula, $V = \frac{\pi D^2}{4}h$

=……………..= …………………cm^3

CONCLUSION:

The volume of the given cylinder is ……………………cm^3.

PRECAUTION:

1.If the vernier scale is not sliding smoothly over the main scale,apply machine oil/grease.

2.Screw the vernier tightly without exerting undue pressure to avoid any damage to the threads of the screw.

3.Keep the eye directly over the division mark to avoid any error due to parallax.

4.Note down each observation with correct significant figures and units.

<u>Assignment question</u>

1.What part of the vernier callipers is the vernier scale?
2.Which is the instrument you will use to measure the internal and external diameter of a tube?

3. The least count of a vernier is 0.01 cm. What is the order up to which it can measure length accurately?
4.which is the larger scale on the body of vernier caliper?
5.What is the Main scale and vernier scale?

E X P E R I M E N T N O . 4

DATE :…………………… BRANCH:……………………..

ROLL NO ………………. Name of Student:………………………

Sign of Sr.lect./Lecturer /Lab.asst

A I M O F T H E E X P E R I M E N T :

T o f i n d o u t / t o m e a s u r e t h e v o l u m e o f a h o l l o w c y l i n d e r b y u s i n g v e r n i e r c a l i p e r .

Our Objective

- To know the use of the Vernier Calipers.
- To measure the diameter of a small spherical / cylindrical body.
- To measure the length, width and height of the given rectangular block.
- To measure the internal diameter and depth of a given beaker/calorimeter and hence find its volume.

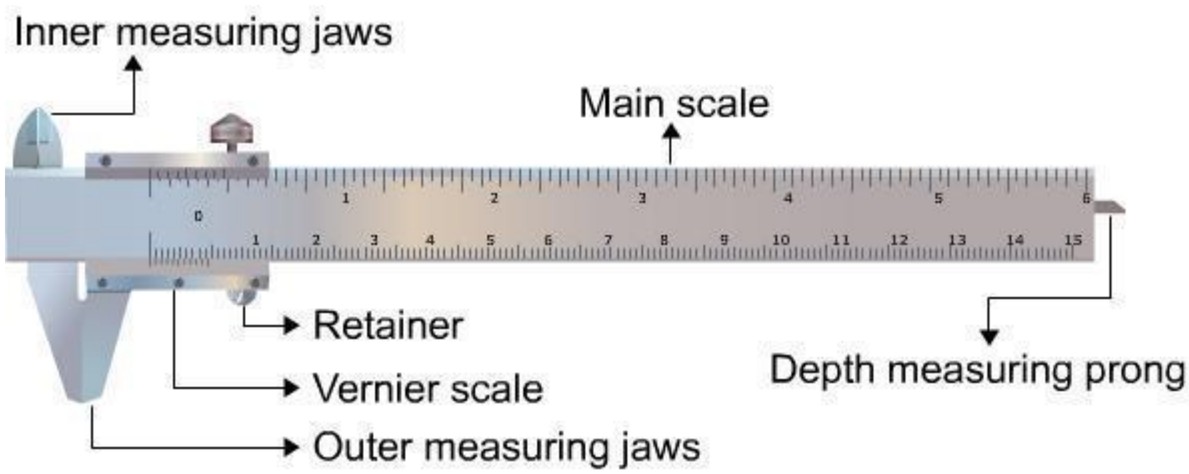
Material Required: A Vernier callipers, Hollow cylinder,Instrument box

Theory :

Least Count:
The minimum measurement or smallest division of a measuring instrument is called Least count(L.C)

$$\text{Least count} = \text{one main scale (MS) division} - \text{one Vernier scale (VS) division} \quad \ldots\ldots\ldots(1)$$

$$\text{Least Count} = \frac{\text{One Main scale(MS) division}}{\text{Number of divisions in Vernier Scale}}$$



Least count of Vernier Callipers (Vernier Constant)
10 vernier scale division=9main scale division
1 vernier scale division=9/10 main scale division
=0.9 main scale division

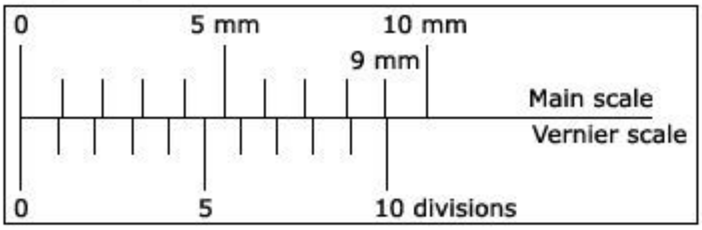
Vernier constant= 1 main scale division – 1 vernier scale division
= (1– 0.9) main scale divisions
= 0.1 main scale division

Vernier constant =0.1mm=0.01cm

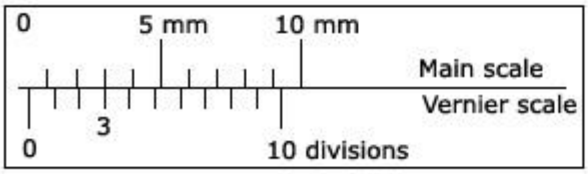
Zero error and its correction

When the jaws A and B touch each other, the zero of the Vernier should coincide with the zero of the main scale. If it is not so, the instrument is said to possess zero error (e). Zero error may be positive or negative zero error.

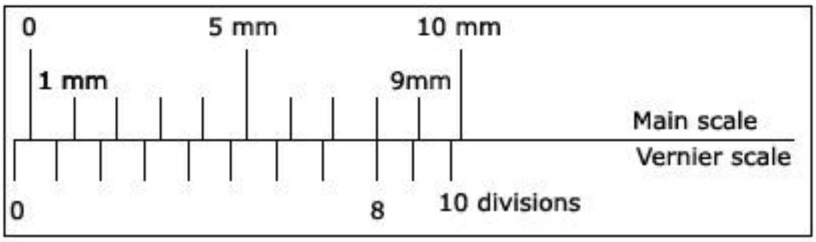
Zero Error



Positive Error



Nagative Error



WORKING FORMULA:

The volume of a hollow cylinder= $V = \pi\left(\frac{D^2-d^2}{4}\right)h$

where D = external diameter of cylinder d = internal diameter of the cylinder h = length/height of cylinder

PROCEDURE

1. We'll first determine the vernier constant (VC), which is the least count (L.C) of the vernier calliper and record it stepwise as in the equation, L.C = 1 MSD - 1 VSD.
2. Now, bring the movable jaw in close contact with the fixed jaw and find the zero error. Do this three times and record the values. If there is no zero error, then record 'zero error nil'.
3. Open the jaws of the Vernier Calliper and place the sphere or cylinder between the two jaws and adjust the movable jaw, such that it gently grips the body without any undue pressure on it. That done, tighten the screw attached to the Vernier scale.
4. Note the position of the zero mark of the Vernier scale on the main scale. Record the main scale reading just before the zero mark of the vernier scale. This reading (N) is called main scale reading (MSR).

