Calibrating & Reading Laboratory Glassware

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Math Review

What is the quotient for each of these problems?

$$\frac{10 \cancel{\text{ pizzas}}}{5 \cancel{\text{ pizzas}}} = 2$$

$$\frac{10 \text{ pizzas}}{5} = 2 \text{ pizzas}$$

$$\frac{10 \text{ pizzas}}{\$5} = \frac{2 \text{ pizzas}}{\text{dollar}}$$

So... how do you know what your unit is in the quotient?

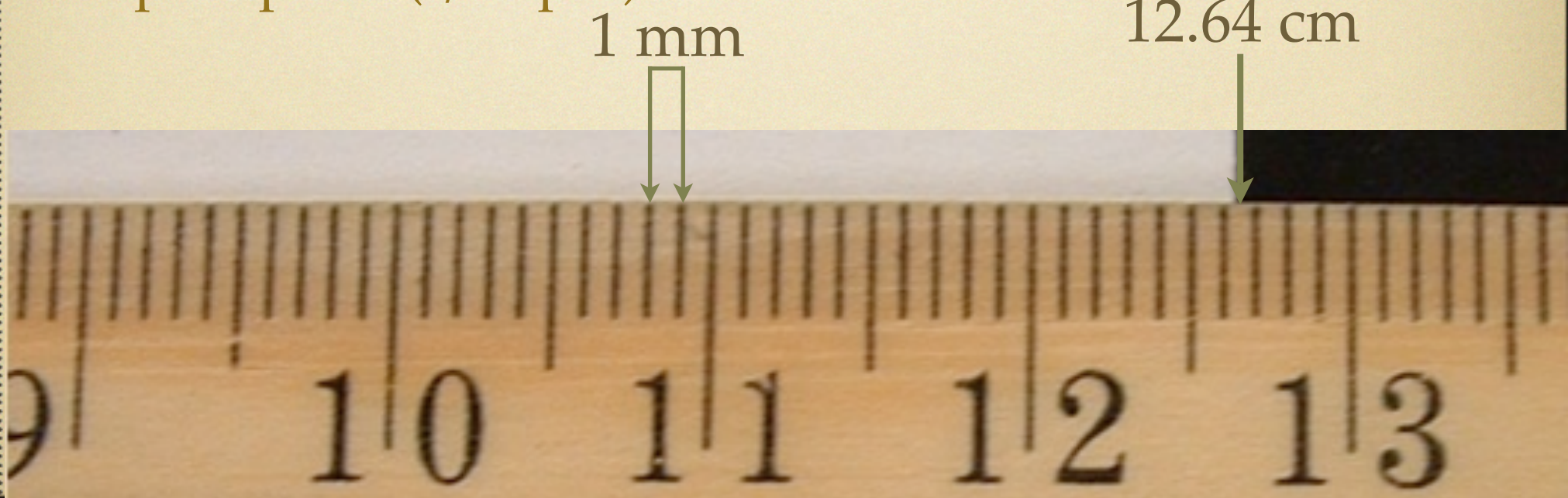
- When your units in the numerator and dominator are the same the units cancel out and you are left with a number (which tells you how many times the numerator is than the denominator).
  Examples: 6 cm/2 cm = 3 (6 cm is 3x bigger than 2 cm)
  10 dogs/2 dogs = 5 (10 dogs is 5x more than 2 dogs)

- When you have a unit in your numerator and none in the dominator, the unit carries over into the quotient.
  Examples: 8 colas/4 = 2 colas
  12 bees/2 = 6 bees

- When the numerator and denominator have different units they both carry over into the quotient.
  Examples: 8 colas / 4 people = 2 colas/person
  20 fish/2 aquariums = 10 fish/aquarium

Calibration

- Before you read an instrument, you must calibrate it.
- Calibrate means ***to determine what each space on an instrument represents.***
- Most metric rulers are calibrated in 1 mm per space.
- The unit for calibration is always some measurement per space. (/ = per)



Calibrating an Instument

1) Take two lines on the instrument that are numbered and subtract their values. Be sure to include units.

