PHYSICS EXPERIMENTS TO BE WRITTEN IN PRACTICAL NOTEBOOK (NOVA ICSE PHYSICS LAB MANUAL-9)

Instructions to be followed for all experiments

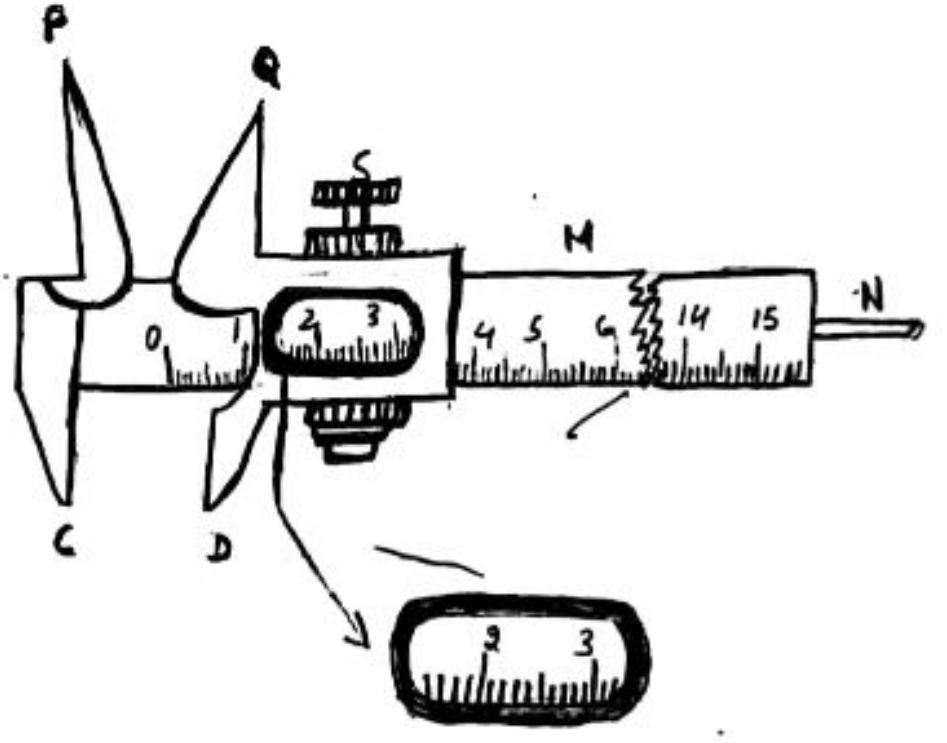
1. On the ruled line pages - Write the experiment number (as given in the list of experiments to be performed for session 2020-21); Aim of experiment, Apparatus, Theory, Procedure, Precautions (as can be seen in sample of a practical file made by a student attached herewith).
2. On the blank pages - Write the aim and apparatus (at the top with the pencil). Draw the diagram related to experiment using pencil, ruler, protactor (as per requirement).
3. New experiment is to be started from a new page. Make sure that when you are starting a new experiment both ruled lines side and blank side is empty.
4. Kindly write with blue pen only on ruled side. However, black pen can be used for making headings. Students are required to use only pencil while writing or drawing on blank side.
5. For reference, a sample practical file made by a student is being attached with.

Tender Heart School, Sec. 33B, Chd.
Physics Project
Class – IX (2021-22)

1. To find the least count (L.C.) of vernier calipers.
2. To determine volume of a rectangle block using vernier calipers.
3. To analyse the working of a periscope.
4. To verify the laws of reflection of light by using a plane mirror.
5. To find volume of given metal bob using measuring jar and to verify calculation.
6. To determine the pitch and least count of a screw gauge.
7. To plot the magnetic lines of force of a bar magnet.

AIM: To find the least count (L.C) of vernier callipers.

APPARATUS: Vernier calliper and magnifying glass.



VERNIER CALLIPERS

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EXPERIMENT No. - 1

AIM: To find the least count (L.C.) of vernier callipers.

APPARATUS: Vernier calliper and magnifying glass.

ABOUT THE VERNIER CALLIPERS:-

There are two scales in a vernier callipers:

(i) Main scale, and

(ii) Vernier scale.

The main parts of vernier callipers are:

(a) **Main scale:** The main scale 'M' is graduated in mm and cm on one side.

(b) **Vernier scale:** It is a sliding scale. The side of vernier scale lying towards the mm side of the main scale has 10 equal parts (divisions) and 10 div. of vernier scale coincides with 9 div. of the main scale.

(c) **Jaws:** It has two jaws PL and QD. PL jaw lies on the zero end of the main scale and QD is attached on vernier. P and C are fixed while QD moves with vernier. The upper jaws are used to measure the internal diameter and lower jaws are used to measure length, external diameter, etc.

(d) **Strip:** It is attached to VS and is used to measure the depths of hollow objects (cylinder, beaker, etc.).

DETERMINATION OF THE LEAST COUNT OR VERNIER CONSTANT:

Least count is the smallest value of a physical quantity which can be measured accurately with an instrument. For

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$10\ VSD = 9\ MSD$

$1\ VSD = \frac{9}{10}\ MSD$

The quantity (1 MSD − 1 VSD) is called vernier constant (VC)

$$VC = \left[1 - \frac{9}{10}\right] MSD$$

$$= \frac{1}{10}\ msD = \frac{1}{10} \times 1mm \quad (As,\ 1M.S.D = 1mm)$$

$$VC = 0.1\ mm$$
$$= 0.01\ cm$$

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an instrument where vernier is used its vernier constant (VC) is the least count (LC).

ZERO ERROR: Bring the jaws C and D in contact with each other. If zero of vernier scale coincides with zero of main scale, there is no zero error. Hence, no correction for the instrument. If the two scales do not coincide, then zero error exists.

(i) Positive zero error: When zero of vernier scale lies on the right of the zero of the main scale, the vernier callipers is said to possess positive zero error. The two jaws are kept in contact an the number of vernier scale divisions coinciding with some main scale division is noted.

(ii) Negative zero error: When the zero of vernier scale lies on the left of the zero of the main scale the vernier callipers is said to possess negative zero error.

