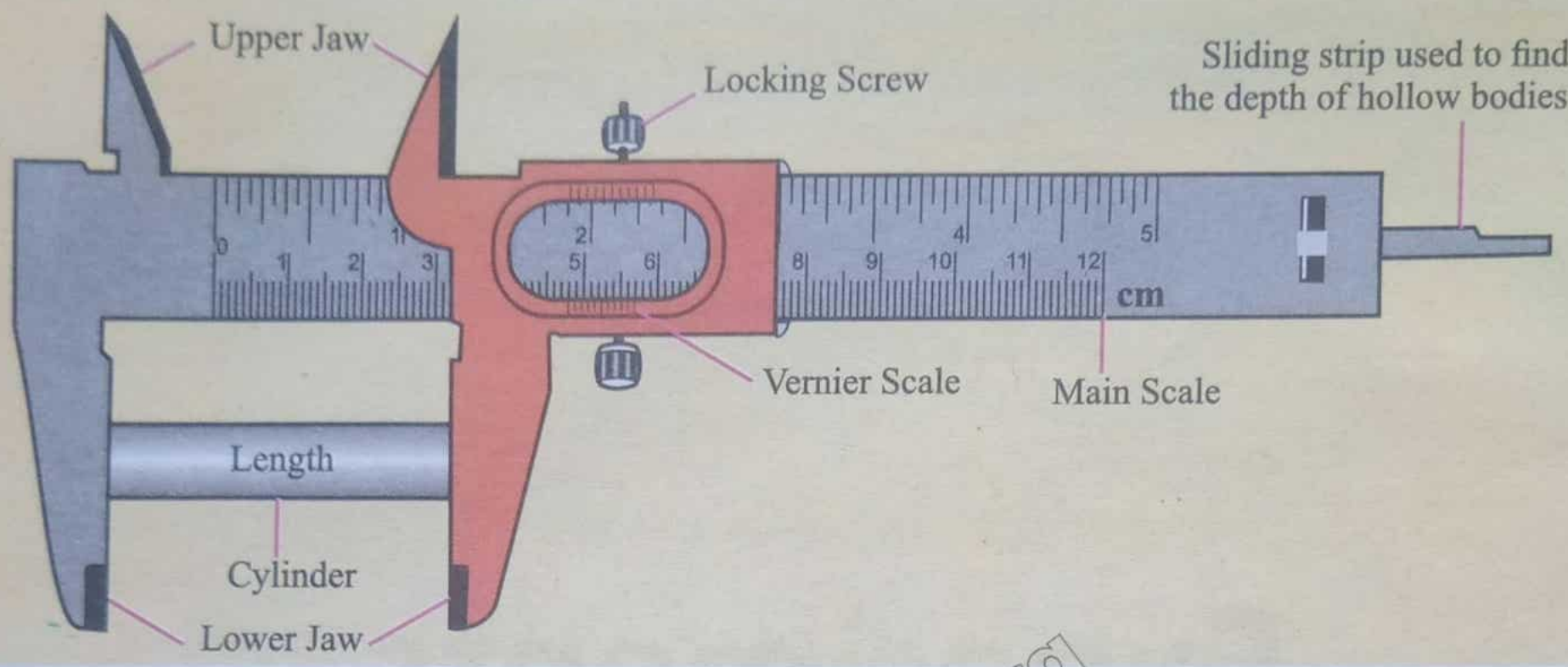
EXPERIMENT NO. 1

To find the volume of a cylinder using Vernier caliper

APPARATUS: Vernier caliper, solid cylinder

DIAGRAM:



PROCEDURE:

I took vernier caliper, found its least count and zero error. Then I paced the given cylinder lengthwise into the lower jaws and tightened the screw of vernier scale so that jaws remained fixed. I observed the main scale reading just to the left of zero line of vernier scale. That gave me main scale reading R. Then to find fraction to be added "y" I noted which of vernier scale division coincided with any main scale division, n. I multiplied that number by least count and then added to main scale reading R. That after zero correction gave me the length of cylinder. I repeated the experiment by changing the position of cylinder three times more.

