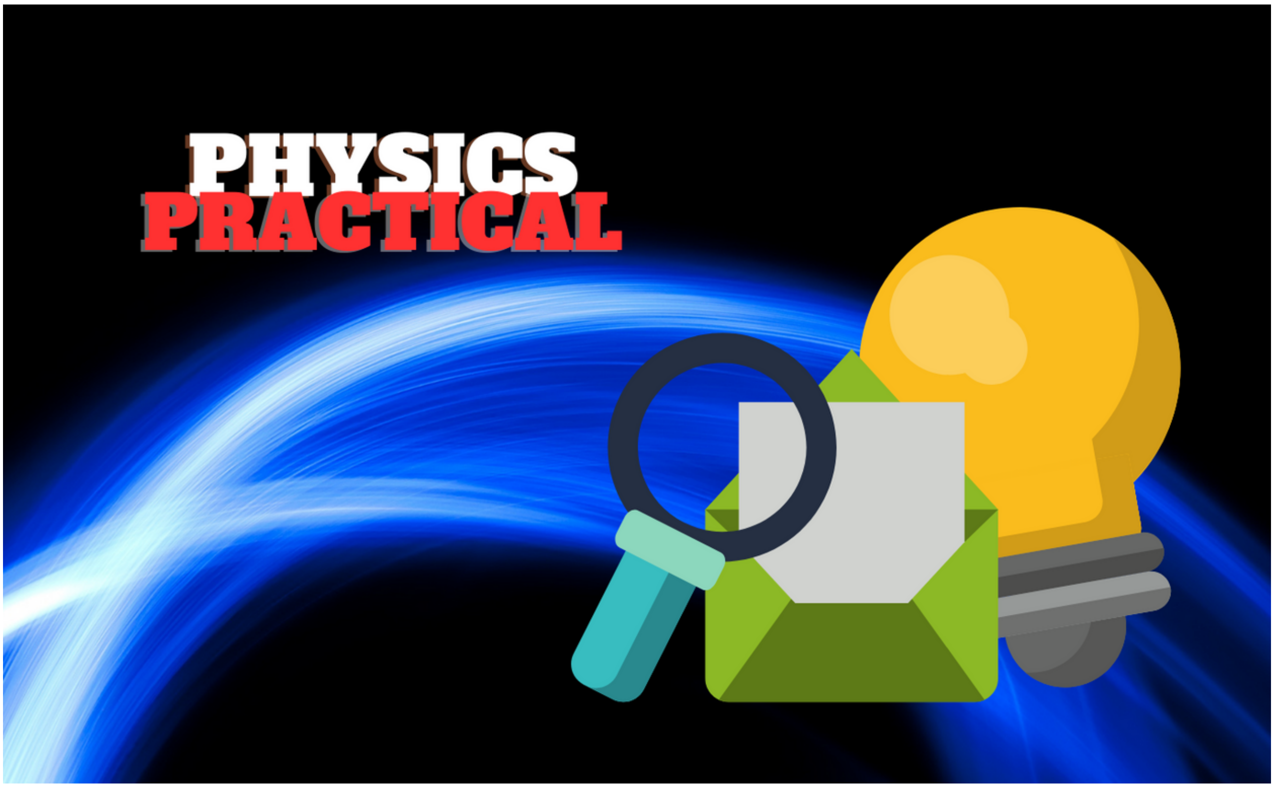

CLASS 11 PHYSICS PRACTICAL

WITH

SAMPLE READING

EXAMCRAKER.IN

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EXPERIMENT NO 1

NAME OF EXPERIMENT: TO DETERMINE THE CROSS-SECTIONAL AREA OF A GIVEN GLASS ROD BY USING MICROMETER SCREW GAUGE

APPARATUS REQUIRED

1. Micrometer screw gauge
2. Glass rod

THEORY

The pitch of the screw is defined as the linear distance travelled by the screw gauge in one complete rotation of the circular scale. It is denoted by the letter P. The L.C. is the distance travelled by the screw when the circular scale is rotated through only one of its circular divisions, then the least count (L.C.) is given by

$$L.C. = \frac{\text{Pitch}}{\text{No. of circular scale divs.}} = \frac{P}{N}$$

If x be the linear scale of the rod, y be the circular scale reading, then

Required diameter of the rod

$$d = (\text{Linear scale reading} + \text{Circular scale reading} \times L.C.) \pm \text{Instrumental error} = (x + y \times L.C.) \pm \text{error}$$