PRECAUTIONS:

(i) Different parts of the vernier callipers should be frictionless.

(ii) The vernier constant and zero error should be counted carefully.

(iii) Undue pressure on the body by the vernier callipers should be avioded.

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SOURCES OF ERROR:

(i) Graduations on scale may not be evenly marked.
(ii) Parallax may creep in while taking observations.
(iii) Main scale and jaws may not beat right angles to each other.

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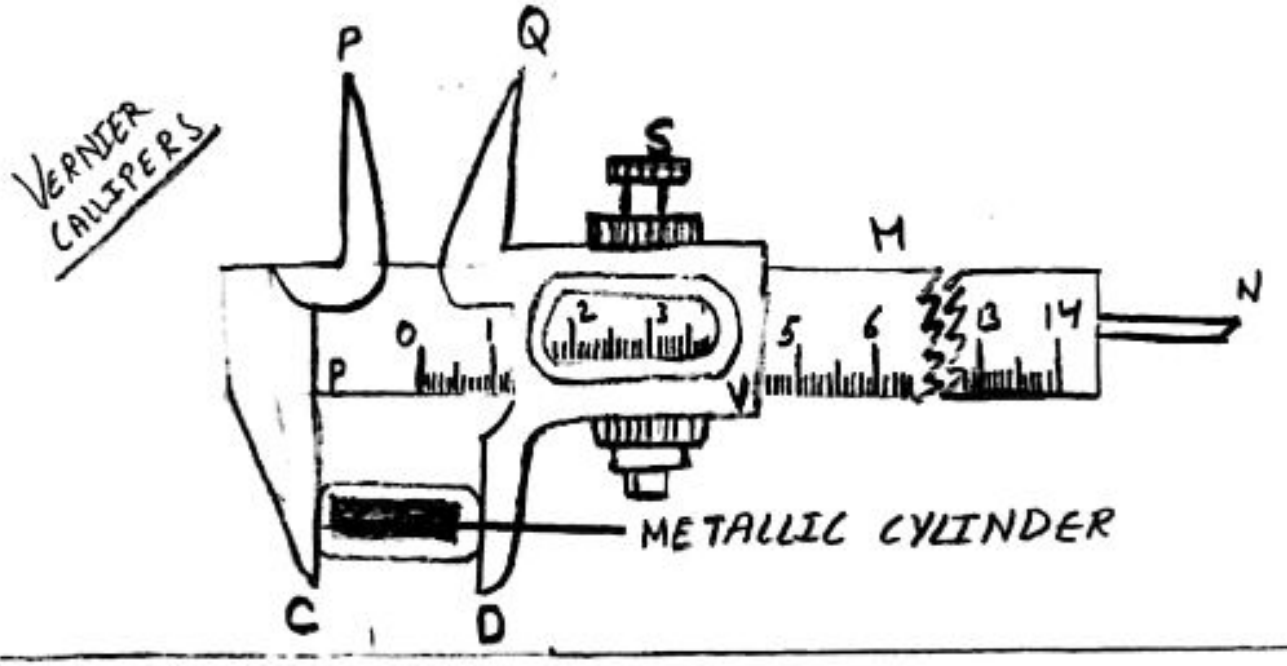
AIM: To determine volume of a rectangle block using vernier callipers.

APPARATUS: Vernier callipers and the given block



$10\ VSD = 9\ MSD$

$1\ VSD = \frac{9}{10}\ MSD$

The quantity $(1\ MSD - 1\ VSD)$ is called vernier constant (VC)

$$VC = \left[1 - \frac{9}{10}\right] MSD$$

$$\frac{1}{10}\ MSD = \frac{1}{10} \times 1\ mm \quad (1\ MSD = 1\ mm)$$

$$VC = 0.1\ mm = 0.01\ cm$$

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EXPERIMENT No.-2

AIM: To determine volume of a rectangle block using vernier callipers.

APPARATUS: Vernier calliper and the given rectangular block.

DETERMINATION OF LEAST COUNT OR VERNIER CONSTANT:

Least count is the smallest value of a physical quantity which can be measured accurately with an instrument. For an instrument where Vernier is used its Vernier constant (VC) is its least count (LC).

PROCEDURE:

(i) Determine the Vernier constant (least count) of the callipers are explained above.

(ii) Bring the movable jaw in contact with the fixed jaw. If zero of vernier scale coincides with zero of main scale, then there is no zero error. If it does not coincides, then find the zero error and hence the zero correction.

(iii) With the help of lower jaws grip the body gently without undue pressure.

(iv) Note the main scale reading just before the zero of the vernier scale and vernier scale division coinciding with some main scale division.

(v) Determine the length by adding the product of number of divisions coinciding and the VC to the main scale. length =

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Sr. no.	Main scale reading x (cm)	Vernier Scale division coinciding with MSD (n)	n × L.C.	Observed value $y = x + n \times L.C.$ (cm)
1.	6.8 (Length)	1	$1 \times 0.01 = 0.01$	$6.8 + 0.01 = 6.81$
2.	3.9 (Breadth)	4	$4 \times 0.01 = 004$	$3.9 + 0.04 = 3.94$
3.	0.4 (Height)	5	$5 \times 0.01 = 0.05$	$0.4 + 0.05 = 0.45$

Volume = Length × Breadth × Height

$= 6.81\ cm \times 3.94\ cm \times 0.45\ cm$

$= (6.81 \times 3.94 \times 0.45)\ cm^3$

$= 12.074\ cm^3$

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(MSR + VSR x VC), Repeat the procedure to find breadth and height (thickness).

PRECAUTIONS:

(i) Different parts of the vernier calliper should be frictionless.
(ii) The vernier constant and zero error should be calculated carefully.
(iii) Undue pressure on the body by the vernier callipers should be avoided.

SOURCES OF ERROR:

(i) Body may not be perfectly spherical or cylindrical
(ii) Graduations on scale may not be evenly marked.
(iii) Parallax may creep in while taking observations.
(iv) Main scale and jaws may not be at right angles to each other.