5. Note the number (n) of the Vernier scale division which coincides with the division of the main scale.
6. You'll have to repeat steps 5 and 6 after rotating the body by 90° for measuring the diameter in a perpendicular direction.
7. Repeat steps 4 to 7 for three different positions and record the observations.
8. Now find total reading using the equation, TR = MSR+VSR = N+(n x L.C) and apply the zero correction.
9. Take the mean of the different values of the diameter and show that in the result with the proper unit.
10. **OBSERVATION TABLE:**

TABULATION FOR LENGTH/HEIGHT OF A CYLINDER(h)

No. of obs.	L.C (in cm)	Main scale reading(MSR) in cm	Vernier coincidence(v.c)	Vernier scale reading(VSR) in cm=v.c*L.c	Observed reading(MSR+VSR) in cm	Mean height in cm(h)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

TABULATION FOR EXTERNAL DIAMETER OF A CYLINDER(D)

No. of obs.	L.C (in cm)	Main scale reading(MSR) in cm	Vernier coincidence(v.c)	Vernier scale reading(VSR) in cm=v.c*L.c	Observed reading(MSR+VSR) in cm	Mean ext.diameter in cm(h)
1						
2						
3						
4						
5						
6						
7						
8						
9						

10						

TABULATION FOR INTERNAL DIAMETER OF A CYLINDER(d)

No. of obs.	L.C (in cm)	Main scale reading(MSR) in cm	Vernier coincidence(v.c)	Vernier scale reading(VSR) in cm=v.c*L.c	Observed reading(MSR+VSR) in cm	Mean int. diameter in cm(d)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

CALCULATION:

The length/height of the given cylinder=………………………..cm

The internal diameter of given cylinder=……………..cm

The external diameter of given cylinder=…………………………..cm

Now,putting the values in the formula,=$v = \pi(\mathrm{D}^2 - \mathrm{d}^2)\frac{\mathrm{h}}{4}$………………..= ………………..cm^3

CONCLUSION:

The volume of the given cylinder is ……………………cm^3.

PRECAUTION:

1.If the vernier scale is not sliding smoothly over the main scale,apply machine oil/grease.

2.Screw the vernier tightly without exerting undue pressure to avoid any damage to the threads of the screw.

3.Keep the eye directly over the division mark to avoid any error due to parallax.

4.Note down each observation with correct significant figures and units.

Assignment question

1. Define Vernier constant?
2. What is Vernier coincidence?
3. What is zero error? When Zero Error is Positive?
4. What is the least count of Meter scale, Stopwatch,Vernier Calliper?
5. Why is the Vernier caliper so called?

EXPERIMENT NO.5

DATE :…………………… BRANCH:………………… …..

ROLL NO ………………. Name of Student:……………………….

Sign of Sr.lect./Lecturer /Lab.asst

AIM OF THE EXPERIMENT:

To determine radius of curvature of a given spherical (convex) surface by a spherometer.

OBJECTIVE OF THE EXPERIMENT

1.Determine least count of the experiment.

2.Measure the distance between conseucative leg of spherometer.

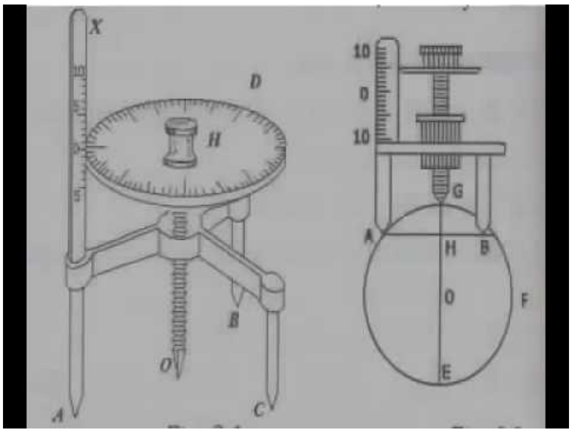
3.Measure the height of curved surface by the spherometer

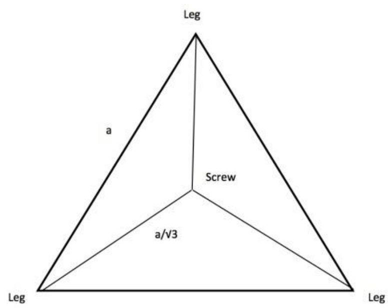
4.Calculate the radius of curvature by using the working formula.

APPARATUS REQUIRED

Spherometer, convex surface, a Big size plainGlass,Instrument box

DIAGRAM





THEORY

RADIUS OF CURVATURE

The radius of curvature 'R' of a curved surface is the radius of the sphere of which the curved surface is a part.

Radius of curvature $R = \frac{d^2}{6h} + \frac{h}{2}$

Where 'd' is the distance between two fixed legs of the spherometer.

And 'h' is the height/depth of curved surface.

PROCEDURE

1.Raise the central screw of the spherometer and press the spherometer gently on the practical note-book so as to get pricks of the three legs . Mark these pricks as A,B and C.

2. Measure the distance between the pricks (points) by joining the points as to form a triangle ABC.

3. Note these distances (AB, BC, AC) on note book .

4. Find the value of one pitch scale division.

5. Determine the pitch and the least count of the spherometer and record it stepwise.

6. Raise the screw sufficiently upwards.

7. Place the spherometer on the convex surface so that its three legs rest on it.

8. Gently turn the screw downwards till the screw tip just touches the convex surface..

9. Note the reading of the circular scale which is in line with the pitch scale.

10. Remove the spherometer from over the convex surface and place over large size plane glass slab.

11. Turn the screw downwards and count the number of complete rotations (n1) made by the disc (one rotation becomes complete when the reference reading crosses past the pitch scale).

12. Continue till the tip of the screw just touches the plane surface of the glass slab.

13. Note the reading of the circular scale which is finally in line with the pitch scale.

14. Find the number of circular scale division in last incomplete rotation.

15. Repeat steps 6 to 14, three times. Record the observation in tabular form.

OBSERVATION TABLE:

TABULATION FOR MEASURING HEIGHT OF A CONVEX SURFACE

No. of obs.	Pitch in cm	L.C in cm	ICSR(I)	No.of complete rotation(N)	FCSR(F)	Extra division (I-F)	P.S.R in cm (pitch ×N)	C.S.R in cm (L.C×I-F)	Observed height (P.S.R+C.S.R) in cm	Mean height in cm
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

TABULATION FOR ' d'

Fig. no.	d_1	d_2	d_3	$d=\frac{(d1+d2+d3)}{3}$ in cm	Mean 'd' in cm

Calculation

d of the spherometer =…………….cm

and h by spherometer =………………..cm

Radius of curvature of the given watch glass R = $\frac{d^2}{6h}+\frac{h}{2}$=………………cm

CONCLUSION

The radius of curvature of the given convex surface is ………………….cm.