$$\therefore \text{Cross-section of the rod} = \frac{\pi d^2}{4}$$

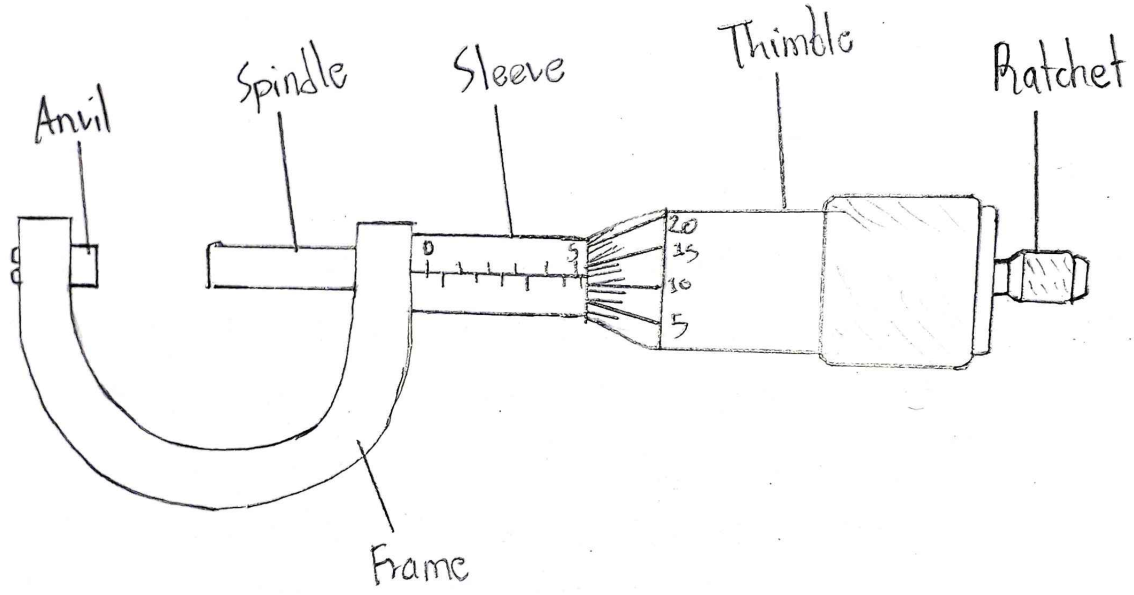


Fig. Micrometer screw gauge

PROCEDURE

1. The value of 10 smallest divisions of the main scal was found out, from which the value of one div. wa calculated. The total no. of circular divisions was noted.
2. The linear distance through which the circular scale moves along the main scale for 4 complete rotations of its circular head was found out, from which the distance for 1 complete rotation was calculated. This gives the Pitch of the screw. Hence, the Least count was determined.
3. The instrumental error was next found out.
4. The given rod was held tight between the plane faces. The reading of the main scale ~~immediately before~~ the circular scale ~~was read~~. The circular scale reading was next taken.
5. Two readings in direction at right angles to each other were taken for each position.
6. Operations (iv) and (v) ~~are~~ were repeated for 10 positions.

OBSERVATION

Value of 10 smallest divisions of the main scale = 10 mm

$\therefore$ Value of 1 smallest division of main scale = 1 mm.

In 4 complete rotations, the circular scale moves through 4 divs. of the main scale.

$\therefore$ In 1 complete rotation, the ~~circular~~ scale moves through 1 division of main scale.

$\therefore$ Pitch (P) = 1 mm

No of circular scale division = N = 100 divs.

$$\text{L.C. (least count)} = \frac{\text{Pitch}}{\text{No. of cir. scale divs}}$$

$$= \frac{P}{N} = \frac{1}{100} = 0.01 \text{ mm}$$

INSTRUMENTAL ERROR

The zero of the circular scale is above (negative error).

Instrumental error $= +x \times L.C. = 10 \times 0.01$

$\therefore$ Correction $= +x \times L.C. = +0.10$ mm

OBSERVATION TABLE

No. of Obs.	Main Scale Reading x mm	Circular Scale Reading y	Value of y×L.C. mm	Total = x+y×L.C. = d mm.	Apparent mean d cm	Corrected mean d cm
1.	8	75	0.75	8.75		
2.	8	19	0.19	8.19		
3	8	11	0.11	8.11		
4	8	4	0.04	8.04		
5	8	16	0.16	8.16	8.313	8.413
6	8	27	0.27	8.27		
7	8	5	0.05	8.05		
8	8	13	0.13	8.13		
9	8	96	0.96	8.96		
10	8	47	0.47	8.47		

Now,

Apparent mean $= 8.313$ mm

Then,

Corrected mean $= 8.313 + 0.10$

$= 8.413$ mm

$\therefore$ Cross-section of the rod $= \frac{\pi d^2}{4}$

$= \frac{22}{28} \times (8.413)^2$

$= 55.61\ mm^2$

RESULT

Hence, the cross-sectional area of a given glass rod is determined by using micrometer screw gauge.