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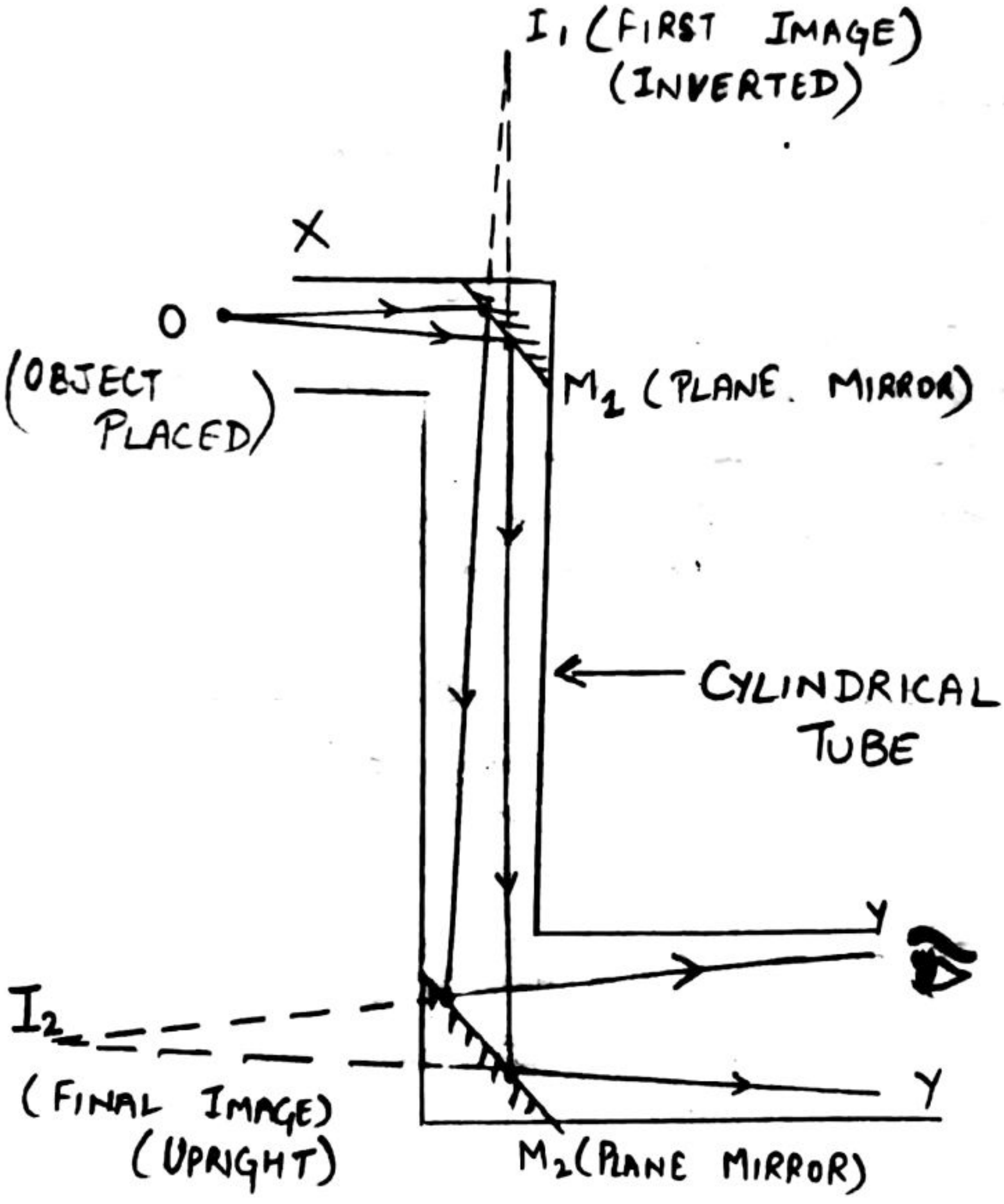
AIM - To analyse the working of a Periscope

APPARATUS - Periscope



EXPERIMENT No. - 3

AIM: To analyse the working of a periscope.

APPARATUS: Periscope.

THEORY: It is based on the principle of reflection at two plane mirror facing each other and kept inclined at an angle of 45° with the vertical.

WORKING: The rays of light entering the tube from the object O strike the plane mirror M_1 at an angle of incidence nearly equal to 45°. These rays are reflected along the axis of the tube obeying the laws of reflection. The reflected rays from mirror M_1 strike the mirror M_2 at an angle of incidence nearly equal to 45°. The rays are finally reflected ray by the mirror M_2 parallel to their original path reaching the eye at y. Thus, the objects which could not be seen due to obstruction, can now be easily seen. The mirror M_1 has a virtual object for the mirror M_2, which forms an image I_2, which is seen by the eye. The final image is seen by the eye. The final image is I_2 is also virtual, since light ray from the object are reflected ray by two mirrors lateral inversion caused by the first image is reversed by second mirror. This makes the final image to appear without lateral inversion. (ie upright image is formed)

