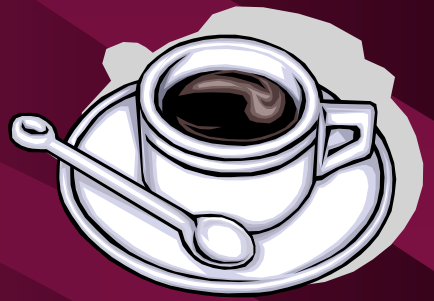
CHAPTER 16
WHAT IS MATTER?



SECTION 16.2
Measuring Matter

A review on measuring the volume and mass of matter.

VOLUME

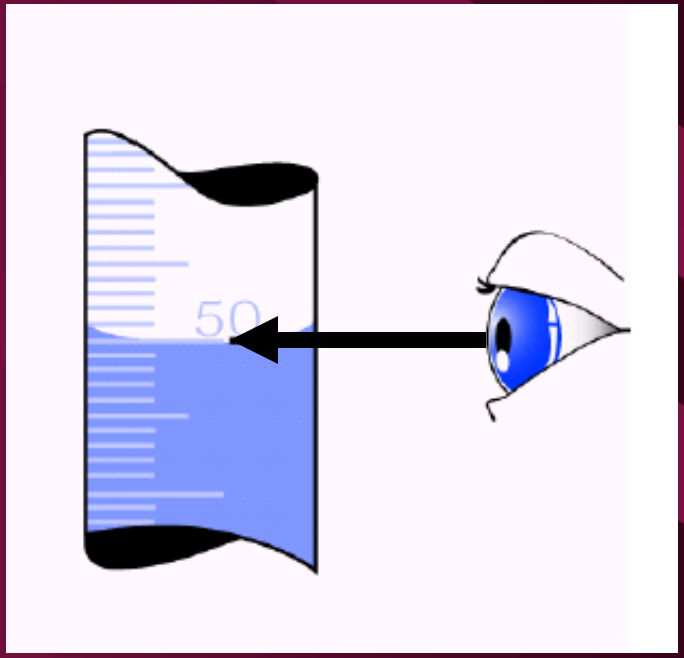
Liquid volume measurements:

- Easy to do… simply pour liquid into a marked container…

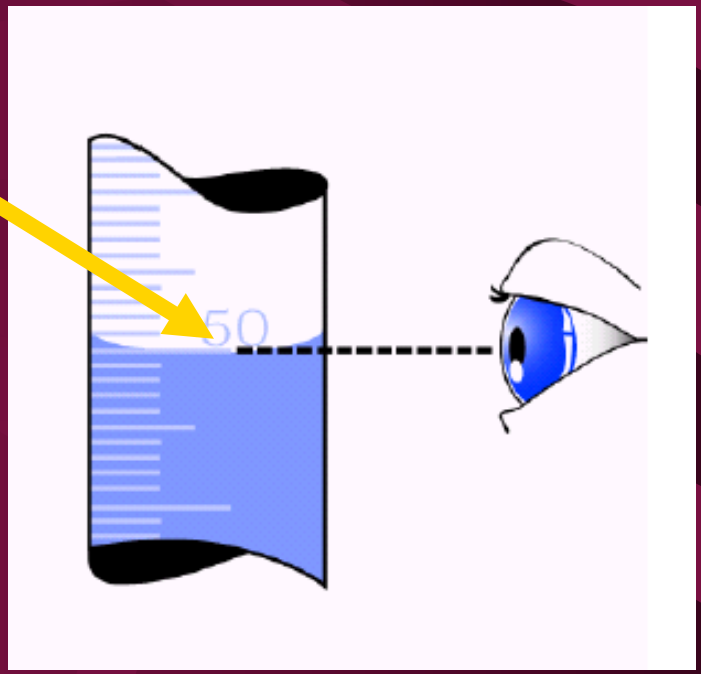
…and read the volume mark.