PRECAUTIONS

1. The screw should move freely without friction.

2. The screw should be moved in same direction to avoid back-lash error of the screw.

3. Excess rotation should be avoided.

Assignment question

1. What is the value of Radius of curvature of phone surface?

2.What is Radius of curvature of a Spherometer? What is the value of Radius of curvature of a Plane surface

3.What is the unit of Radius of curvature?

4.Why the Instrument is named as Spherometer?

5.What is the pitch of the spherometer?How do you find leastcount of spherometer?

E X P E R I M E N T   N O . 6

DATE :…………………… BRANCH:……………………..

ROLL NO ……………….. Name of Student:……………………….

Sign of Sr.lect./Lecturer /Lab.asst

A I M   O F   T H E   E X P E R I M E N T

To determine radius of curvature of a given spherical (concave) surface by a spherometer.

OBJECTIVE OF THE EXPERIMENT

1.Determine least count of the experiment.

2.Measure the distance between conseucative leg of spherometer.

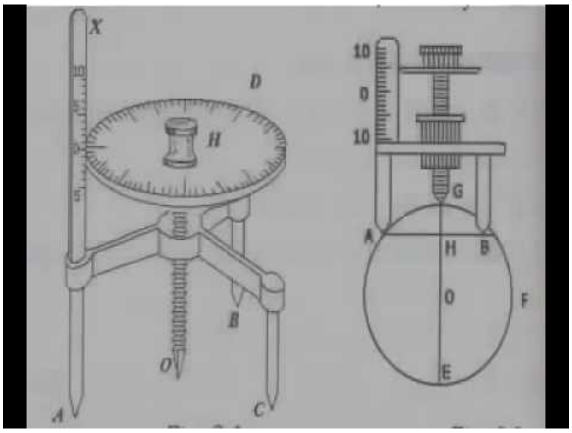
3.Measure the height of curved surface by the spherometer

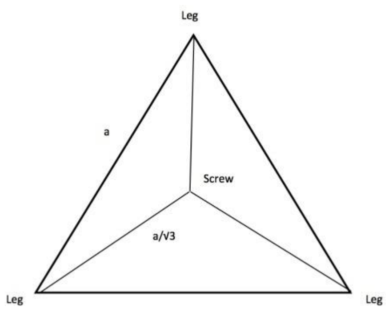
4.Calculate the radius of curvature by using the working formula.

APPARATUS REQUIRED

Spherometer, concave surface, a plainGlass , Instrument box

DIAGRAM





THEORY

RADIUS OF CURVATURE

The radius of curvature ‘R’ of a curved surface is the radius of the sphere of which the curved surface is a part.

Radius of curvature $R = \frac{d^2}{6h} + \frac{h}{2}$

Where ‘d’ is the distance between two fixed legs of the spherometer.

And ‘h’ is the height/depth of curved surface.

PROCEDURE

1.Raise the central screw of the spherometer and press the spherometer gently on the practical note-book so as to get pricks of the three legs . Mark these pricks as A,B and C.

2. Measure the distance between the pricks (points) by joining the points as to form a triangle ABC.

3. Note these distances (AB, BC, AC) on note book .

4. Find the value of one pitch scale division.

5. Determine the pitch and the least count of the spherometer and record it stepwise.

6. Raise the screw sufficiently upwards.

7. Place the spherometer on the convex surface so that its three legs rest on it.

8. Gently turn the screw downwards till the screw tip just touches the convex surface..

9. Note the reading of the circular scale which is in line with the pitch scale.

10. Remove the spherometer from over the convex surface and place over large size plane glass slab.

11. Turn the screw downwards and count the number of complete rotations (n1) made by the disc (one rotation becomes complete when the reference reading crosses past the pitch scale).

12. Continue till the tip of the screw just touches the plane surface of the glass slab.

13. Note the reading of the circular scale which is finally in line with the pitch scale.

14. Find the number of circular scale division in last incomplete rotation.

15. Repeat steps 6 to 14, three times. Record the observation in tabular form.

OBSERVATION TABLE:

TABULATION FOR MEASURING HEIGHT OF A CONCAVE SURFACE

No. of obs.	Pitch in cm	L.C in cm	ICSR(I)	No.of complete rotation(N)	FCSR(F)	Extra division (I-F)	P.S.R in cm (pitch ×N)	C.S.R in cm (L.C×I-F)	Observed height (P.S.R+C.S.R) in cm	Mean height in cm
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

TABULATION FOR ' d'

Fig. no.	d_1 in cm	d_2 in cm	d_3 in cm	d=$\frac{(d1+d2+d3)}{3}$ in cm	Mean 'd' in cm

Calculation

d of the spherometer =…………….cm

and h by spherometer =………………..cm

Radius of curvature of the given watch glass R =$\frac{d^2}{6h}+\frac{h}{2}$= …………………………..cm

CONCLUSION

The Radius of curvature of the given concave surface is ………………… .cm.

PRECAUTIONS

1. The screw should move freely without friction.

2. The screw should be moved in same direction to avoid back-lash error of the screw.

3. Excess rotation should be avoided.

Assignment question

1.Is there any zero error in a Spherometer?
2.Can you measure the radius of curvature of wrist –watch glass by using a Spherometer?
3.When the zero error is positive and when negative?
4.Why is a Spherometer important?
5.What are two uses of Spherometer?

EXPERIMENT NO.7

DATE :…………………… BRANCH:…………………….

ROLL NO ………………. Name of Student:……………………..

Sign of Sr.lect./Lecturer /Lab.asst

AIM OF THE EXPERIMENT

Determine of acceleration due to gravity(g) by Simple pendulum method.

OBJECTIVE OF THE EXPERIMENT

a) Understand the concept of 'g'.
b) Known the concept of a simple pendulum and measure the diameter of bob.
c) Measure the diameter of the bob with hook.
d) Mark the point of suspension of effective length.
e) Measure the timeperiod of oscillation and calculate 'g' by working formula.

APPARATUS REQUIRED

1.a solid metallic bob with hook	2.piece of thread	3.metre scale
4.slide calliper	5.clamp stand	6.geometry box

THEORY

Simple Pendulum :

An ideal simple pendulum consists of a heavy point mass (called bob) tied to one end of a perfectly inextensible, flexible and weightless string. In practice, we make it by tying a metallic spherical bob to a fine cotton stitching thread.

TIMEPERIOD(T)- It is the time taken by the pendulum to finish one full oscillation and is denoted by "T".