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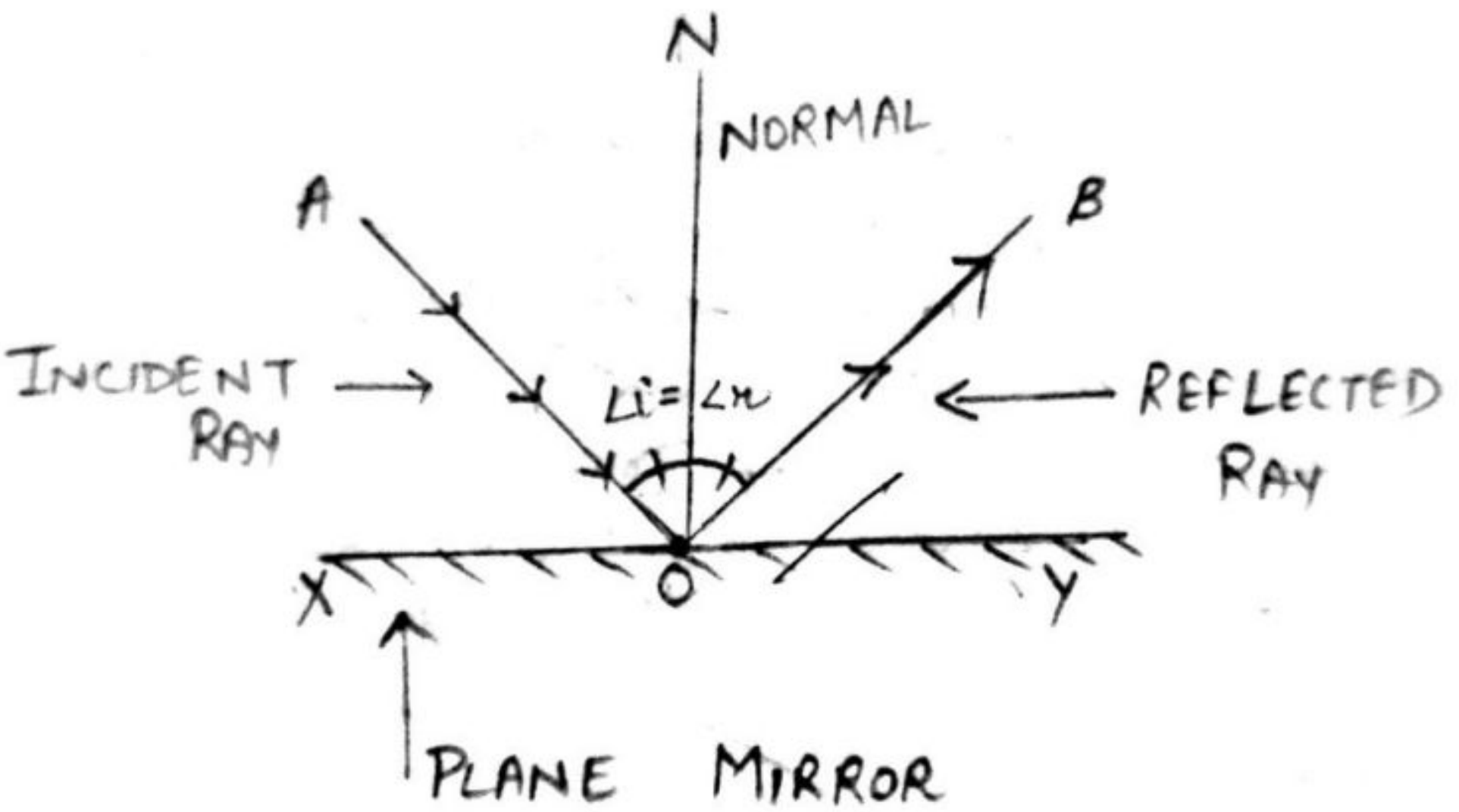
AIM - To verify the laws of reflection of light by using a plane mirror.

APPARATUS - A plane mirror, drawing sheet, drawing board, drawing pins, a sharpened pencil, few all purpose pins, a scale, a protractor, wooden stand for holding plane mirror.



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EXPERIMENT No. -4.

AIM: To verify the Laws of reflection of light by using a plane mirror.

APPARATUS: A plane mirror, drawing sheet, drawing board, drawing pins, a sharpened pencil, few all purpose pins, a scale, a protractor, wooden stand for holding plane mirror.

PROCEDURE:

(i) Fix the white sheet of paper on the drawing board with the help of drawing pins.

(ii) Divide the sheet into three equal parts.

(iii) ~~Draw~~ Draw a line XY in each of these parts.

(iv) at the centre of this line draw a normal, i.e., a perpendicular. Mark this as NO.

(v) With respect to this normal, mark an angle of 30° (or any other angle of your choice).

(vi) Draw a line AO such that $\angle AON = 30°$. This is the angle of incidence called $\angle i$.

(vii) Place an all purpose pin (termed object pin P_1) on this line, very close to point O.

(viii) Place another all purpose pin (termed object pin P_2) on the same line at a distance of at least 10 cm from object pin 1.

(ix) Put the plane mirror in its holder on line XY.

(x) Look (with one eye closed) for the image of object pins P_1 and P_2 on the other side of the normal.

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S. No.	Angle of incidence ($\angle i$)	Angle of reflection ($\angle r$)
1.	30°	30°
2.	45°	45°
3.	60°	60°

Result:

$\angle i = \angle r$

Hence,

Angle of incidence = Angle of Reflection

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(xi) Move your eye so that you see only one image of the pins, i.e., the image of one pin goes behind the other. (see only the bottom of the pins).

(xii) Place an all purpose pin (termed image pin P_3) on this point. Place another pin (termed image pin P_4) at a distance of at least 10cm from image pin P_3 such that all four pins are in straight line, i.e., only one pin is visible.

(xiii) Take out the two image pins and encircle the prick points.

(xiv) Draw a line OB joining these prick points.

(xv) Measure angle $\angle NOB$. This is the angle of reflection $\angle r$.

(xvi) Repeat the above procedure for the second and third part of the drawing sheet but with different angles of incidence.

(xvii) Compare the values of angle of incidence and angle of reflection in the above cases.

RESULT :-

As the angle of incidence is equal to the angle of reflection and the incident ray, the reflected ray and the normal lie in the same plane, therefore the laws of reflection have been verified.

PRECAUTIONS :-

i) A sharp pencil should be used for drawing the.

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incident ray, the reflected ray, and the normal.

(ii) The angle of incidence should lie between 30° and 60°.

(iii) The distance between the pins should be atleast 10 cm.

(iv) The pins must be vertical.

(v) The pins should have sharp tips so that they can be fixed easily.

(vi) The pin pricks should be encircled.

