

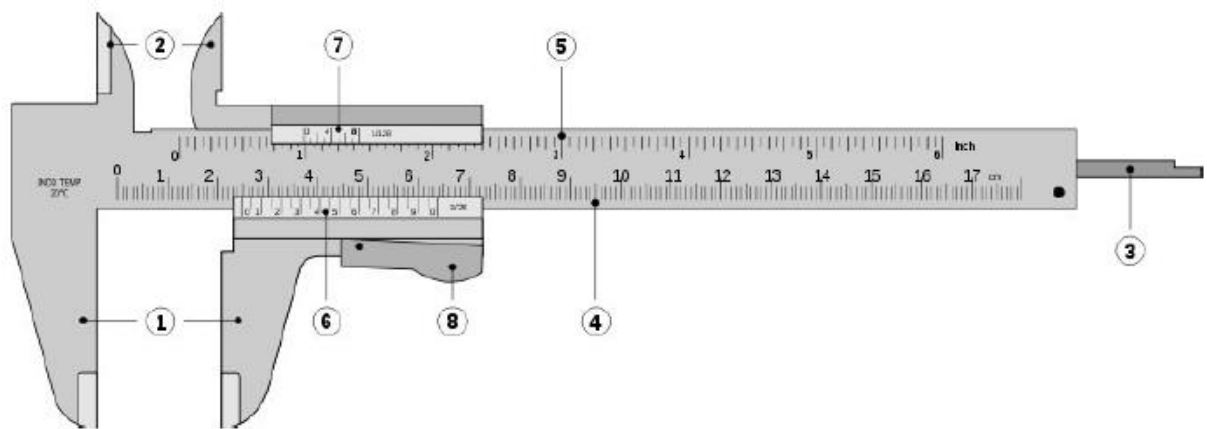
# Measurement of Thickness and Length

## TP 01 Vernier caliper

**Aim:** to determine the length, height and diameter of the given work piece using Vernier caliper.

**Apparatus required** Vernier caliper,

**Theory and description:** The principle of Vernier is that when two scales or divisions slightly different in size are used, the difference between them can be utilized to enhance the accuracy of measurement. The Vernier Caliper essentially consists of two steel rules and these can slide along each other. The details are shown in figure below.



- 1) **Outside jaws:** used to measure external diameter or width of an object;
- 2) **Inside jaws:** used to measure internal diameter of an object;
- 3) **Depth probe:** used to measure depths of an object or a hole;
- 4) **Main scale:** gives measurements of up to one decimal place (in cm);
- 5) **Main scale:** gives measurements in fraction (in inch);
- 6) **Vernier scale:** gives measurements up to two decimal places (in cm);
- 7) **Vernier scale:** gives measurements in fraction (in inch);
- 8) **Fine adjustment clamp:** gives clamping of Vernier scale.

**To find the least count (L.C):** Least count is the minimum distance, which can be measured accurately by the instrument.

$$\text{L.C} = (\text{Value of the smallest division on the main Scale}) - (\text{Value of the smallest division on Vernier Scale})$$

( OR )

$$\text{L.C} = (\text{Value of the smallest division on the main Scale}) / (\text{number of divisions on the Vernier scale})$$

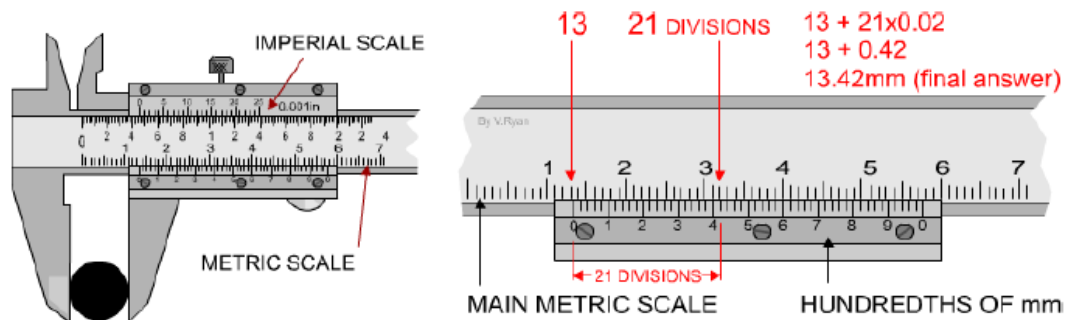
Procedure to find out the final measurement:

- 1) Note the number of division on the main scale that is coincident with the zero on the Vernier scale;
- 2) Find the division of the Vernier scale that coincides with the division of the main scale. This figure must be multiplied with the least count.
- 3) Obtain the final measurement by adding the main scale reading to the product of the Vernier scale reading and least count value.

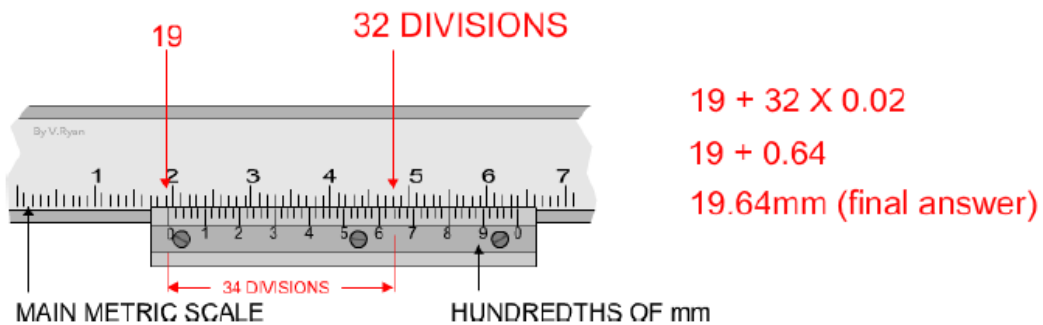
**Final Measurement = MSR (Main Scale Reading) + VSR (Vernier Scale Reading) x L.C.**

By above formula given specimen final measurement can find out.

**EXAMPLE 1:-** To measure a value of 13.42mm (Least count = 0.02mm)



**EXAMPLE 2:-** To measure a value of 19.64mm (Least count = 0.02mm)



## Procedure

### **For Vernier Caliper:**

- 1) When two measuring tip surfaces are in contact with each other, check for zero error. Also check if the surfaces are not unduly worn out or bent or any dirt collected on them;
- 2) The object must be held as close to the main scale bar as possible to avoid errors due to deflection of tips. The axis of Vernier should be perpendicular to the axis of the object. This ensures the correct dimension of the part to be measured;

- 3) Do not apply too much pressure while measuring. First, make the measuring jaws to lightly contact the surfaces of the work piece. Then slightly retract the left jaw and clamp the support bracket at its place;
- 4) Now rotate the micro adjustment i.e. knurled knob to advance the left jaw to contact the work piece surface;
- 5) Read the measurements as above mentioned and find out the required values.

### **Observation table**

**For Vernier Caliper:** {Range (0- 250 mm) & Least count = 0.02 mm}

	<b>Main Scale Reading(MSR) in mm</b>	<b>Vernier Scale Reading(VSR) in mm</b>	<b>Final Measurement = MSR + (VSR X Least count ) in mm</b>	<b>Accuracy</b>

### **Conclusion**