Effective length of the simple pendulum is the distance from the point of suspension of the centre of gravity of the bob.

So the effective length= Length of Thread (l)+ length of the hook (h)+ radius of the bob (r) :

$$L=l + r + h$$

Laws of Simple pendulum:

Law of Isochronism: Time period of a simple pendulum of given length at a given place is independent of amplitude

Law of Length: At a given place the time period of a simple pendulum varies directly as the square root of the length i.e., T α $\sqrt{L}$

Laws of Gravitation:

The time period of the simple pendulum at a given place is inversely proportional to the square root of acceleration of gravity i.e., T α $1/\sqrt{g}$

Formula:

From the laws of simple pendulum:

$T \alpha \sqrt{L}/\sqrt{g}$ => $T \alpha \sqrt{(\frac{L}{g})}$ => $T = 2\pi\sqrt{(\frac{L}{g})}$=> $T^2 = 4\pi^2(\frac{L}{g})$ =>

$$\boxed{g = 4\pi^2 L/ T^2}$$

Procedure:

1.Measure the diameter(2r)of the bob with the help of a slide callipers. Calculate the radius of the bob(r).

2.Then calculate the height of the hook.This is done first by taking the measurement of(2r+h) and 2r is subtracted from it.

3.Then,determining the length from centre of bob to the top of the hook (r+h).This is the sum of radius and height of hook.

4.Tie the thread to the hook and stretch tightly along the meter scale with the tied end at the zero of the scale.

5.Put small ink marks on the thread at places like 30cm,40cm,50cm………………120cm.

6.Then ,suspend the pendulum from the clamp stand and between the two halves of the cork in such a way that the mark on the thread corresponding to an effective length should be just at the bottom surface of the cork.

7.allow the pendulum to hang vertically at the edge of the table

8.Two lines are drawn on the edge of the table to limit the amplitude to 4˚ from mean position of the simple pendulum.

9.The bob is then allowed to oscillated parallel to the edge of the table .This shows that the oscillation is taking place in a vertical plane.

10.A stopwatch is used to note the time for 10 oscillation for a given length of the pendulum.This is repeated for three times.Time period in each case is noted.

11.The pendulum is then suspended from other ink marks given earlier and the timeperiods for 10 oscillations are noted in each case.

12.Plot L˜$T^2$of graph taking L-along X-axis and T^2 along Y-axis.

TABULATION FOR DIAMETER(2R) OF A BOB

No. of obs.	L.C (in cm)	Main scale reading(MSR) in cm	Vernier scale reading(VSR) in cm	Observed reading(MSR+VSR)IN cm	Mean diameter in cm(D)
1					
2					
3					
4					
5					

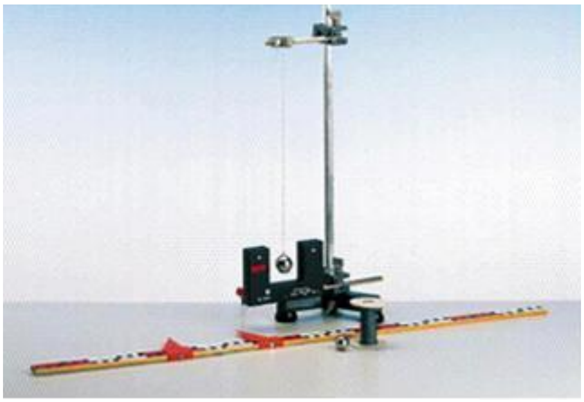
TABULATION FOR 2R+H

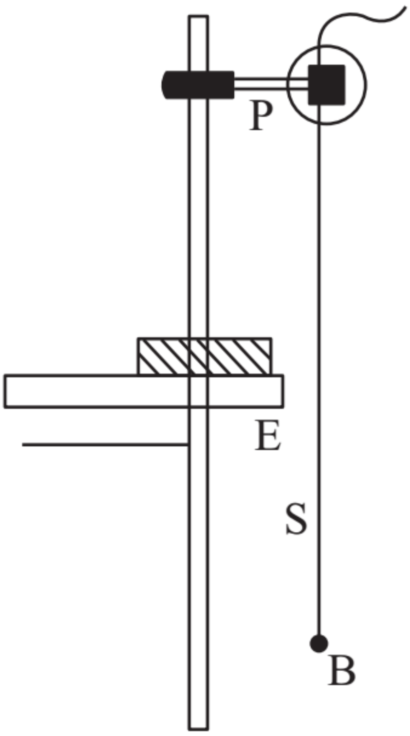
No. of obs.	L.C (in cm)	Main scale reading(MSR) in cm	Vernier scale reading(VSR) in cm	Observed reading(MSR+VSR)IN cm	Mean diameter in cm(D)
1					
2					
3					
4					
5					

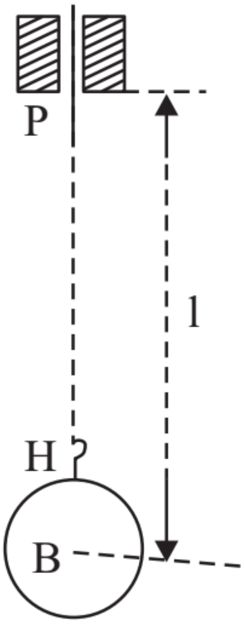
(2R+h)-R= R+h = …………….cm

MEASUREMENT OF TIMEPERIOD

No.of obs	R+h in cm	Length of thread (l) in cm	Effective length L=l+r+h	Time for 10 oscillation in sec			Timeperiod T=t/10 in sec	T^2 in sec^2	L/ T^2 in cm/ sec^2	Mean L/ T^2 in cm/ sec^2
				t_1	t_2	$t=\frac{t1+t2}{2}$				
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										







CONCLUSION: The value of acceleration due to gravity by using Simple pendulum is found to be ----------- cm/sec^2.

PRECAUTION

1. The oscillation should happen in a vertical plane.
2. The amplitude should be small.
3. Time period should be measured carefully
4. Care must be taken so that the system does not get disturbed. In particular, disturbance due to vibration or wind should be avoided.

<u>Assignment question</u>

1. What is the difference between Gravity & acceleration due to Gravity?
2. How does 'g' vary with height, depth or due to rotation of the earth about its axis?
3. Define Simple Harmonic Motion?
4. What is Second Pendulum?
5. What will be the weight of the body at centre of the Earth?

E X P E R I M E N T N O . 8

DATE :…………………… BRANCH:……………………..

ROLL NO ……………….. Name of Student:……………………….