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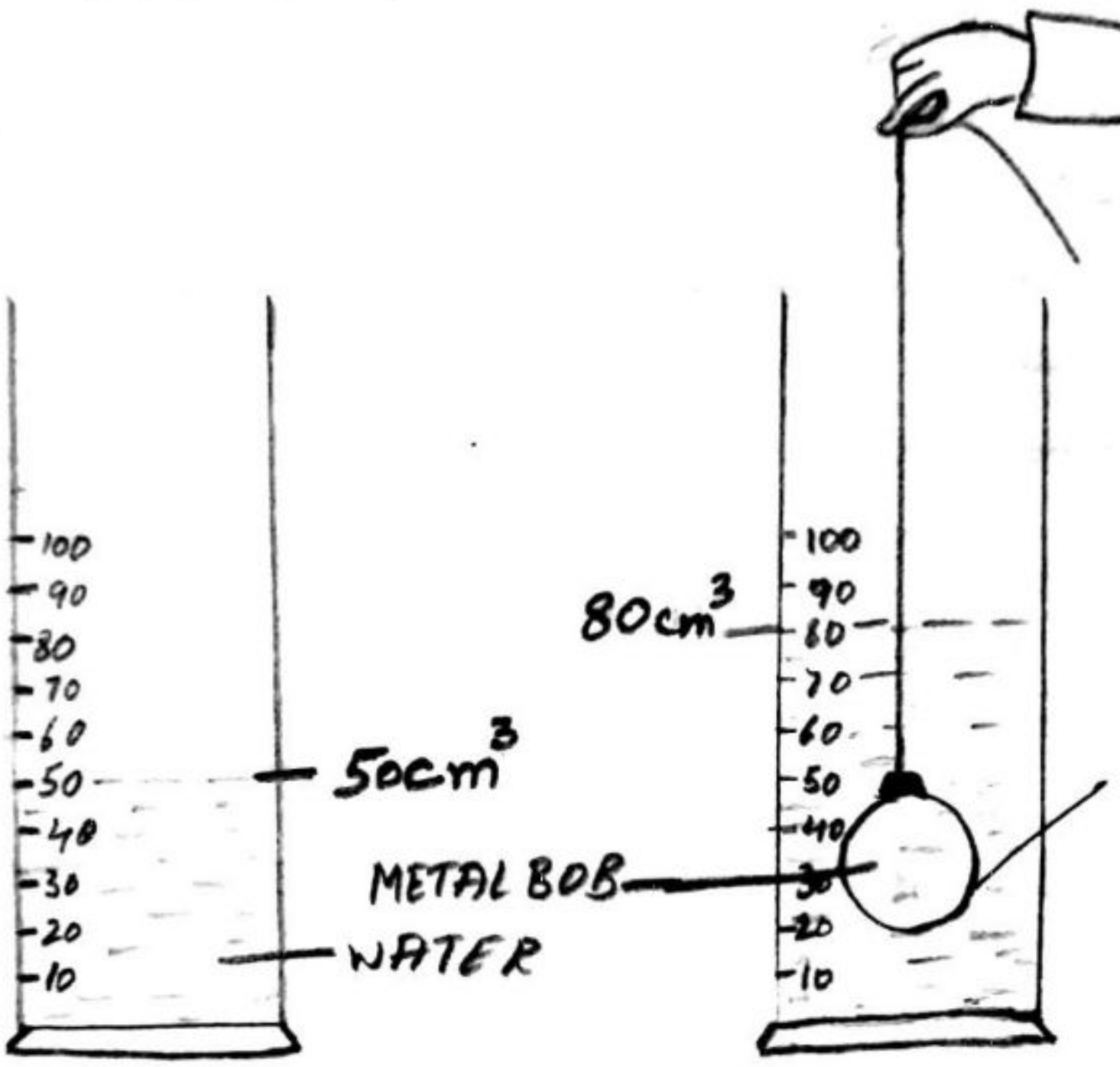
AIM : To find volume of given metal bob using measuring jar and to verify calculation.

APPARATUS: A measuring jar, given metal bob and thread.



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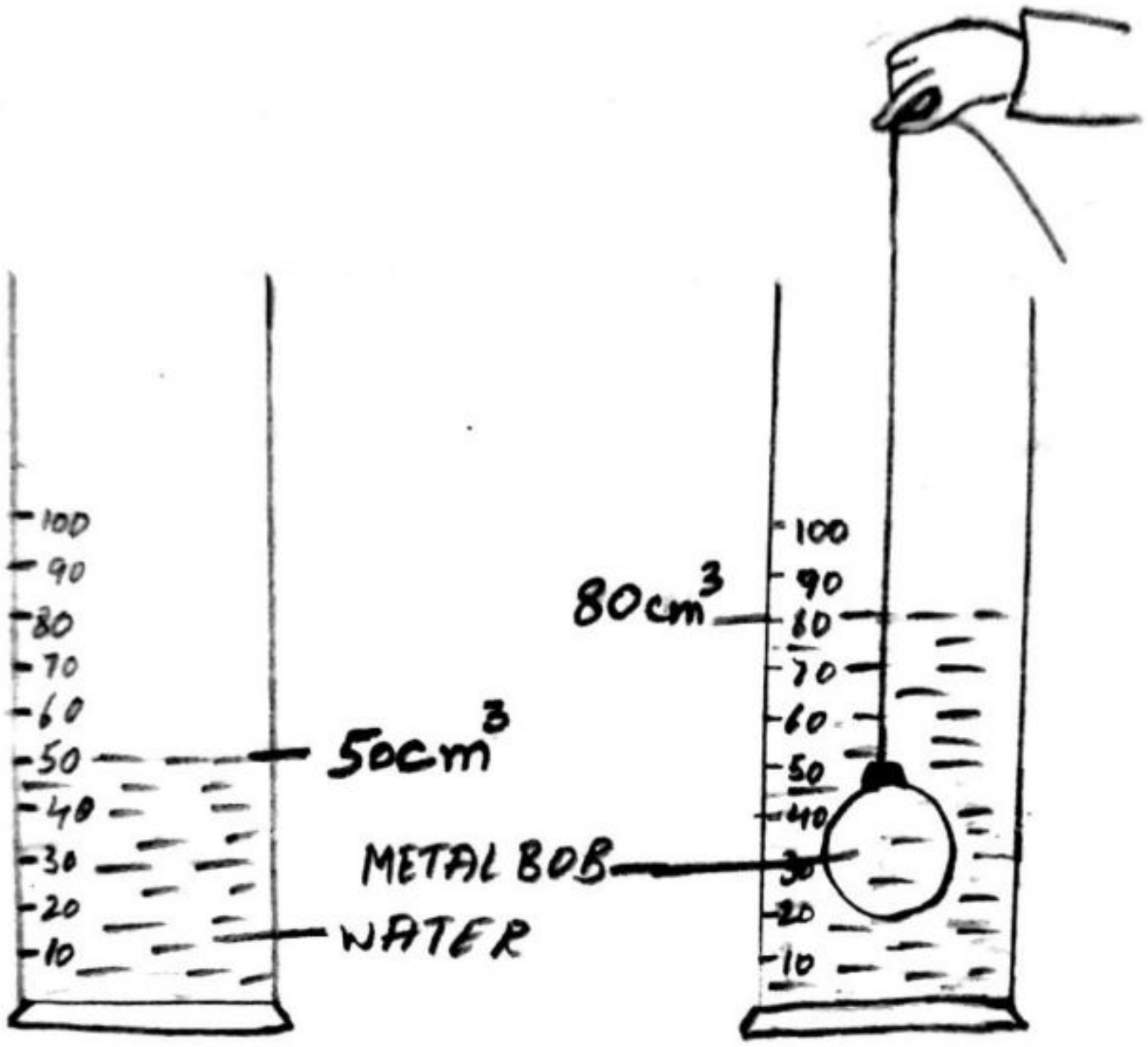
AIM : To find volume of given metal bob using measuring jar and to verify calculation.