2) Count the number of spaces between those two values.

3) Divide the difference between the two values (#1) by the number of spaces (#2).

1.0 cm/10 spaces = 0.1 cm/space

11.0 cm - 10.0 cm = 1.0 cm

Graduated Cylinders

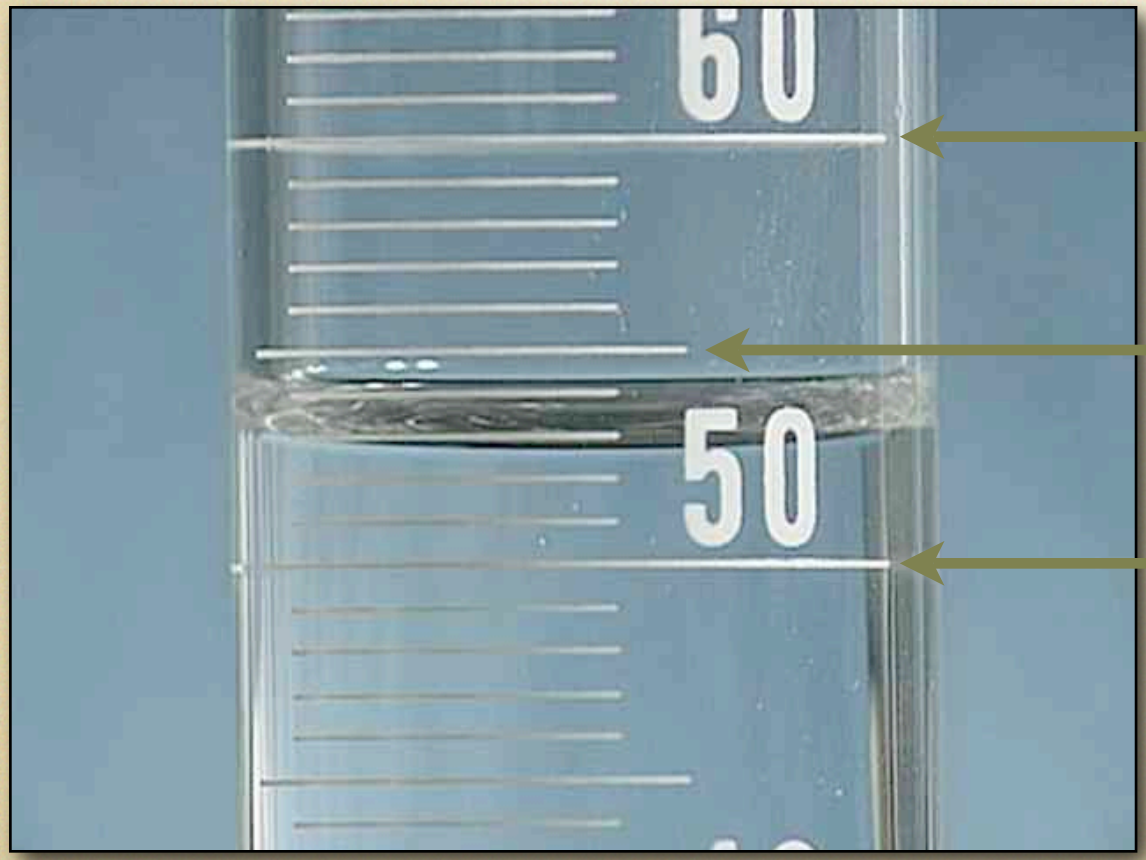
Graduates come in a wide variety of sizes. Always use the smallest graduate you can without refilling it.

The four most common graduated cylinders in the lab are:

10 mL
25 mL
50 mL
100 mL

Numbers on a Graduate

Regardless of the size of a graduate, the **numbers** on all graduates are always in milliliters.



