

Experiment No. ....

Date: .....

**TO DETERMINE LENGTH, INTERNAL DIAMETER, EXTERNAL DIAMETER OF A HOLLOW TUBE BY USING A VERNIER CALLIPER AND HENCE CALCULATE ITS VOLUME AND DENSITY**

**APPARATUS REQUIRED**

1. Given hollow tube                      2. A weighing balance                      3. A vernier callipers

**THEORY**

Vernier calliper is an instrument used for measuring length, internal and external diameter of hollow cylindrical object with more accuracy (*10 times more accurate than a normal scale*). It is also used for measuring the depth of a small vessel and also for measuring the external diameter of spherical objects.

A vernier callipers consists of two scales:

1. Main scale: A fixed scale graduated in millimeters (and in inch) which is similar to a normal ruler scale.
2. Vernier Scale: A moveable scale usually having 10 divisions (but not graduated). The role of vernier scale is to add an extra degree of accuracy to measurements (*usually 10 times higher accuracy than normal scale.*).

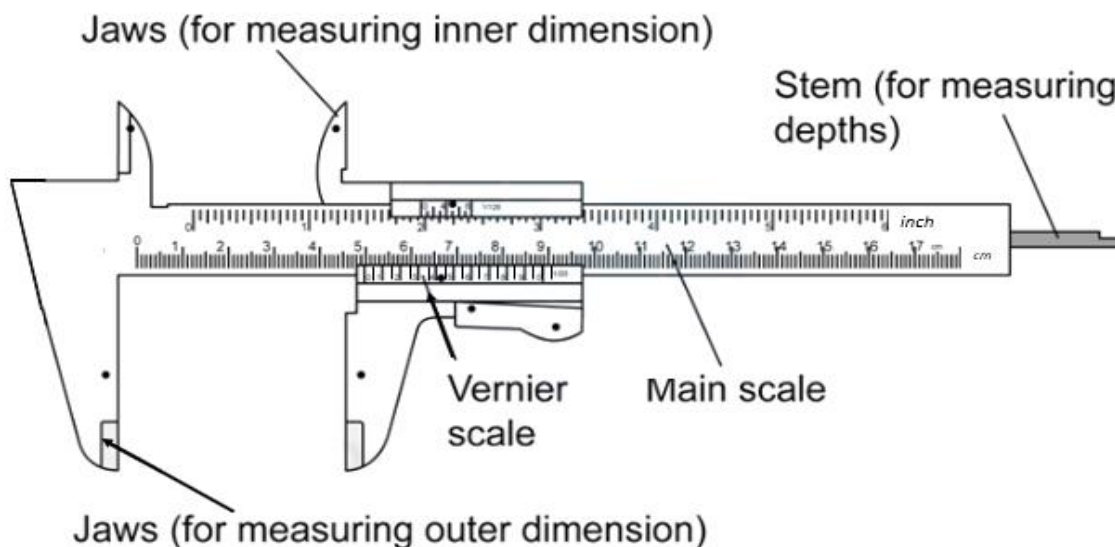


Figure: A vernier calliper

The instrument is so constructed that when the two jaws are in contact, the zero of the vernier scale coincides with the zero of the main scale. In addition, when we insert an object in between the jaws (in taking a measurement), the distance through which the two jaws open out gives the length ( or diameter or depth) of the object.

Steps for taking measurement:

- An object is introduced in between the jaws and held tight between them.
- The main scale reading (M) immediately before the zero of circular scale is noted.
- The number of divisions of vernier scale coinciding with certain main scale division is counted and noted (usually 0 to 10). The reading of the vernier scale is multiplied by vernier constant ( or least count) to obtain the vernier scale reading (i.e., vernier scale reading,  $V = \text{No. of division} \times \text{least count}$ )
- The main scale reading (M) and vernier scale reading (V) are added to find the total measurement.