APPARATUS: A measuring jar, given metal bob and thread.



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EXPERIMENT No. - 5

AIM: To find volume of given metal bob using measuring jar and to verify calculation.

APPARATUS: A measuring jar, given metal bob and thread.

PROCEDURE:-

(i) Fill the measuring jar with water upto 50 ml. Note the level of water in the jar as V_1.

(ii) Tie the metal bob with the thread.

(iii) Slowly lower the metal bob inside the measuring jar until it is completely immersed in water.

(iv) Note down the level of water inside the jar without shaking the metal bob or the jar. Let this be V_2.

(v) The difference $(V_2 - V_1)$ gives the volume of the metal bob.

(vi) Take out the metal bob and dry it.

(vii) Measure the diameter of the bob using a vernier calliper and record the observation in a tabular form.

PRECAUTIONS:-

(i) The metal bob should not touch the sides of the measuring jar.

(ii) The metal bob should by completely immersed in water.

(iii) The dimensions of the bob should be measured

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S.No.	Initial level of water V_1 (in cm^3)	level of water after metal bob is inside V_2 (in cm^3)	volume of metal bob $(V_2 - V_1)$ (in cm^3)
1.	150	160	10
2.	150	160	10
3.	150	160	10

MEAN VOLUME OF BOB $= \frac{(10+10+10)}{3} cm^3$

$= \frac{30}{3} 10$

$= 10\ cm^3$

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accurately.

(iv) The change in volume of water in the measuring jar should be recorded carefully.

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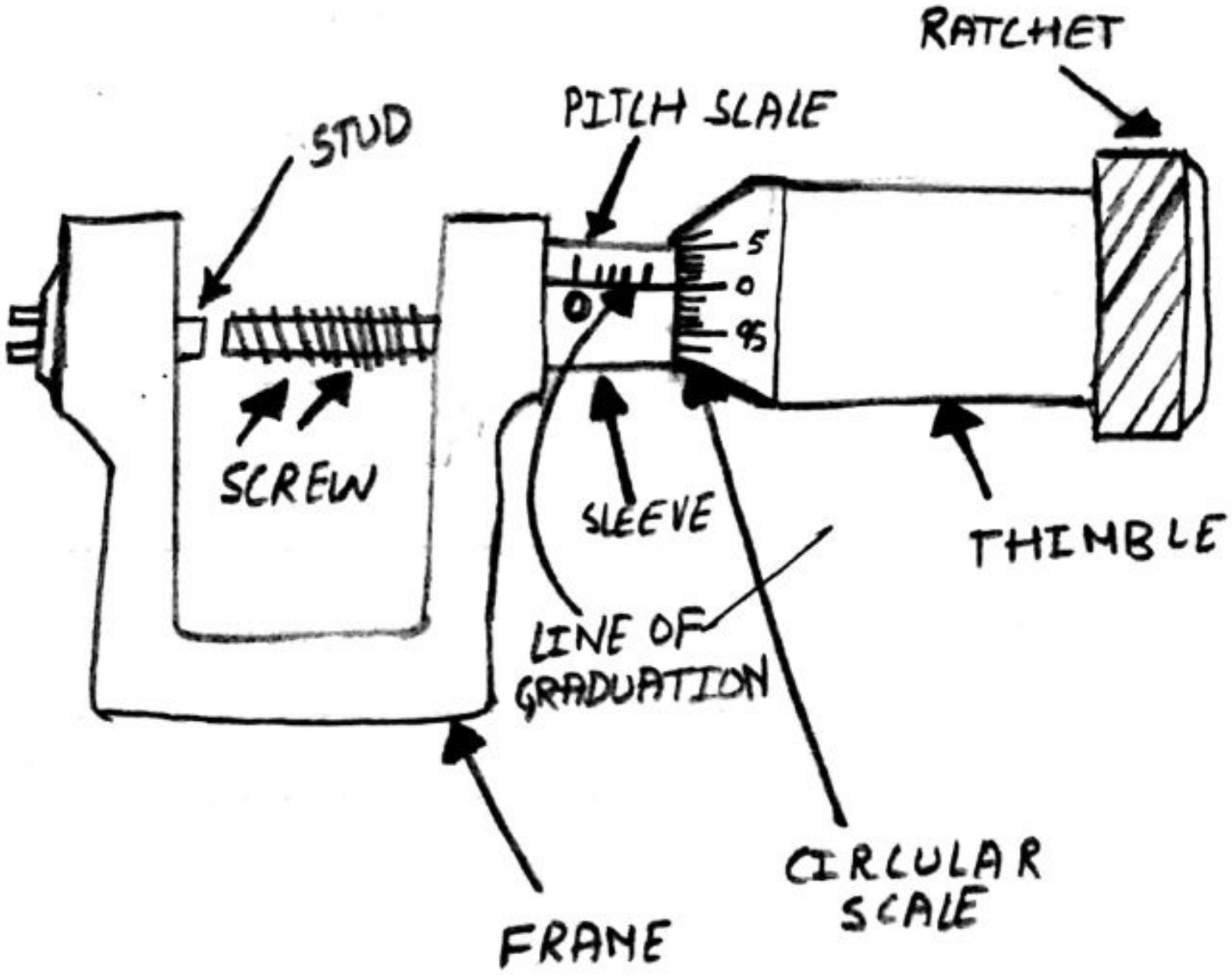
AIM: To determine the pitch and least count of a screw guage.