PRECAUTIONS

1. The screw should not be pressed too hard while finding the zero error or the diameter.
2. The diameter should be measured in two mutually perpendicular directions.
3. The screw should always be turned in the same direction in order to avoid the back-lash error.
4. The zero error should be checked carefully and correction with proper sign should be applied.

077-09-26

EXPERIMENT NO 2

NAME OF EXPERIMENT: TO DETERMINE VOLUME OF THE GIVEN HOLLOW CYLINDRICAL TUBE BY USING VERNIER CALLIPERS

APPARATUS REQUIRED

1. Vernier Callipers
2. Given tube

THEORY

The vernier constant (V.C.) of the vernier callipers is the value of the difference between a vernier division and a main scale division expressed in terms of 1 main scale division (S). Hence, if n vernier divisions coincide with (n-1) main scale divs.

1 vernier division coincides with $\left(\frac{n-1}{n}\right)$ main scale division

∴ Difference between a main scale and 1 vernier div. $= 1 - \frac{n-1}{n} = \frac{1}{n}$

∴ Vernier Constant (V.C) $= \frac{1}{n} \times$ Value of 1 main scale division $= \frac{S}{n} = \frac{1}{10} = 0.1\,mm = 0.01\,cm$

∴ Length of the tube = Main scale reading + vernier reading ± Instrumental error

Let, l = length of the tube

d_1 = external diameter of the tube

d_2 = internal diameter of the tube

We have,

External volume $= \frac{\pi}{4} d_1^2 l$

Internal volume $= \frac{\pi}{4} d_2^2 l$

$\therefore$ Volume of the tube = External volume − Internal Volume

$= \frac{\pi}{4} d_1^2 l - \frac{\pi}{4} d_2^2 l$

$\therefore V = \frac{\pi}{4} l (d_1^2 - d_2^2)$

PROCEDURE

1. The vernier constant of the instrument was determined in the usual way and the zero error if any was noted.
2. The experimental tube was next introduced lengthwise between the jaws of the callipers and held tight between them. The main scale reading immediately before the zero of the vernier was noted. Then the no. of divisions of the vernier coinciding with a certain main scale division was counted and noted. This reading multiplied by the vernier constant gives the value of the vernier reading which when added to the main scale reading gives the total value of

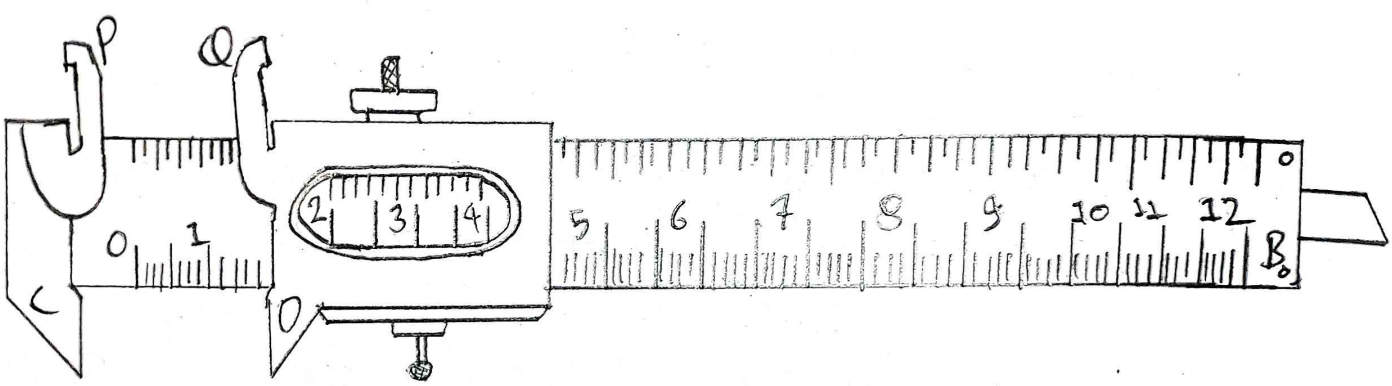


Fig. Vernier Callipers

the length of the tube. Another reading for it length was taken. This was repeated five time and the mean was calculated. The zero correction is any was applied.

3. Similarly, the reading for the external diameter of the tube were taken at five different places along its length taking two observations at each place along two mutually perpendicular diameters, this time placing it vertically instead of lengthwise in between the jaws. The mean diameter was taken and the zero correction applied as before.

4. To measure internal diameter of the tube, the outward projected points of the jaws P and Q of the callipers were introduced inside the given tube. The jaws were opened till projected points touch the diametrically opposite walls of the tube. The reading was taken. This was repeated five times by rotating the tube about its axis.

~~5.~~

OBSERVATIONS

Value of 10 divisions of the main scale = 10 mm

Value of 1 div. of main scale = 1 mm

Vernier divs. coincide with 9 main scale divs (n)

$\therefore$ 1 division of vernier scale $= \frac{9}{10}$

$\therefore$ Vernier constant (V.C.) $= s - v = \frac{s}{n}$

Type y

ZERO ERROR

The zero of the vernier coincides with or is to the left or is to the right of the zero of the main scale by x div.

