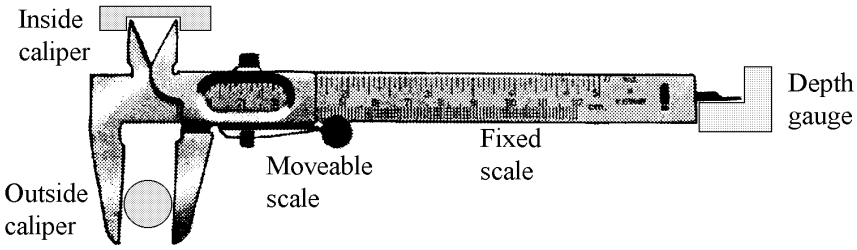
Appendix: Measuring tools

To ease your entry into physics 241 labs, a description of some of the equipment that will be used is given here. Gadgetry covered here includes the vernier caliper and the micrometer

Vernier Caliper

A vernier caliper is a measuring device that can be used to find length and depth measurements, both inside and outside of an object. Calipers used in this laboratory are accurate to about one hundredth (.01) of a centimeter if used properly.

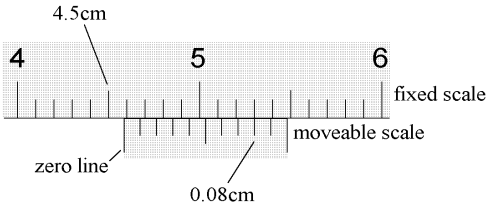


The procedure for obtaining a reading from one is as follows:

1. Read the fixed scale to determine the number which will be at the left of the decimal place (usually, metric will be used here, so this will be millimeters). This number is the last whole number using the tick mark to the left of the zero line of the moveable scale (see figures).

2. Count the number of divisions from the zero line to the line which exactly lines up with a line on the fixed scale above it. This gives the next significant figure, to be added to the value arrived at in step one.

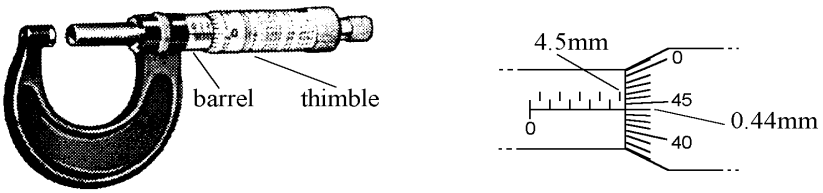
Below is an example which shows how the fixed and moveable scales appear for a reading 45.8 millimeters (which is the same as 4.58 centimeters).



Micrometer Caliper

The micrometer caliper is another device used to measure length values. It is accurate to about one thousandth (0.001) of a centimeter and is used here primarily for determining the radius of wires, for which good results are more difficult to obtain with a centimeter stick

or ruler.



To measure with the micrometer caliper:

1. Read the barrel to the nearest one half of a millimeter, indicated by the hash marks half way between the whole millimeter marks (see the figure above). Record the last value visible before reaching the edge of the thimble.

2. The thimble is used to find the decimal part of the measured number, found from the mark on the thimble which lines up with the mark on the barrel connecting the whole-number millimeter marks (step 1). If, for example, the last number read on the barrel is 3.0 millimeters, and the mark for 25 on the thimble is lined up with the mark on the barrel, then the measured number is 3.25 millimeters. On the other hand, if it is possible to see a half mark, so that the number on the barrel reads 3.50 millimeters, then the 25 above must be added to this for a final answer of 3.75 millimeters. Thus, it is important to be aware of which mark is the last visible on the barrel before the edge of the thimble. Misreading can lead to an error of 0.5 millimeters, which is significant in some experiments.

The figure above shows an example of how to read the barrel and thimble of a micrometer for a measurement of 4.94 millimeters or 0.494 centimeters.

Another device which uses the same kind of principle is the micrometer screw. This device is designed so that a dial, marked off in 100th's of a millimeter, can be rotated, either counterclockwise or clockwise. One complete rotation of the dial corresponds to a difference of one millimeter, usually marked by a linear scale, which also acts as the marker of the rotating dial. Thus, the face of the dial can be used as the marker for the linear scale, marked off in millimeters, and the linear scale can be used as the marker for the dial. By first reading the linear scale for the whole millimeter value, (using the dial face as the decimal point indicator with the last whole millimeter mark above the dial being the whole millimeter value), and then the value on the dial as the decimal value (using the numbered face of the linear scale as the indicator) a value can be read off to two decimal place accuracy.