APPARATUS; Screw gauge.



SCREW GAUGE

EXPERIMENT No. 6

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Date : 8/7/2015

AIM: To determine the pitch and least count of a screw gauge.

APPARATUS: Screw gauge

ABOUT THE SCREW GAUGE:

Screw gauge has a U-shaped metallic frame. At one end of this there is a small screw called stud running through the internal threadings. Its position remains fixed. At the other end of the frame, a tubular hub extends to a few millimeter or centimeter (generally 15mm and 1·5cm). The inner side of the hub is threaded by the outer side it has a sleeve which bears graduated markings in mm spacing. This scale is called the main scale or Pitch scale. There lies a base line on the axis of the hub, and is called the line of Graduations or Reference line. A hollow cylindrical cap, called Thimble, is fixed to the right end of the screw and runs through the hub as a nut, without touching the sleeve of hub.

The sleeve end of cylindrical cap is generally divided into 100 equal parts, called Circular Scale or Head Scale. A ratchet system is also fixed at the right end of the screw cap, so as to prevent over-tightening of the screw (when fully closed), resulting in the ticking sound of the freely

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running ratchet. When the screw is fully closed, there is no gap between the stud head and screw head, both being perfect plane surfaces.

To make a screw gauge withstand wear and tear, it is made of gun metal bass and even steel being a more economial yet tough metal).

The instrument, being more accurate (has least count better than that of vernier callipers), can be used to measure the thickness of a paper/sheet, diameter of a wire or length of any small object, that can fit into U-frame/ between the studs.

PROCEDURE:-

(i) Observe the pitch scale (or main scale) of screw gauge and note the magnitude of one smallest division on it.

(ii) To find the pitch of screw gauge, Find the distance moved (on the main scale) by the screw when it is given 5 complete rotations.

As pitch of the screw = distance moved by screw (on the main scale) on giving one rotation.

$$\therefore \text{Pitch} = \frac{\text{Distance moved by screw in 5 rotations (in mm)}}{5}$$

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i.e., the least count of LC =

$$\frac{\text{Pitch of the screw}}{\text{Number of divisions on the circular scale}}$$

Generally, for the pitch of screw = 1mm, and
No. of division on circular scale = 100

$$LC = \frac{1mm}{100} = 0.01\ mm$$

or $LC = 0.01\ mm$

$= 0.001\ cm$

If the distance moved by the screw in 5 rotation is 5mm.

$\therefore$ Pitch = $\frac{5\text{ mm}}{5} = 1\text{ mm}$

(which is generally the case)

(iii) Observe the numbers of divisions on the circular scale. (Generally, there are 100 divisions on the circular scale)

(iv) Calculate the least count of the screw gauge.

PRECAUTIONS:-

(i) Always use the ratchet R to rotate the screw.

(ii) Use proper sign of zero correction.

(iii) Rotate the screw only in one direction during observation. This is to avoid back-lash error.

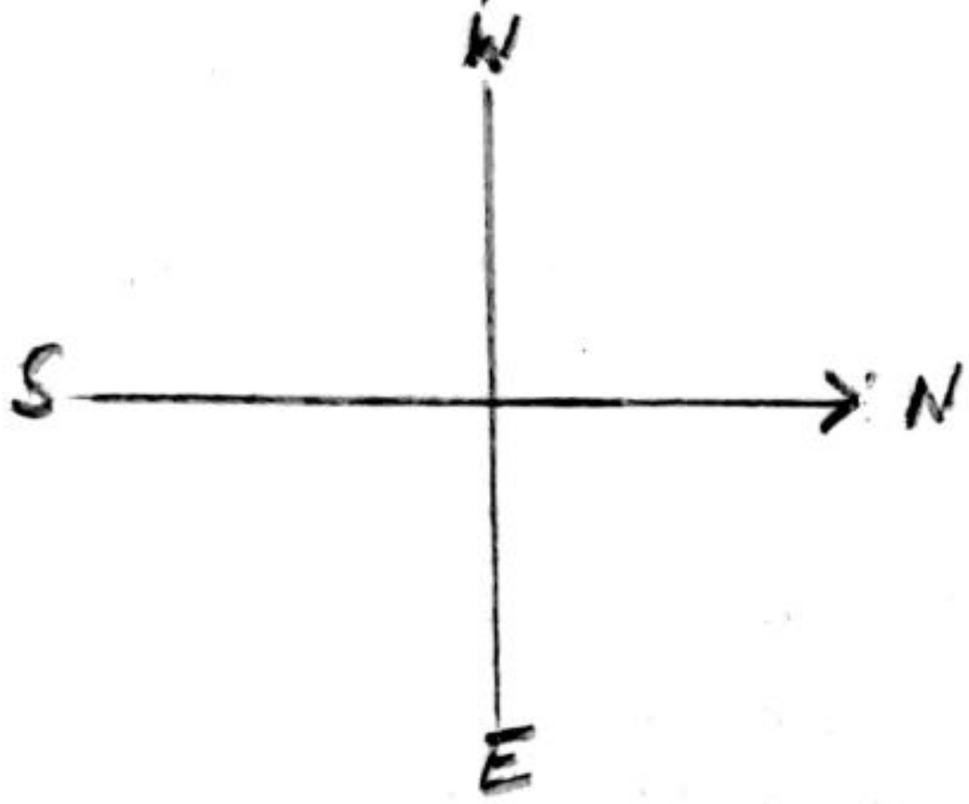
(iv) Measure the diameter in two perpendicular directions.