$\therefore$ Instrumental error $= 0$

or, $-x \times V.C.$

or, $+x \times V.C.$

$\therefore$ Zero correction $= 0$

or, $+x \times V.C.$

or, $-x \times V.C.$

OBSERVATION TABLE

No. of Obs.	Obs. for	Reading of the Main Scale cm (a)	Vernier Scale V	Value of V=(b) cm	Total a+b cm	Apparent mean cm	Corrected mean cm
1.	length	6.5	0	0	6.5	6.722	l
2.		6.8	5	0.05	6.85		
3.		6.8	2	0.02	6.82		
4.		6.9	4	0.04	6.94		
5.		6.5	0	0	6.5		
1.	Ext. diameter	2.5	0	0	2.5	2.504	d_1
2.		2.5	1	0.01	2.51		
3.		2.5	0	0	2.5		
4.		2.5	1	0.01	2.51		

No. of Obs.	Obs. for	Reading of the Main Scale cm (a)	Vernier Scale V	Value of V = (b) cm	Total a+b cm	Apparent mean cm	
5.		2.5	0	0	2.5		
1.		1.7	4	0.04	1.74		
2.	Int.	1.7	3	0.03	1.73		
3.	diameter	1.7	4	0.04	1.74	1.736	d_2
4.		1.7	4	0.04	1.74		
5.		1.7	3	0.03	1.73		

CALCULATION

$$V = \frac{\pi}{4} l (d_1^2 - d_2^2)$$

$$= \frac{22}{7} \times \frac{1}{4} \times 6.722\left((2.504)^2 - (1.736)^2\right)$$

$$= \cancel{5.}\ 17.19 \text{ cc}$$

RESULT

Hence, the volume of the given tube was determined by using vernier callipers.

PRECAUTIONS

1. The zero error must be carefully determined before any measurement.
2. Extra pressure should not be applied to the jaws while holding the object to be measured.
3. The vernier should be tightly screwed in position before removing the object from the gap.

D.

EXPERIMENT NO. 3

NAME OF EXPERIMENT: TO DETERMINE THE THICKNESS OF A GIVEN PLATE USING SPHEROMETER

APPARATUS REQUIRED

1. Spherometer
2. Base plate
3. The given test plate
4. Watch glass

THEORY

The pitch of the screw is defined as the linear distance travelled by the screw in one complete rotation of the circular scale. It is denoted by the letter P.

The least of the apparatus is the smallest distance measured by the means of the apparatus. In the spherometer it is the distance travelled by the screw when the circular scale is rotated through its one circular scale division. Hence if P be the pitch of the screw and N be the circular scale divisions, then the least count L.C. is given by

$$\text{L.C. (Least count)} = \frac{\text{Pitch}}{\text{No. of cr. scale divs.}}$$

$$= \frac{P}{N} = \frac{1}{100} = 0.01\,mm$$

If a be the no. of complete rotations made and y be the no. of additional circular scale division required in lowering the central leg from the initial position on the test plate to the final position on the base plate, the thickness of the plate is given by:

$$\text{Required thickness} = (x \times p + y \times L.C.)\ \text{mm.}$$

PROCEDURE

1. The value of 10 smallest divisions of the main (linear) scale was found out, from which the value of 1 div. was calculated. The total no. of circular scale divs. was noted.
2. Then the circular scale was lowered from a particular position on the linear scale through 4 complete rotations downward and the distance through which it moves was read from the scale. Then the pitch was calculated and hence the least count was determined.
3. The given test plate was placed on the base plate. The spherometer was placed so that the central leg lies on the test plate and the three outer legs on the base plate. The central leg should just touch the test plate. It was confirmed by introducing a thin piece of paper in between the tip of the central leg and test plate. If the paper cannot get in, the leg has touched the test plate.
4. In this position, the initial circular scale reading on the test plate was noted. The test plate was removed. The total no. of complete rotations lowered was noted. The final reading of the circular scale

