

Precision and Uncertainties for Common Lab Equipment

When you record a scientific measurement, the last digit that you record is understood to have some uncertainty, and to be your best estimate. When reading non-electronic devices such as rulers, thermometers, and glassware, the general rule of thumb is to "read between the lines"! *This means that you can estimate one more digit or decimal place than the device is marked.* But this rule does NOT APPLY to electronic equipment (such as a balance or electronic thermometer) which gives you a direct digital readout. For these digital devices, your teacher will provide you the precision of the instrument.

The following uncertainties apply to careful measurements made by a trained observer:

Length (common metric rulers): ± 0.01 cm (or 0.1 mm)

Mass (electronic balances): always \pm one unit in the last digit. This means that a common centigram balance is ± 0.01 grams; a milligram balance ± 0.001 grams.

Volumetric Glassware

- 10 mL graduated cylinder: ± 0.02 mL (always record to 2 decimal places)
- 25 mL graduated cylinder: ± 0.1 mL (always record to 1 decimal place)
- 100 mL graduated cylinder: ± 0.5 mL (always record to 1 decimal place)
- 500 mL graduated cylinder: ± 5 mL
- 50 mL buret: ± 0.02 mL (always record to 2 decimal places)
- 10 mL graduated pipet: ± 0.01 mL (always record to 2 decimal places)
- Fixed volume pipets (glass): $\pm 0.2\%$ of the capacity (Ex: 25 mL = ± 0.05 mL)

Beakers and Flasks: Approximately 5% of the capacity. (But of course, you would never use one of these to measure a precise amount of liquid, would you?)

Thermometer

- (alcohol or mercury): ± 0.2 °C
- TI CBL temperature probe: ± 0.1 °C

pH Measurements

- pH paper: ± 1 pH unit (pH paper gives a "quick and dirty" estimate)
- TI CBL pH probe: ± 0.1 pH units (even though it reads out to 0.01).

pressure

- TI CBL pressure probe: ± 2 kPa (even though it may read out to decimal places)