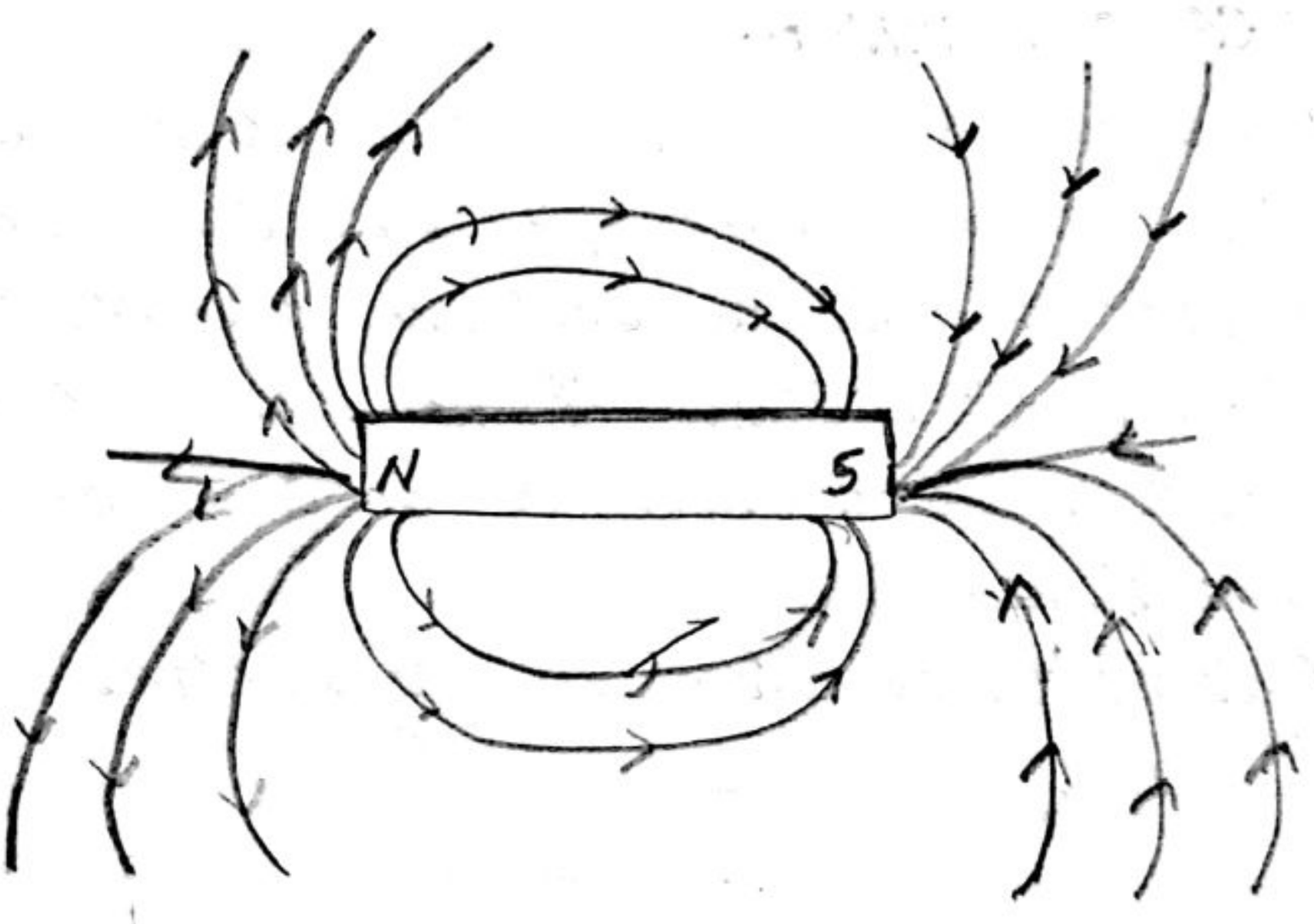
(v) Avoid error due to parallax.
Avoid

Tasha

AIM: To plot the magnetic lines of force of a bar magnet.

APPARATUS: bar magnet, magnetic compass needle, drawing board, sheet of paper, board pins.





LINES OF FORCE OF A BAR MAGNET

EXPERIMENT No. 7

Page No. 16
Date : 29/ 7 /2015

AIM: To plot the magnetic lines of force of a bar magnet.

APPARATUS: bar magnet, magnetic compass needle, drawing board, sheet of paper, board pins.

PROCEDURE:

(i) fix the sheet of paper on the drawing board.
(ii) place the bar magnet in the middle of the paper and draw its outline.
(iii) Place the compass needle in the N-pole of the magnet. The needle will rest in a particular direction.
(iv) Mark the position of the poles of the needle.
(v) Remove the compass and keep it in such a way that the S-pole of the needle takes up the position of its N-pole.
(vi) Again, mark both the poles of the needle, when it is at rest.
(vii) Repeat this till the compass needle reaches the S-pole of the bar magnet.
(viii) Join all the points to form a smooth curve and mark an arrow to show that the line starts from the N-pole.
(ix) similarly draw many such lines on either side of the magnet.

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(X) Draw a line perpendicular to the axis of the magnet, bisecting it. Place the compass needle on this line near the magnet and move it ~~again~~ away, step by step, from the magnet on this line. You will find one point on each side of the magnet on this line where the needle will appear to become free and it takes a complete round and stays in any position. Mark these points as P and Q. These points P and Q are known as the neutral points

CONCLUSION:

The field lines pattern represents the combined magnetic field of the Earth and the magnetic field of the bar magnet placed along the magnetic meridian with it north pole facing towards the north. The combined magnetic field of the magnet and the Earth is strongest near the ends (called the poles) of the magnet, where the field lines are closer. It is very weak but not zero at points very far from the magnet and is zero at the points P and Q which are called the null points because at these points the magnetic field of the bar magnet and the magnetic field of the Earth are equal but in opposite directions.

1. Magnetic lines of force donot intersect.

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2. The lines of force start from the North pole and end in the South pole.

14/8/15

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