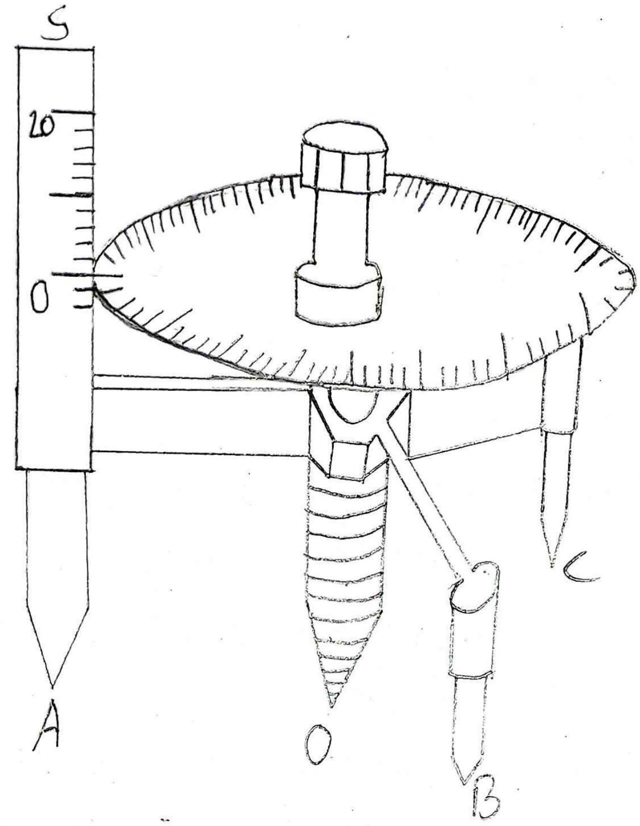


fig. Spherometer

was also noted when the central leg just touch the base plate. This operation was repeated 5 on one side of the plate.

5. The plate was turned over and the above 5 readings were repeated.
6. The mean of these readings was taken. That gave the thickness of the plate.

OBSERVATIONS

Value of 10 smallest divisions of the main scale = 10 mm.

∴ Value of 1 smallest division of the main scale = 1 mm.

In 4 complete rotations, the circ. scale moves through 4 divisions of the main scale.

∴ In 1 complete rotation, 1 divs. of the main scale.

∴ Pitch of the screw = 1 (P) = 1

No of circular scale divs. = N = 100

Least Count (L.C.) $= \frac{P}{N} = \frac{1}{100} = 0.01$ mm

OBSERVATION TABLE

No. of obs.	Initial circular scale reading on the test plate(a)	No. of complete rotations made(x)	Value of complete rotations = x×P. mm(1)	Final circular scale reading on the base plate (b)	No. of additional circular scale divs. N=(a−b)	Value of N = N× L.C. mm (2)	Total thickness =(1)+(2) mm	Mean Thick-ness
1.	78	4	1×4	99	79	0.79	4.79	
2.	76	4	1×4	93	83	0.83	4.83	
3	79	4	1×4	97	82	0.82	4.82	
4	80	4	1×4	98	82	0.82	4.82	
5	77	4	1×4	98	78	0.78	4.78	
			The test plate is turned over					4.807
6	77	4	1×4	98	79	0.79	4.79	
7	80	4	1×4	99	81	0.81	4.81	
8	78	4	1×4	99	79	0.79	4.79	
9	80	4	1×4	98	82	0.82	4.82	
10	80	4	1×4	99	81	0.81	4.82	

∴ Mean thickness of these readings = 4.807 mm

RESULT

Hence, the thickness of the given test plate was determined by using spherometer.

PRECAUTIONS

1. Screw should be moved in same direction to avoid the backlash error.
2. Leg of spherometer should just touch the plate properly.
3. No. of circular scale reading and no of completed rotation should be noted carefully.

22-10-18

1

EXPERIMENT NO. 4

NAME OF EXPERIMENT : TO DETERM[illegible] OF CURVATURE OF GIVEN WATCH GLASS

APPARATUS REQUIRED

1. Spherometer 2. Watch glass 3. Base plate

THEORY

The pitch of the screw is defined as the linear distance travelled by the screw in one complete rotation of the circular scale. It is denoted by letter P.
The least count of the apparatus is the smallest distance measured by means of the apparatus. In the spherometer it is the distance travelled by the screw when the circular scale is rotated through its one circular scale division. Hence if P be the pitch of the screw and N be the circular scale divisions, then the least count L.C. is given by,

$$L.C.\ (\text{Least Count}) = \frac{\text{Pitch}}{\text{No. of cr. scale divs.}}$$

$$= \frac{P}{N} = \frac{1}{100} = 0.01\ mm$$

If x be the no. of complete rotations made and y be the no. of additional circular scale division required in lowering the central leg from the initial position on the test plate to the final position on the base plate, the radius of curvature R of the given watch glass