To get the greatest accuracy, keep two things in mind:

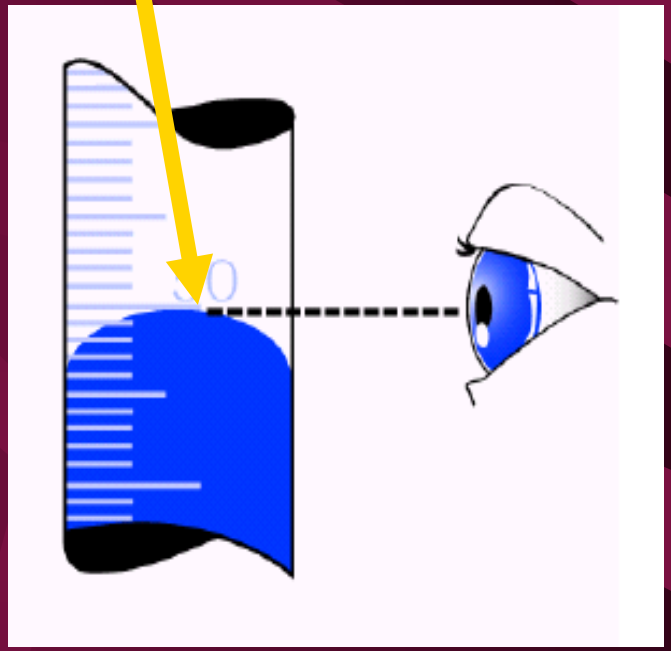
First, read the mark at <u>eye level</u>.



Second, read the volume at the bottom of the meniscus, (the curve in the surface of the liquid) if the curve is downward.



If the meniscus curves upward, then read it at the top of the curve.



Solid volume measurements:

- Calculate the volume of regular solids by using a formula.
- So, what's a regular solid?

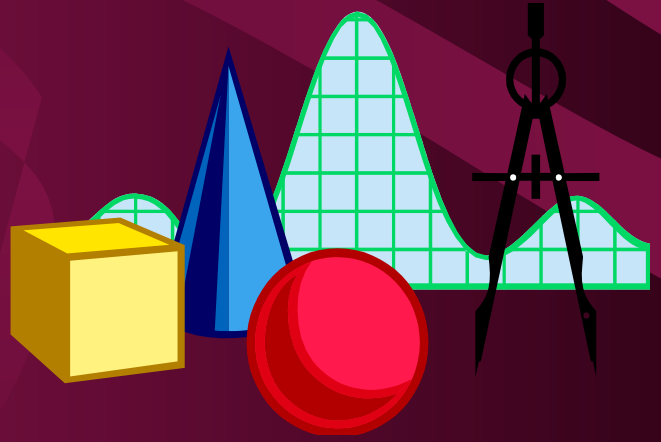


Table 16.2: *Volume Formulas*

Shape	Formula in words	Formula in symbols
rectangular solid and cube	length × width × height	$l \times w \times h$
cylinder	pi × radius^2 × height	$\pi r^2 \times h$
cone	1/3 × pi × radius^2 × height	$1/3 \times \pi r^2 \times h$
sphere	4/3 × pi × radius^3	$4/3 \times \pi r^3$

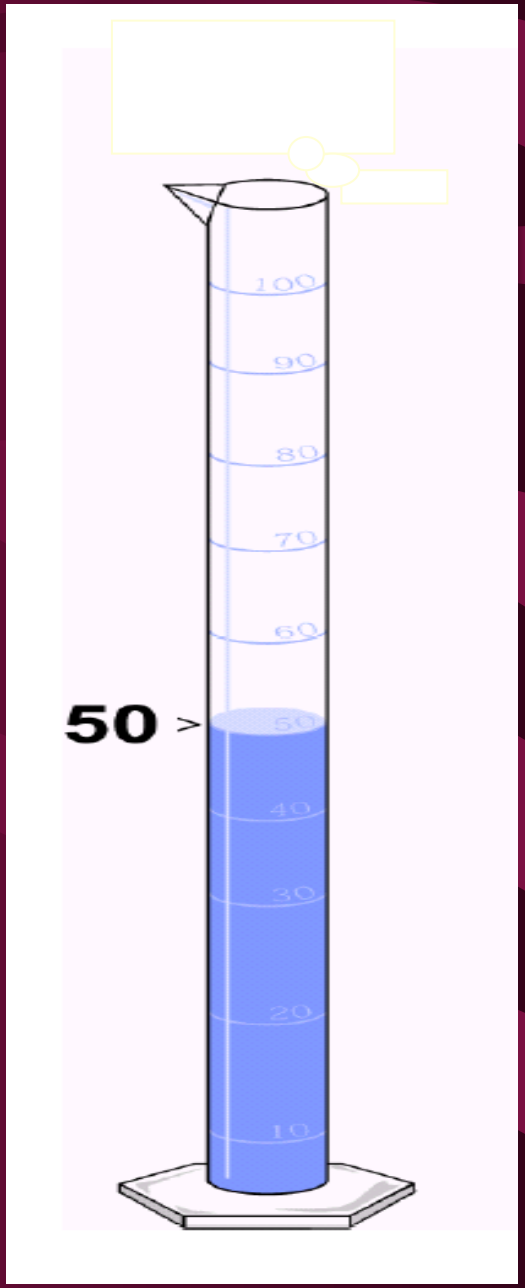
Use the displacement method to find the volume of an object with an irregular shape.