Sign of Sr.lect./Lecturer /Lab.asst

AIM OF THE EXPERIMENT : To determine Angle of prism by using prism by the method of reflection

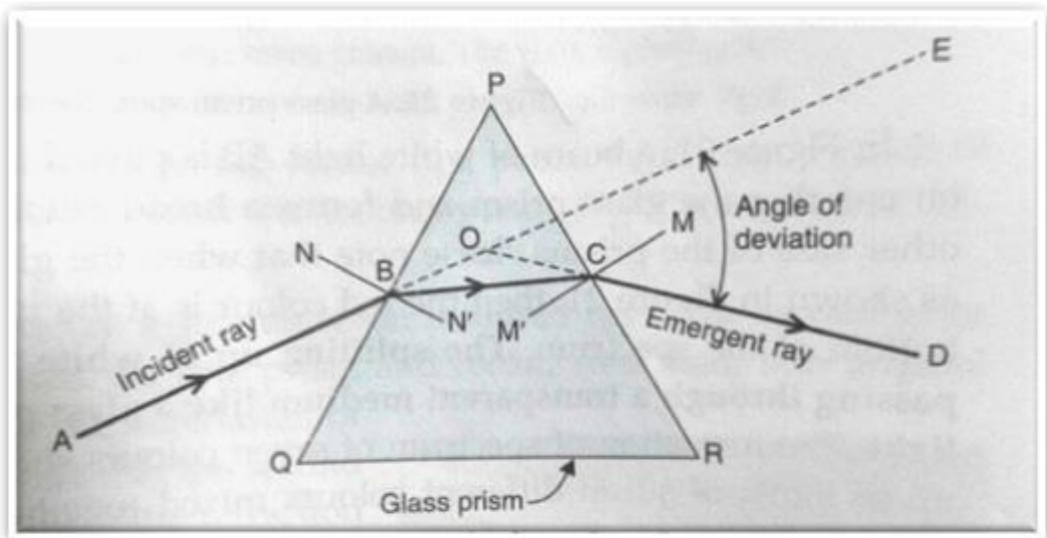
OBJECTIVE OF THE EXPERIMENT:

a)-Understand the concept of prism

b)-Determine the angle of prism(A)

APPARATUS REQUIRED: i)Drawing board ii)Prism iii)Drawing pins iv)Needle point /steel pins v) Drawing sheet vi)Scale,set square,protractor and a sharp pencil.

EXPERIMENT FIGURE



THEORY

Angle of deviation(D):

The angle between incident ray and emergent ray is called angle of deviation.

Angle of incidence(I):

The angle between incident ray and normal to the interface is called angle of incidence or incident angle.

Angle of emergence(e):

The angle between emergent ray and normal to the interface is called angle of emergence or emergent angle.

Base angle:

The angle between incident ray and interface of refracting surface of prism is called base angle.

Angle of minimum deviation(Dm)

The angle between incident ray and emergent ray, when angle of incidence is equal to angle of emergence,this is called_Angle of minimum deviation.

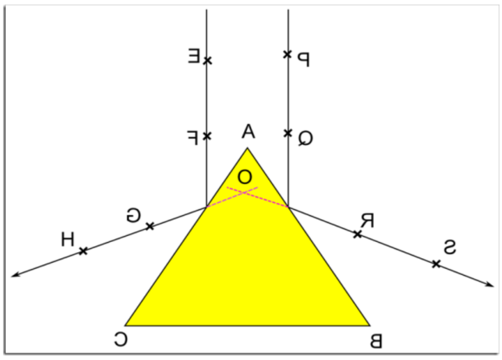
WORKING FORMULA

If the angle of the prism is $\angle A$ then angle of deviation $\angle D = \angle i + \angle e - \angle A$ and $\angle r_1 + \angle r_2 = \angle A$
If $\angle A$ is the angle of the prism, $\angle D_m$ the angle of minimum deviation.

Then the refractive index of the material of the prism $\mu = \frac{sin\frac{(A+D_m)}{2}}{sin\frac{A}{2}}$

PROCEDURE

We can divide the entire procedure of this experiment in to two parts i) we have to first determine the angle of the prism A then ii) We have to determine the angle of minimum deviation D of the prism.
Part i: Determine the angle of the prism A:Place the drawing board on the table and fix the drawing sheet on the drawing board using drawing pins.Place the prism on the drawing sheet,holding the prism trace the outer boundary of the prism which will be triangle.Mark the three vertices of the triangle as A,B and C.Now draw two parallel lines so that the edge A lies symmetrically between parallel lines.



Then two pins are fixed on one of the lines at points P and Q.Looking through the face AB two more pins are fixed at the points R and S so that the reflective images of the pins at P an Q lie in the same straight line with these two pins without any parallax error.Now join the points R and S using a scale .The RS line represents the reflected ray of PQ.In the same way repeat the procedure on the other face of the prism AC, to get the reflected images G,H of the incident ray passing through EF.Remove the prism and extend the st.lines passing through RS and GH in to triangle ABC so that they meet at a point O.
Measure the angle ROG which will be equal to 2A
Hence $\angle A = \frac{\angle ROG}{2}$

Observations:

DETERMINATION OF ANGLE OF PRISM

No.of obs.	2A in degree	Mean value of 2A in degree	A in degree

CALCULATION

- From the above table , Angle of prism (A) = ……………….degree

CONCLUSION

The angle of prism by using prism is found to be ------------degree

Precaution:

1. Ray direction should be marked.
2. The position of the pin must be marked with circle immediately after removing the pins.
3. The experiment table and board should be placed in a firm manner so that there is no disturbance due to vibration.
4. The pins must be fixed straight.
5. Parallax error should be avoided.

Assignment question

1. Define Angle of Prism.
2. Define Refraction &Reflection.
3. Define Absoulte refractive Index.
4. What is the Speed of Light in Vaccum?
5. Define angle of Incidence and angle of Refraction.

EXPERIMENT NO.9

DATE :…………………… BRANCH:………………… …..

ROLL NO ……………….. Name of Student:……………………….

Sign of Sr.lect./Lecturer /Lab.asst

AIM OF THE EXPERIMENT: To determine Angle of Minimum deviation of a prism by I-D curve method.