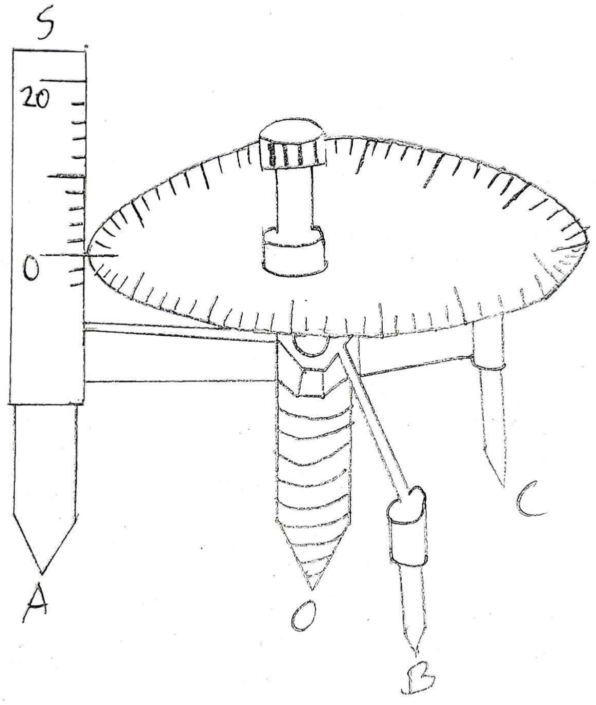


fig: Spherometer

is given by

$$R = \frac{a^2}{6h} + \frac{h}{2}$$

where 'a' is the distance between any two outer legs of the spherometer, h is the depth through which the central leg is lowered from the curved surface to the base plate.

PROCEDURE

1. The value of 10 smallest divisions of the main scale was found out, from which the value of 1 div. was calculated. The total no. of circular scale divs. was noted.
2. Then the circular scale was ~~noted~~ lowered from a particular position on the linear scale through 4 complete rotations downward and the distance through which it moved was read from the scale. Then the pitch was calculated and hence the least count was determined.
3. The watch glass was placed on the base plate with its convex side upwards. The initial circular scale reading on the base plate was noted, the total no. of complete rotations made was also noted. This operation was repeated 5 times.
4. Next the initial reading was taken on the base plate and final reading on the concave surface, the total no. of complete rotations ~~being~~ made being noted.
5. The distance between any two outer legs was measured

by pressing the spherometer legs on a sheet o
joining the prick marks.

6. The radius of curvature was then calculated by using the above given formula.

OBSERVATIONS

Value of 10 smallest divisions of the main scale = 10 mm

∴ Value of 1 smallest divisions of the main scale = 1 mm

In 4 complete rotations, the crc. scale moves through 4 divisions of the main scale.

∴ In 1 complete rotation, 1 divs. of the main scale.

∴ Pitch of the screw = 1 (P) 1

No. of the circular scale divs = N = 100

Least Count (L.C.) $= \frac{P}{N} = \frac{1}{100} = 0.01$ mm.

OBSERVATION TABLE

Table : Convex Surface

No of Obs.	Initial circular scale reading on the convex surface(a)	No. of complete rotations made (x)	Value of complete rotations made = x×P mm (1)	Final circular scale reading on the base plate (b)	No. of additional circular scale divs. N = (a − b)	Value of ~~N~~ = N× L.C. mm (2)	Total depth h = (1) + (2) mm	Mean depth h, mm
1.	17	2	2×1	0	17	0.17	2.17	
2.	12	2	2×1	95	17	0.17	2.17	
3.	19	2	2×1	94	25	0.25	2.25	2.18
4.	13	2	2×1	96	17	0.17	2.17	
5.	14	2	2×1	98	16	0.16	2.16	

Table: Concave surface

No. of Obs.	Initial circular scale reading on the base plate(a)	No. of complete rotations made (x)	Value of complete rotations made = x×P mm (1)	Final circular scale reading on the concave surface(b)	No. of additional circular scale divs. N=(a−b)	Value of N=N×L.C. mm (2)	Tota dept =(1)+ (2) mm	h_2 mm
1.	96	2	2×1	61	35	0.35	2.35	
2	96	2	2×1	59	37	0.37	2.37	
3.	96	2	2×1	58	38	0.38	2.38	2.36
4.	97	2	2×1	59	38	0.38	2.38	
5.	96	2	2×1	61	35	0.35	2.35	

CALCULATION

Distance between any two outer legs = a = 40 mm

$$R_1 = \frac{a^2}{6h_1} + \frac{h_1}{2} \qquad R_2 = \frac{a^2}{6h_2} + \frac{h_2}{2}$$

$$= \frac{(40)^2}{6\times2.18} + \frac{2.18}{2} \qquad = \frac{(40)^2}{6\times2.36} + \frac{2.36}{2}$$

$$= 122.32 + 1.09 \qquad = 112.99 + 1.18$$

$$= 123.41\text{ mm} \qquad = 114.17\text{ mm}$$

RESULT

Hence, the radius of curvature of given watch glass was determined using spherometer.

PRECAUTIONS

1. The screw should move freely without friction.

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

3. Excess rotation should be avoided.

27-10-25

Da

EXPERIMENT NO. 5

NAME OF EXPERIMENT: TO DETERMINE VALUE 'g' AT LAB BY USING SIMPLE PENDULUM

APPARATUS REQUIRED

1. A simple pendulum
2. Clamp and thread
3. Stop watch or clock
4. Meter scale

THEORY

A simple pendulum is a very heavy material bob suspended from a rigid support by means of a light, inextensible and flexible string.