Submerge the object in water and measure how much water the object displaces or pushes aside.

Let's measure the volume of a small object like a key…

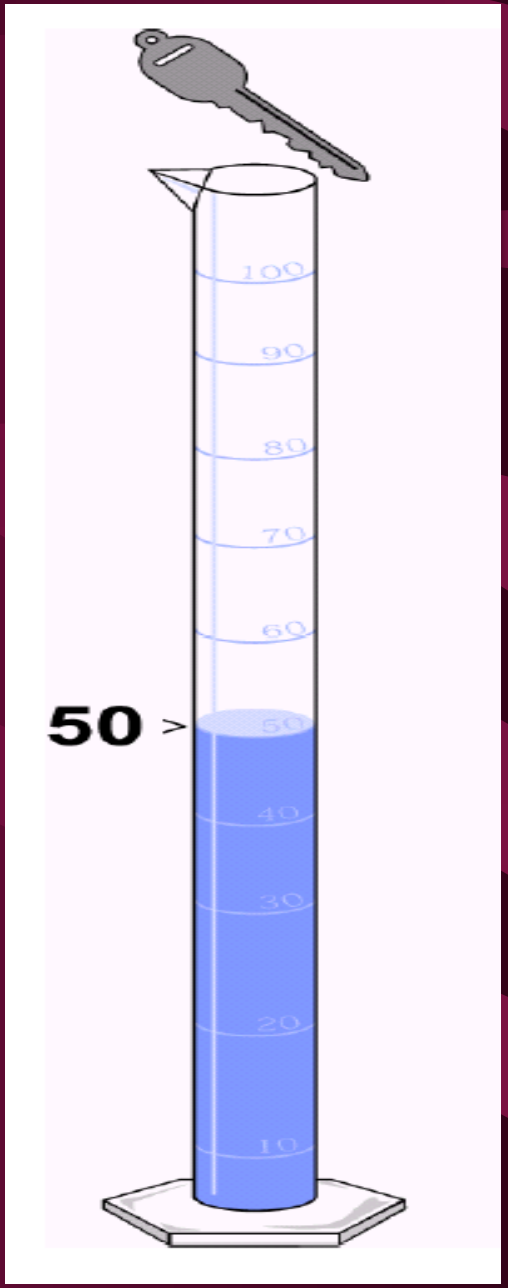
Step 1:

Fill a 100 ml graduated cylinder with water to the halfway point – 50 ml.



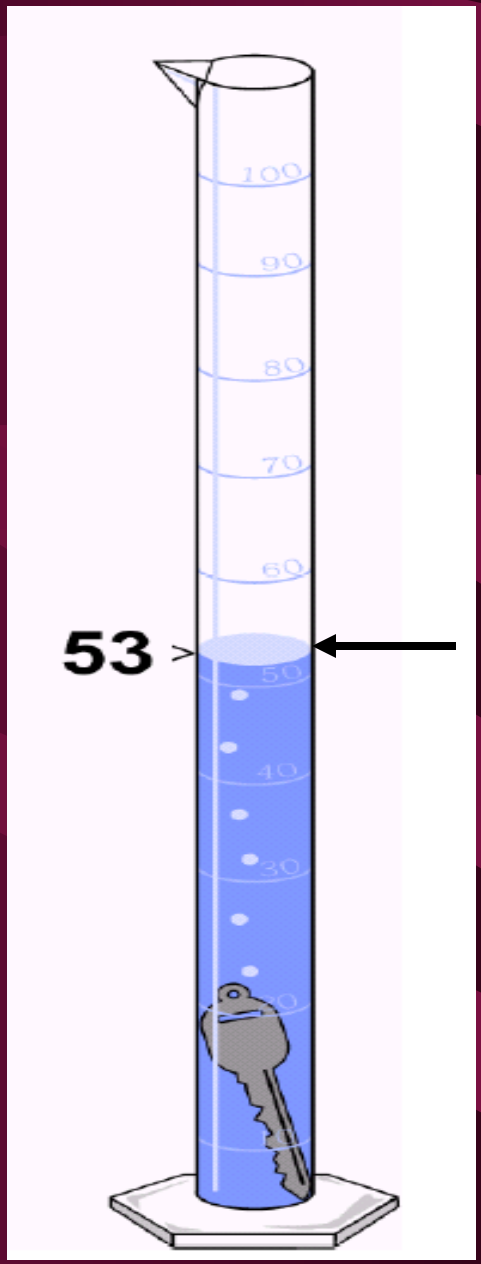
Step 2:
Gently slide the key into the water.

