

A note about taking measurements

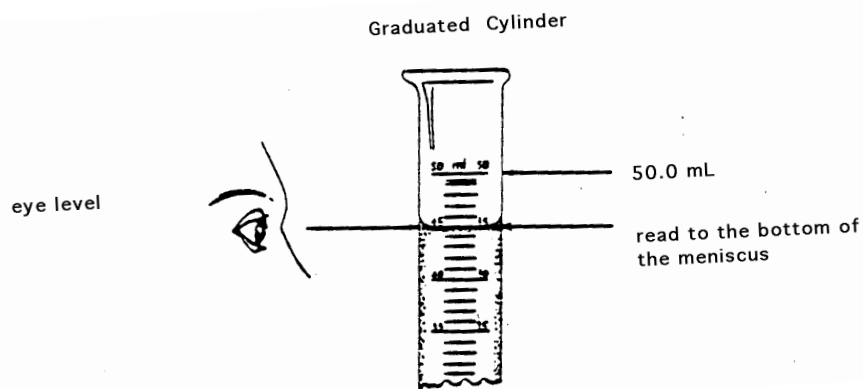
Measurements are essential to experimental sciences such as chemistry, physics, biology, and geology. The measurements are usually made using the metric system units. Scientists make measurements to the greatest precision possible using metric units. **The precision of a measurement is limited by the calibration of the measurement tool.** A balance that gives readings to only the nearest 0.001 gram cannot be used to give masses to 0.00001 gram.

To use a balance for **mass** measurements:

- The "tare" button will zero the balance.
- Always use a container or weighing paper for weighing chemicals.
- Do not place chemicals directly on the balance pan. Do not handle chemicals with your hands!
- Clean up any materials on or near the balance. Excess chemicals go into the chemical waste container.
- If a balance seems to be out of order, please tell your instructor. DO NOT attempt to make adjustments on the balance.

To make **volume** measurements:

- There are 10 mL, 25 mL, and 100 mL graduated cylinders available. Use the size most appropriate for the measurements.
- Note that the more graduations (markings) there are within 1 mL, the more precision afforded by the glassware. For example, you can make more precise measurements with the 10 mL cylinder (two decimal places) and less with a 100 mL cylinder (one decimal place).



To make **temperature** measurements:

- Temperature measurements are made using mercury thermometers, thermocouples, gas filled thermometers, alcohol thermometers, etc.
- Measurement errors can result from the way the thermometer is located in a liquid. We can minimize some sources of error if we observe the following practices:
 - Position the thermometer probe away from the walls of the container. Be sure the liquid is thoroughly mixed.
 - Allow the thermometer to be in contact with the liquid for enough time so that the thermometer reaches equilibrium with the liquid.
- Temperatures should be measured to the precision allowed by the thermometer. If the thermometer scale reads to ± 1 °C, only readings to the nearest degree are possible.
- If a Bunsen burner is used, read and record the temperature being sure to keep the thermometer bulb away from the bottom of the beaker.