A seconds pendulum is that pendulum for which the time period i.e. time for one complete oscillation is 2 seconds. The time period 't' of oscillation of simple pendulum is given by

$$t = 2\pi\sqrt{\frac{l}{g}}$$ where t = time period

l = effective length
= distance between the point of support and the centre of gravity of the bob

g = acceleration due to gravity

or, $$t^2 = \left(\frac{4\pi^2}{g}\right) \times l \quad \text{——} \quad (1)$$

which resembles the equation of st. line passing through the origin.

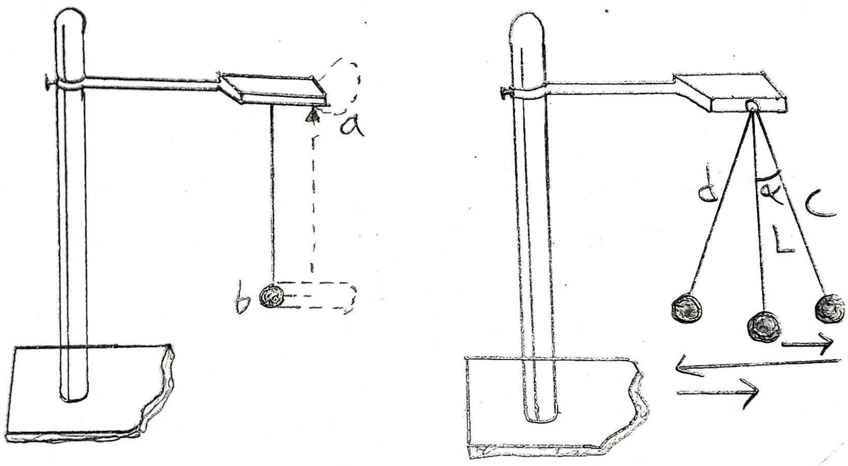


fig. Simple Pendulum

Hence, the graph of l and t^2 should [illegible] passing through the origin.

from (1)
$$g = 4\pi^2 \times \frac{l \text{ cms}}{t^2 \text{ sec}^2} \quad \text{—— (2)}$$

For a Seconds pendulum, $t = 2$ secs.

∴ from (1) above, $\cancel{4 = 4\pi^2 \frac{l}{g} \quad \text{—— (3)}}$

$$\therefore \quad l = \frac{g}{\pi^2} \quad \text{—— (3)}$$

The length of the second pendulum can be determined in the laboratory by extrapolating the value of l corresponding to $t^2 = 4$ from the graph of l and t^2 corresponding to $t = 2$ from the graph of l and t.

PROCESS

1. The vertical diameter of the bob was determined by means of a vernier callipers 5 times and the mean was taken.
2. The length L of the pendulum was taken from the point of support to the lower edge of the bob so that the ~~fe~~ effective length was obtained by subtracting the vertical radius from L. The effective length was adjusted to be 40cm for the 1st observation.

3. The bob was displaced slightly from original position. The time for 20 oscillations was fou out by means of a stop watch or clock, this repeated twice for each length. The time period was then calculated.
4. Operations (2) and (3) were repeated for effective length 60 cm. etc. Seven observations were taken, observations were entered as shown below.
5. Graph of (1) l and t (2) l and t^2, were drawn. The length of the Seconds pendulum was extrapolated from each graph.