- The water level in the graduated cylinder will rise as the key displaces some of the water.



Step 3: Take a new volume reading.

- The difference in the two volume readings is the volume of the key. (53 ml – 50 ml = 3 ml)

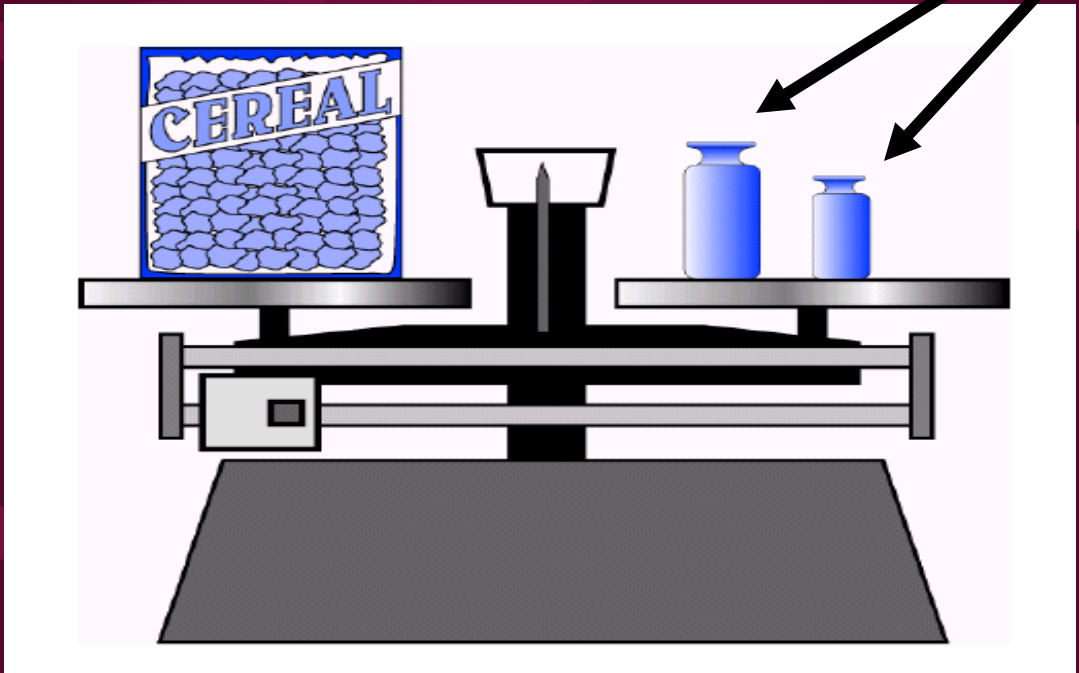


MASS

Mass is the amount of matter in an object.

- Mass is measured on a balance.
- Mass is measured in units of grams (g).

A balance measures the mass of an object by comparing it to objects whose masses are known.



Mass is independent of the force of gravity.

- Would a balance function correctly on the moon? Why or why not?

A scale measures the gravitational force (weight) between an object and Earth.

- Would a scale function correctly on the moon? Why or why not?

INDIRECT MEASUREMENT

How do you measure quantities of matter that are very small or very large?

We can use indirect measurement:

- Obtain a sample of the matter that is a measurable size.
- Measure its volume and mass.

- Estimate or measure either the mass or the volume of the matter.
- Set up a proportion.
- Example:

$$\frac{\text{mass of sample}}{\text{volume of sample}} = \frac{\text{mass of matter}}{\text{volume of matter}}$$

- **Solve for the unknown quantity.**

$$\frac{\text{mass of matter}}{\text{volume of sample}} = \frac{\text{mass of sample}}{\text{volume of matter}}$$