OBJECTIVE OF THE EXPERIMENT:

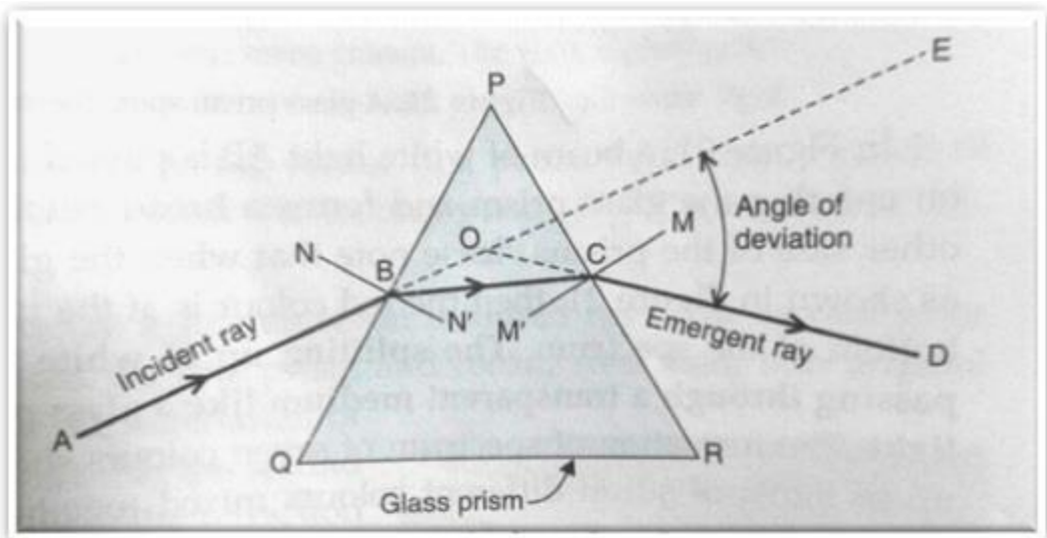
a)-Understand the concept of prism

b)-Determine the angle of prism(A)

c)- Determine the refractive index of prism.

APPARATUS REQUIRED: i)Drawing board ii)Prism iii)Drawing pins iv)Needle point /steel pins v) Drawing sheet vi)Scale,set square,protractor and a sharp pencil.

EXPERIMENT FIGURE



THEORY

Angle of deviation(D):

The angle between incident ray and emergent ray is called angle of deviation.

Angle of incidence(I):

The angle between incident ray and normal to the interface is called angle of incidence or incident angle.

Angle of emergence(e):

The angle between emergent ray and normal to the interface is called angle of emergence or emergent angle.

Base angle:

The angle between incident ray and interface of refracting surface of prism is called base angle.

Angle of minimum deviation(Dm)

The angle between incident ray and emergent ray, when angle of incidence is equal to angle of emergence,this is called_Angle of minimum deviation.

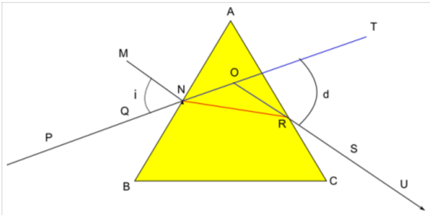
WORKING FORMULA

If the angle of the prism is $\angle A$ then angle of deviation $\angle D = \angle i + \angle e - \angle A$ and $\angle r_1 + \angle r_2 = \angle A$
If $\angle A$ is the angle of the prism, $\angle D_m$ the angle of minimum deviation.

Then the refractive index of the material of the prism $\mu = \frac{sin\frac{(A+D_m)}{2}}{sin\frac{A}{2}}$

Procedure

- Determine the angle of minimum deviation $\angle D_m$:Fix the drawing sheet on the drawing board using drawing pins,keep the prism on the paper and trace the prism.The trace will give us a triangle ABC.



AB reflecting surface , AC refracting surface and BC is the base of the prism.Draw a normal line MN to the reflecting surface at N.Draw a incident line PQ making some angle (>30degrees) with the normal line MN.Now place the prism on its trace along ABC.Fix two pins on the incident ray at two points P and Q .Now observing through the face AC two pins S and U are fixed so that these two pins at S and U will be in the line with P and Q.Remove the prism join the points S and U with a st line which meets the face AC at R.Extend the incident ray PQ forward and emergent ray SU backwards till the meet at O.
Measure the $\angle TOR = d$.
repeat the experiment in the above said procedure for various angles of incidences i.e 35,40,45,50,55 ……. and measure the respective angles of deviations d1,d2,d3,d4,d5….. record these values in the table.

DETERMINATION OF ANGLE OF MINIMUM DEVIATION(Dm)

Fig.no.	Base angle	Incident angle	Angle of deviation	Angle of minimum deviation from I-D graph
1	30			
2	35			
3	40			
4	45			
5	50			

CALCULATION

- Angle of prism (A) = ……………….

- From graph, angle of minimum deviation D = ------------°

CONCLUSION

The angle of minimum deviation of a prism is ……………….degree.

PRECAUTIONS:

i)Pins should be fixed perfectly vertical

ii)While fixing the pins in line with the refractive or reflective images of incident rays care should be taken for the parallax error.

iii) There should be some space between the pins.

iv)Pins should not be disturbed during the experiment.

v)Same edge of the prism should be taken as vertex A for all the observations .

vi) Clean both the faces AB and AC of the prism proper before taking the readings.

Assignment question

1. What are the condition for Minimum Deviation ?
2. What are the laws of Reflection?
3. Define angle of Prism and Dispersion?
4. Write two uses of Prism?
5. Which word is used as the abbreviation for remembering the names of seven colors in white light?Write the fullform?

EXPERIMENT NO.10

DATE :…………………… BRANCH:………………….….

ROLL NO ………………. Name of Student:……………………….

Sign of Sr.lect./Lecturer /Lab.asst

AIM OF THE EXPERIMENT:

To draw the magnetic lines of force and locate the Neutral point due to a bar magnet with North-pole pointing North (N→N).

OBJECTIVE OF THE EXPERIMENT

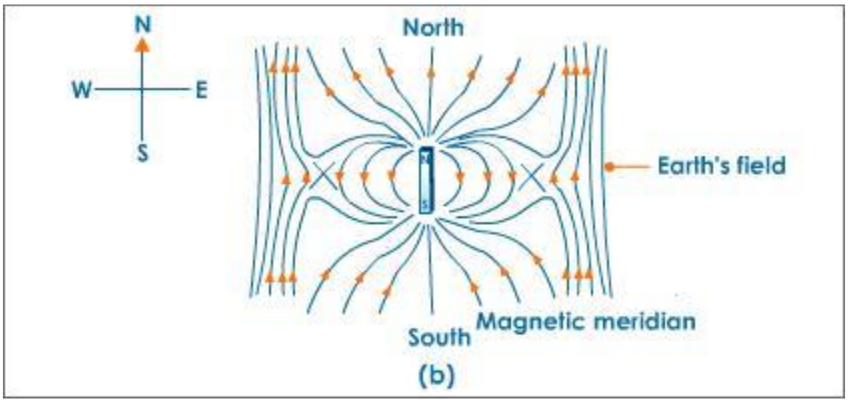
After performing this experiment you should be able to:

- find the N and S-pole of a bar magnet;
- Define magnetic meridian;
- Locate the position of poles in a bar magnet;
- Know the condition for getting a neutral point; and
- Place a bar magnet in proper orientation

APPARATUS REQUIRED

1) Bar magnet 2) a compass needle 3) a drawing board 4) fixing pin 5)drawing paper 6)Instrument box

EXPERIMENT FIGURE



THEORY

LINES OF FORCE

It is a closed imaginary curve starting from the north pole and ending in south pole in magnetic field such that the tangent drawn at any point on the curve gives the direction of resultant magnetic field at that point.

