Physics 223
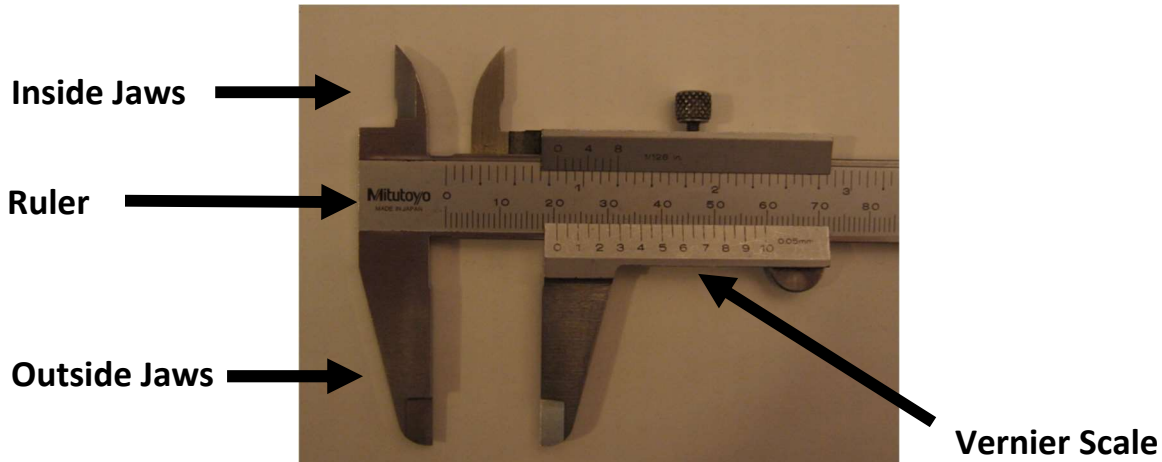*General Physics Lab*
Experiment 0: The Vernier Caliper

The Vernier Caliper, first introduced by Pierre Vernier of France in 1631, is an instrument for making accurate linear measurements by utilizing two graduated scales: a main scale ("Ruler"), and a sliding scale ("Vernier Scale") as show here:

Inside Jaws

Ruler

Outside Jaws

Vernier Scale

We will use the S.I. system of units in this lab, therefore we will learn to measure objects using the millimeter-graduated ruler scale on our calipers (although the technique learned here may be used to read the inch-graduated ruler scale as well). In the pictures presented, the millimeter scale is on the bottom of the ruler, although the caliper on your lab table may have the millimeter scale on the top.

A caliper measurement will always take the following form:

$$(\textbf{RR}.\textbf{VV} \pm \textbf{UU})\text{ mm}$$

Where **"RR"** represents the ruler measurement, **"VV"** represents the Vernier scale measurement, and **"UU"** represents the uncertainty in your measurement. The calipers we use all have an uncertainty of $\pm .05\ mm$.

 The procedure for measuring the length of an object using a Vernier Caliper is as follows:

1) Using your right hand, firmly **grip the object** within the Outside Jaws of the caliper, keeping firm pressure on the sliding Vernier Scale with your thumb. Do not let the object touch the ruler!

2) **Read the Ruler** by determining which ruler hatch mark the "zero" hatch mark on the Vernier Scale has just exceeded. (The graduated lines on a measuring device are formally called "hatch marks".) Write this number **(taken from the ruler)** in the "RR" position of the form above.

3) **Read the Vernier Scale** by determining which hatch mark on the Vernier scale lines up perfectly with *ANY* hatch mark on the ruler. Write this number **(taken from the Vernier scale)** in the "VV" position of the form above. This number will **ALWAYS** end in a "zero" or "five". *DO NOT READ THE RULER DURING THIS STEP!*

4) **Include the uncertainty** of the device in the "UU" position of the form above. **Don't forget the units!**

Example: Read the following measurement
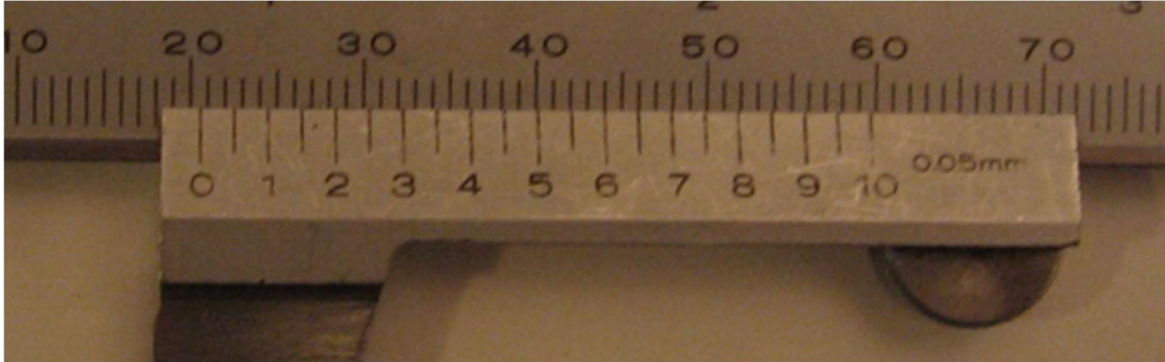
1) Assume the object to be measured is gripped firmly in the outside jaws.

2) The "zero" hatch mark on the sliding Vernier scale has exceeded the $20\ mm$ hatch mark on the ruler without reaching the $21\ mm$ hatch mark on the ruler. Therefore, the ruler ("RR") measurement is $20\ mm$.

3) The "six" on the Vernier scale is the only hatch mark on the Vernier scale that lines up *perfectly* with a hatch mark on the ruler. (Note that the 5.5 and 6.5 Vernier hatch marks are *slightly* off center of a hatch mark on the ruler!) Because the "six" on the Vernier scale is the hatch mark that lines up perfectly with a hatch mark on the ruler, the Vernier measurement ("VV") is $.60\ mm.$ **Remember: *DO NOT READ THE RULER DURING THIS STEP!***

4) Include units and uncertainty!

The measurement shown above is: $(\mathbf{20.60 \pm .05})\ \boldsymbol{mm}$

Practice 1: Measure the three dimensions of the "123 Block" on your lab bench and fill in the table below:

Dimension (Length) to be Measured	Caliper Measurement
Short Length of "123 Block"	
Medium Length of "123 Block"	
Long Length of "123 Block"	