I did the same to find out diameter and radius of the cylinder and in the end calculated volume by using this formula.

$$\text{Volume of the cylinder} = \pi r^2 l$$

OBSERVATIONS:

❖ **Vernier Constant (V.C)**

$$\text{Vernier constant / Least count} = \frac{\text{Value of 1 smallest division on main scale}}{\text{Total number of divisions on vernier scale}}$$

$$= \frac{0.1\ \text{cm}}{10} = 0.01\text{cm}$$

❖ Zero Correction (Z.C)

Zero error = (i) 0 cm

(ii) 0 cm

(iii) 0 cm

Means zero error = 0 cm

Zero correction = ± 0 cm

No. of Obs.	Quantity to be measured	Main Scale reading R (cm)	Vernier scale division coinciding with any main scale division (n)	Fraction to be added y = (n x V.C) (cm)	Final Reading	
					Observed $R' = R + (n \times V.C.)$	Corrected $R' \pm Z.C.$
1	Length	2.8	7	0.07	2.87	2.87
2		2.8	8	0.08	2.88	2.88
3		2.8	7	0.07	2.87	2.87
4		2.8	6	0.06	2.86	2.86
1	Diameter	0.7	4	0.04	0.74	0.74
2		0.7	6	0.06	0.76	0.76
3		0.7	5	0.05	0.75	0.75
4		0.7	5	0.05	0.75	0.75

CALCULATIONS:

Mean length of the cylinder = $l = \frac{2.87+2.88+2.87+2.86}{4}$ cm = 2.87 cm

Mean diameter of the cylinder = $D = \frac{0.74+0.76+0.75+0.75}{4}$ cm = 0.75 cm

$$\text{Radius} = r = D/2 = \frac{0.75\ cm}{2} = 0.375 \text{ cm}$$

Volume of the cylinder = $\pi r^2 l = 3.14 \times (0.375)^2 \times 2.87 = 1.268\ cm^3$

RESULT:

Volume of cylinder = 1.268 cm^3.

PRECAUTIONS

- Zero correction should be applied.
- Jaws of the calipers should not be pressed too hard.
- The vernier should be screwed in position before removing the cylinder from the gap.
- Record a number of observations and find the mean.

VIVA VOCE:

Q: What is vernier constant?

Ans: Vernier constant = $\frac{\text{Value of 1 smallest division on Main scale}}{\text{No.of divisions on Vernier scale}} = \frac{0.1\text{cm}}{10} = 0.01\text{cm}$

Q: What is meant by least count of vernier caliper?

Ans: The minimum measurement which can be made by the vernier calipers is called Least count or vernier constant. Its value is 0.01cm.

Q: Write formula to find the volume of the cylinder.

Ans: Volume of the cylinder can be determined by using the formula

$$V = \pi r^2 l$$

Q: What is zero error?

Ans: If Main scale zero and vernier scale zero does not coincide when the jaws are closed then the error occurring in measurement is called zero error.

Q: What is the use of the upper jaws and the sliding strip of the vernier caliper?

Ans: Upper jaws of the vernier calipers are used to measure internal diameter and siding strip measures the depth of any tube.

Q: What is zero correction?

Ans: To add or subtract the zero error in the observed reading is called zero correction.

Q: If vernier scale has 20 divisions and smallest division on the main scale is 0.1 cm then find the least count of the vernier caliper.

Ans: Least count = $\frac{\text{Value of 1 smallest division on Main scale}}{\text{No.of divisions on Vernier scale}} = \frac{0.1\text{cm}}{20} = 0.005\text{cm}$

Q: What are the various uses of vernier caliper?

Ans: Vernier calipers are used to measure diameter of a cylinder or sphere, length of a cylinder, internal diameter and depth of a tube.