Neutral point

A point at which the magnetic field induction B due to a bar magnet is nullified by the horizontal component of the earth's magnetic field induction (B_0) is called a neutral point.

MAGNETIC FIELD

It is the space surrounding the magnet in which magnetic influence due to the magnet can be realised.

POLE

It is a point situated near the two ends of the magnet where the force of action due to the magnet initiates.A magnet has two poles i.e,north and south

MAGNETIC LENGTH

It is the distance between two pole of a bar magnet.

GEOMETRIC LENGTH

It is the distance between two end point of a bar magnet.

PROCEDURE

- Fix a sheet of white paper on a drawing board with brass pins.
- Take a compass needle, place it at the centre of the paper, and mark the north and south directions.
- Draw a straight line along the paper connecting the two points. This represents the magnetic meridian of the earth.
- Represent the geographical directions at the corner of the paper.
- Draw an arrow from the geographical south to the geographical north on the right side of the paper to indicate the direction of the horizontal component of the earth's magnetic field, B_0.
- Take a bar magnet and place it at the centre of the paper such that the north pole of the bar magnet points towards the north pole of the earth.
- Now place the compass needle at the north pole of the bar magnet and mark a point where the north pole of the compass needle is.
- Shift the compass such that the south pole of the compass needle is at the point you just marked.
- Mark another point at the north of the compass needle, and then shift the compass, as done earlier.Repeat the procedure till the compass needle reaches the other end of the bar magnet.
- Join all the points to get a continuous smooth curve, which represents a magnetic field line.

- Repeat the procedure from the north pole of the magnet, but from different points and draw the magnetic lines of force.

Observation

Findout the distance of two neutral points from the axis of the magnet and then find the mean distance.

CONCLUSION

The lines of force never intersect each other.and the neutral points are located on the equatorial line of the magnet .Neutrals point were found at a distance………………cm from the centre of the magnet and located on board-side-on position w.r.t the magnet and the map of the magnetic field in which a number lines of force was drawn when N→N.

SAFETY AND PRECAUTION

- The drawing board should not be disturbed or turned during the experiment.
- The dot marks should be joined by a smooth curve and not by straight lines
- A very short magnetic needle should be choosen.
- The direction of the lines of force should be given.
- Ensure that no two lines of force intersect each other.

Assignment question

1. Define Neutral point in a Magnetic Field
2. Define Magnetic Lines of Force
3. Why two magnetic lines of force never intersect each other.?
4. Define Magnetic Field.
5. Define Magnetic Length and Geometric Length

EXPERIMENT NO.11

DATE :…………………… BRANCH:……………………..

ROLL NO ……………….. Name of Student:……………………….

Sign of Sr.lect./Lecturer /Lab.asst

AIM OF THE EXPERIMENT:

To draw the magnetic lines of force and locate the Neutral point due to a bar magnet with North-pole pointing South(N→S).

OBJECTIVE OF THE EXPERIMENT

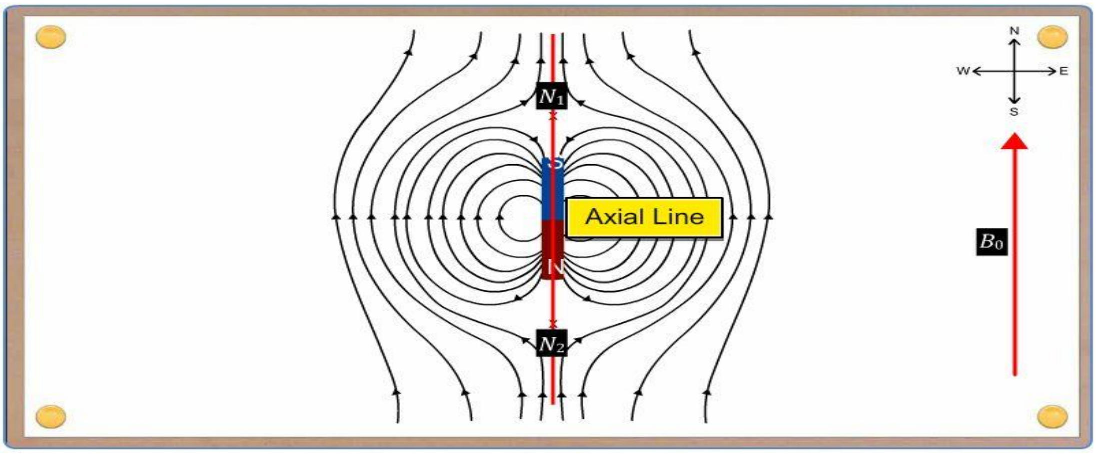
After performing this experiment you should be able to:

- find the N and S-pole of a bar magnet;
- define magnetic meridian;
- locate the position of poles in a bar magnet;
- know the condition for getting a neutral point; and
- place a bar magnet in proper orientation

APPARATUS REQUIRED

1) Bar magnet 2) a compass needle 3) a drawing board 4) fixing pin 5)drawing paper 6)instrument box

EXPERIMENT FIGURE



THEORY

LINES OF FORCE

It is a closed imaginary curve starting from the north pole and ending in south pole in magnetic field such that the tangent drawn at any point on the curve ggives the direction of resultant magnetic field at that point.

Neutral point

A point at which the magnetic field induction B due to a bar magnet is nullified by the horizontal component of the earth's magnetic field induction (B_0) is called a neutral point.

MAGNETIC FIELD

It is the space surrounding the magnet in which magnetic influence due to the magnet can be realised.

POLE

It is a point situated near the two ends of the magnet where the force of action due to the magnet initiates.A magnet has two poles i.e,north and south

MAGNETIC LENGTH

It is the distance between two pole of a bar magnet.

GEOMETRIC LENGTH

It is the distance between two end point of a bar magnet.

PROCEDURE

- Fix a sheet of white paper on a drawing board with brass pins.
- Take a compass needle, place it at the centre of the paper, and mark the north and south directions.
- Draw a straight line along the paper connecting the two points. This represents the magnetic meridian of the earth.
- Represent the geographical directions at the corner of the paper.
- Draw an arrow from the geographical south to the geographical north on the right side of the paper to indicate the direction of the horizontal component of the earth's magnetic field, B_0.
- Take a bar magnet and place it at the centre of the paper such that the north pole of the bar magnet points towards the north pole of the earth.
- Now place the compass needle at the north pole of the bar magnet and mark a point where the north pole of the compass needle is.
- Shift the compass such that the south pole of the compass needle is at the point you just marked.
- Mark another point at the north of the compass needle, and then shift the compass, as done earlier.Repeat the procedure till the compass needle reaches the other end of the bar magnet.
- Join all the points to get a continuous smooth curve, which represents a magnetic field line.
- Repeat the procedure from the north pole of the magnet, but from different points and draw the magnetic lines of force.

