

# Review of Metric Measurement

## Triple Beam Balance

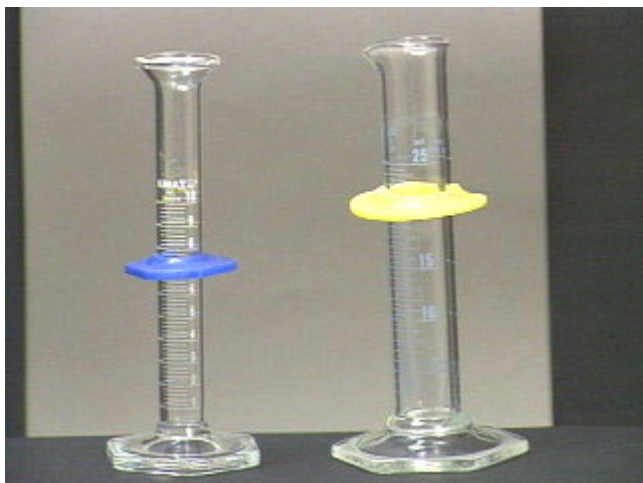


### **Instructions on use**

- The triple beam balance is used to measure masses very precisely; the reading error is 0.05 gram.
- With the pan empty, move the three sliders on the three beams to their leftmost positions, so that the balance reads zero. If the indicator on the far right is not aligned with the fixed mark, then calibrate the balance by turning the set screw on the left under the pan.
- Once the balance has been calibrated, place the object to be measured on the pan.
- Move the 100 gram slider along the beam to the right until the indicator drops below the fixed mark. The notched position immediately to the left of this point indicates the number of hundreds of grams.
- Now move the 10 gram slider along the beam to the right until the indicator drops below the fixed mark. The notched position immediately to the left of this point indicates the number of tens of grams.
- The beam in front is not notched; the slider can move anywhere along the beam. The boldface numbers on this beam are grams and the tick marks between the boldface numbers indicate tenths of grams.
- To find the mass of the object on the pan, simply add the numbers from the three beams.
- As with a ruler, it is possible to read the front scale to the nearest half tick mark.

## Graduated Cylinders

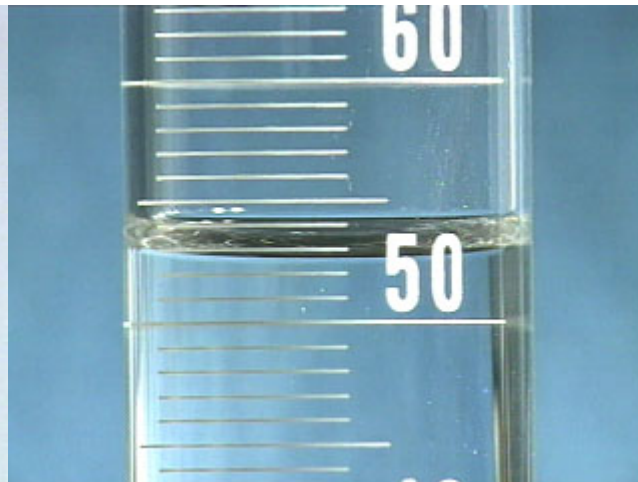
Graduated cylinders are used to measure specific volumes of liquids. The glass cylinder has etched marks to indicate volumes, a pouring lip, and quite often, a plastic bumper to prevent breakage.



Determine the volume contained in a graduated cylinder by reading the bottom of the meniscus at eye level. Read the volume using all certain digits and one uncertain digit. Certain digits are determined from the calibration marks on the cylinder. The uncertain digit (the last digit of the reading) is estimated. Several examples are shown below:

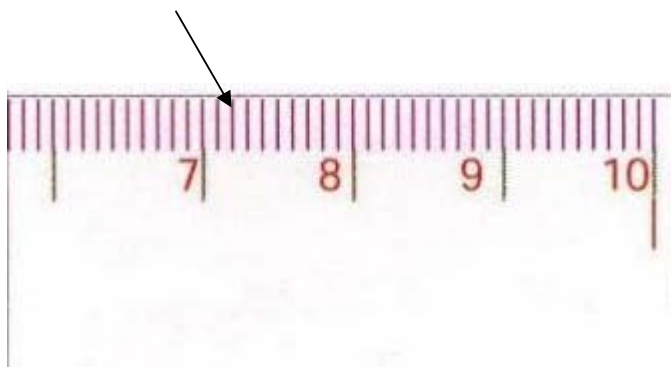


10mL graduated cylinder (**6.62 ml**)



100mL graduated cylinder (**52.7 ml**)

### Metric Ruler



**72mm or 7.2 cm**

Be sure to state the measurement and the units!!!

**A. LENGTH MEASUREMENT:** Using the metric ruler or metric stick, measure each of the following. Units must be in meters (m), centimeters (cm) or millimeters (mm).

1. length of small test tube                    \_\_\_\_\_
2. inside diameter of large test tube        \_\_\_\_\_
3. length of this paper                         \_\_\_\_\_

**B. VOLUME MEASUREMENT:** Using a *graduated cylinder* (or measuring cylinder), measure the volume of the following objects. Fill them to the top with water. Pour the water into the cylinder to measure it. The water surface is NOT flat. It is curved. This is called a **MENISCUS**. Read the lower part of the curve. If the volume is small, use the 10 ml cylinder. Otherwise use your large cylinder. Express the answer in milliliters (ml).

1. volume of small test tube                    \_\_\_\_\_
2. volume of large test tube                    \_\_\_\_\_
3. volume of "250-mL" beaker                 \_\_\_\_\_

**C. MASS MEASUREMENT:** Measure the mass (in grams) of the following objects, using the triple beam balance.(show 2 decimal places)

1. mass of small test tube                    \_\_\_\_\_
2. mass of a flask                                \_\_\_\_\_
3. mass of a 100 or 150 ml beaker            \_\_\_\_\_