OBSERVATIONS

Vertical diameter of the bob = 1.74 cm

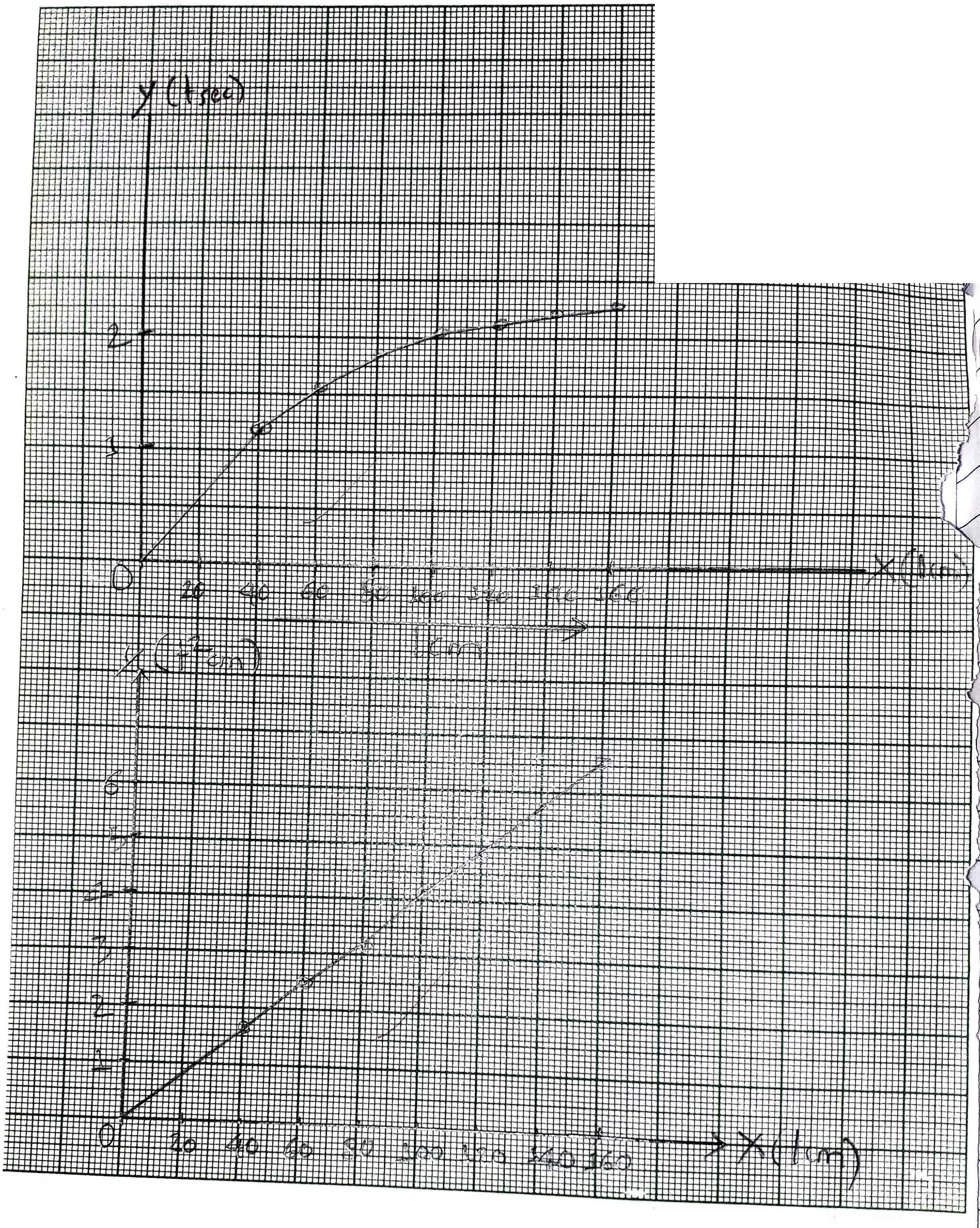
∴ Vertical (r) = 0.87 cm

Value of 10 divs. of the stop watch = ______ secs.

∴

OBSERVATION TABLE

No. of Obs.	length L bet the point of suppor t and lower edge of the bob. = L cm	Effective length $l = L - r$ cm	Time for 20 oscillations t secs.	Time period t secs	t^2	$1/t^2$	Mean $1/t^2$	$g = 4\pi^2 \frac{l}{t^2}$
1.	40+r	40	25.69	1.29	1.65	24.24		
2.	60+r	60	31.53	1.58	2.49	24.09		
3.	80+r	80	36.29	1.81	3.28	24.09	24.36	962.47
4.	100+r	100	40.59	2.02	4.12	24.27		
5.	120+r	120	44.16	2.20	4.84	24.79		


Y (t sec)
2
1
0
X (l cm)
20 40 60 80 100 120 140 160
l cm
(T² cm)
6
5
4
3
2
1
0
20 40 60 80 100 120 140 160
X (l cm)

6.	140+r	140	47.97	2.40	5.76	24.30
7	160+r	160	51.31	2.56	6.55	24.42

CALCULATION

(1) From the graph of l and t^2, we have

$l = \underline{100}$ when $t^2 = 4$

∴ the length of the second pendulum = ______ cm

Also from the graph of l and t, we have

$l = \underline{100}$ when $t = 2$ secs

∴ the length of second pendulum = ______ cm

(2) Thus mean value of $\frac{l}{t^2} = 24.36$

$$g = 4\pi^2 \times \frac{l}{t^2}$$

$$= 4 \times \left(\frac{22}{7}\right)^2 \times 24.36$$

$$= 962.47 \text{ cm/s}^2$$

$$= 9.63 \text{ m/s}^2$$

RESULT

Hence, the value of 'g' was determined in lab by using simple pendulum.

PRECAUTIONS

1. The amplitude of vibration should be very small, within 4° if possible.
2. The stop clock should be started and stopped carefully.

3. While drawing graphs, scale should b
cover the whole paper.

~~1-12-02~~