Observation

Findout the distance of two neutral points from the axis of the magnet and then find the mean distance.

CONCLUSION

The lines of force never intersect each other.and the neutral points are located on the axial line of the magnet .Neutrals point were found at a distance……………….cm from the centre of the magnet and located on end-side-on position w.r.t the magnet and the map of the magnetic field in which a number lines of force was drawn when N→S.

SAFETY AND PRECAUTION

- The drawing board should not be disturbed or turned during the experiment.
- The dot marks should be joined by a smooth curve and not by straight lines
- A very short magnetic needle should be choosen.
- The direction of the lines of force should be given.
- Ensure that no two lines of force intersect each other.

Assignment question

1. Are the neutral point equidistance from magnetic poles?
2. Define Magnetic flux density.
3. Can we get a north pole and a south pole by breaking a bar magnet?.
4. Why does the compass needle align itself in a particular direction?
5. What is the magnetic force between two magnetic poles?

EXPERIMENT NO.12

DATE :……………………   BRANCH:………………… …..

ROLL NO ………………..   Name of Student:……………………….

Sign of Sr.lect./Lecturer /Lab.asst

AIM OF THE EXPERIMENT

To verify Ohm's Law by Ammeter – Voltmeter method.

APPARATUS REQUIRED

a)DC ammeter b) DC voltmeter c) Resistance box d)Connecting wire
e)Rheostat f) battery eliminator

THEORY

Voltmeter: The device which measure potential difference is called voltmeter.
Ammeter: The device which measure the quantity of current is called ammeter
Rheostat: It is a device which is used to change the resistance of the circuit.
Current: It is the time rate of flow of charge in the conductor. It is measured in ampere.
Potential difference: It is the difference in potential between two points in an electric circuit and its unit is volt.

Resistance:

- Resistance is the property of a component which restricts the flow of electric current. Energy is used up as the voltage across the component drives the current through it and this energy appears as heat in the component.
- Resistance is measured in ohms, the symbol for ohm is an omega(Ω).

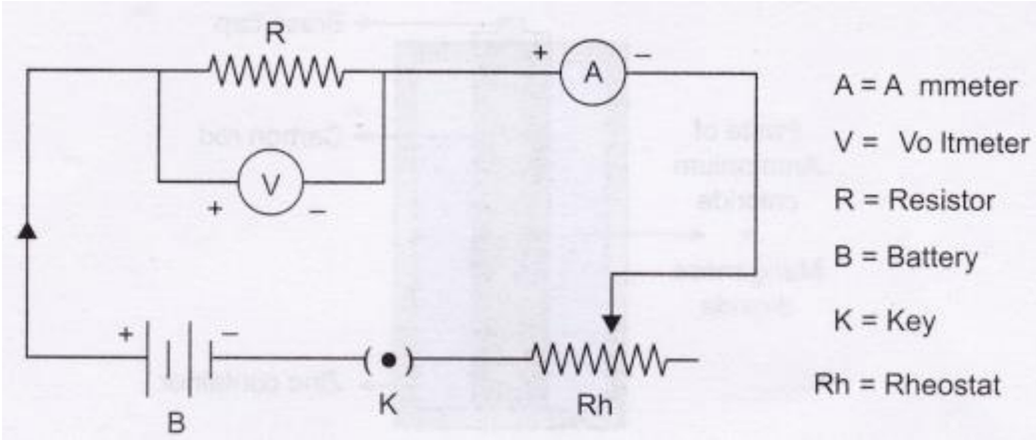
Ohm's law states that at a constant temperature, current '**I**' through a conductor between two points is directly proportional to the potential difference or voltage '**V**', across the two points. That is,

$$V \propto I$$

$$or \quad \frac{V}{I} = constant = R$$

$$or \quad V = IR$$

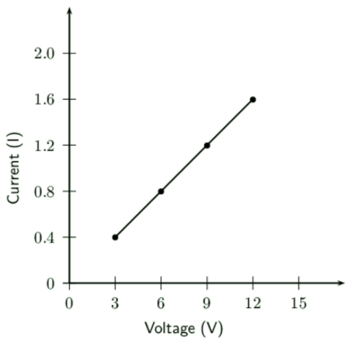
Thus, the ratio **V : I** is a constant. This constant is called as the resistance (**R**) of the conductor.



• In a circuit ammeter is connected in series.

• The voltmeter is connected in parallel across the points between which potential difference is to be measured.

• A straight line graph obtained between V and I verifies the Ohm's law.



Procedure:

1. Determine the least count of the ammeter and voltmeter by noting down its range and the total no. of divisions on them.

2. Check for zero error. It should be adjusted prior to commencement of experiment.

3. Remove the insulation from the end of the connecting copper wires using sand paper.

4. Connect the ammeter, battery, voltmeter, key and rheostat as per the circuit diagram.

5. Keep the key open.

6. In the circuit, connect the positive terminal of the ammeter to the positive terminal of battery.

7. Check the rheostat, adjust its slider and see whether the ammeter and voltmeter readings are shown.

8. When there is a constant flow of current in the resistor, note down the current and the corresponding potential difference.

9. Note down the values of potential difference in the voltmeter corresponding to the step by step increase of the current and then by decrease of the current by sliding the rheostat.

10. Calculate the resistance by taking the mean of potential Difference.

11. Plot a graph between the voltage and current with V on the X-axis. The slope of the graph gives the inverse of the resistance.

Observation:

TABULATION FOR V ~ I READING

Sl. No.	Ammeter reading(I) in amp	Voltmeter reading(V) in volt			V/I = R in ohm	Mean R in ohm
		Current increasing	Current decreasing	Mean		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Conclusion: The ratio of V to I was seen to be constant in Tabulation - 1. The plot of V versus I passed through the origin. Hence, the Ohm's law is verified. The resistance as determined from the graph was ___________ohm.

Precautions:

1. Connections should be tight otherwise some external resistance may introduce in the circuit.

2. The least counts of the ammeter and voltmeter should be estimated carefully.

3. The current should not be flown for a longer time, otherwise, it would increase the temperature and in turn would change the resistance of the resistor.

4. Current beyond 2 Amperes should be avoided.

Assignment question

1. Why the voltmeter is to be connected in parallel to circuit?
2. What is the value of charge in 1 electron?
3. What is the nature of graph obtained for V and I?
4. What is the unit of Electric current?

5.What is resistance? Unit of resistance ?