EXPERIMENT NO : 2

Aim: To measure the inner dimensions of a given container using vernier callipers and hence find its inner volume. Verify the same using a measuring jar. Also find the percentage error in the measurement of the volume.

Apparatus: vernier callipers, container, measuring jar.

Theory: Suppose the zero of the vernier scale lies ahead of N^{th} division of the main Scale when the given object is kept between the jaws, then the main scale reading (M.S.R.) = N

If the n^{th} division of the vernier coincides with any division of the main scale , the vernier scale reading (V.S.R.) = $n \times$ least count

Total reading = M.S.R. + V.S.R.
= N + (n × least count)

After measuring the dimensions, the formula for finding the volume is applied to get the volume of the given object.

Volume of container = $\pi r^2 d$

Procedure:

1. Observe the main scale and find the value of one smallest main scale division
2. Calculate the value of least count
3. Calculate the zero error if any
4. Use the upper jaws to measure the inner diameter of the container.
5. Note the main scale reading *i.e*., the main scale reading immediately before the zero of the vernier scale.
6. Find the vernier scale division that coincides with any one of the main scale division.
7. Calculate the V.S.R.
8. Find the observed reading by adding the M.S.R. and the V.S. R.
9. Subtract the zero error if any from the observed reading to get the correct reading.
10. Record more observations taking different positions of the object.
11. Find out the mean measurement.
12. Similarly find the depth of the container at different locations.
13. Apply the formula to calculate the volume of the object.

Result: Inner volume of the given container = ……cm^3

Precautions:

1. The zero error should be noted carefully with sign and taken into account
2. The jaws should not be pressed too hard
3. The dimension to be measured should be parallel to the main scale.
4. Oil the vernier if its motion is not smooth

Sources of error:

1. The vernier may be loose
2. The graduation on the scale may not be evenly marked
3. Vernier jaws may not be at right angle to the main scale
4. Parallax may be there in taking observations

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Observation and calculation :

Value of one main scale division = ……cm
No. of vernier scale divisions = ……

$$\text{Least count of the vernier} = \frac{Value\ of\ one\ main\ scale\ division}{Number\ of\ divisions\ on\ the\ vernier\ scale}$$

= ……. cm

Vernier scale division coinciding with any division of the main scale when the two jaws are in contact = 0

Zero error = 0 cm

Observations for inner diameter

Sr. No.	M.S.R. (cm)	Coinciding Vernier scale Division (*n*)	V.S.R.= *n* × least count (cm)	Observed reading = M.S.R.+ V.S.R (cm).	Corrected reading = Observed reading – zero error
1. 2. 3.					

Mean : _____cm

Observations for measurement of depth

Sr. No.	M.S.R. (cm)	Coinciding Vernier scale Division (*n*)	V.S.R.= *n* × least count (cm)	Observed reading = M.S.R.+ V.S.R (cm)	Corrected reading = Observed reading – zero error (cm)
1. 2. 3.					

Mean : _____cm

From Calculation:
Inner volume of the given container = ……cm^3

Using the measuring cylinder :
Inner volume of the given container = ……ml (1ml = $1cm^3$)

$$\text{Percentage error} = \frac{Difference\ in\ volume}{True\ Value}\ X\ 100\ \%$$

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