60.0 milliliter line

55.0 milliliter line

50.0 milliliter line

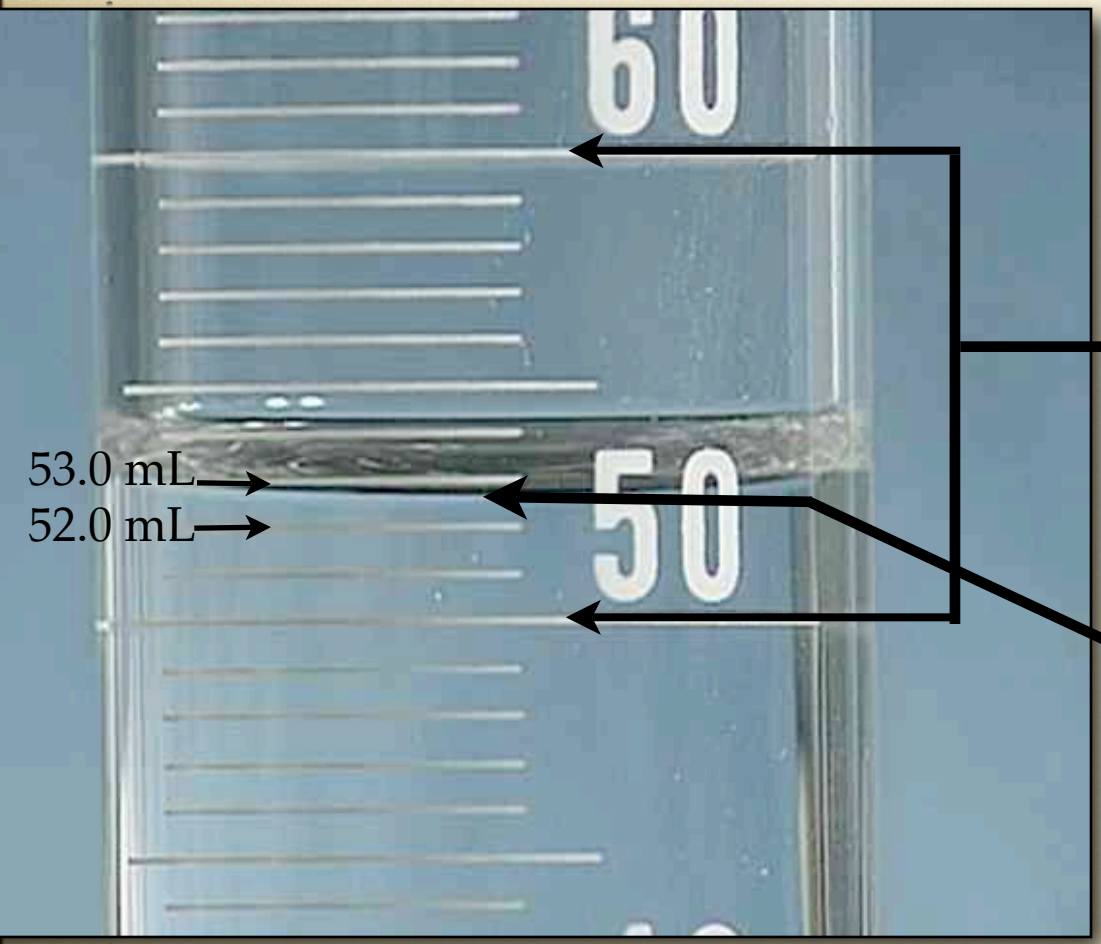
Meniscus

8.8 mL

When you place a liquid in a graduate, the liquid's surface curves down in the center. This curvature is called a meniscus (min-is-kus).

A meniscus is caused by water sticking to the sides of the glass. When you read a graduate, always get eye level and read from the bottom of the meniscus.

Calibration & volume



Calibration:

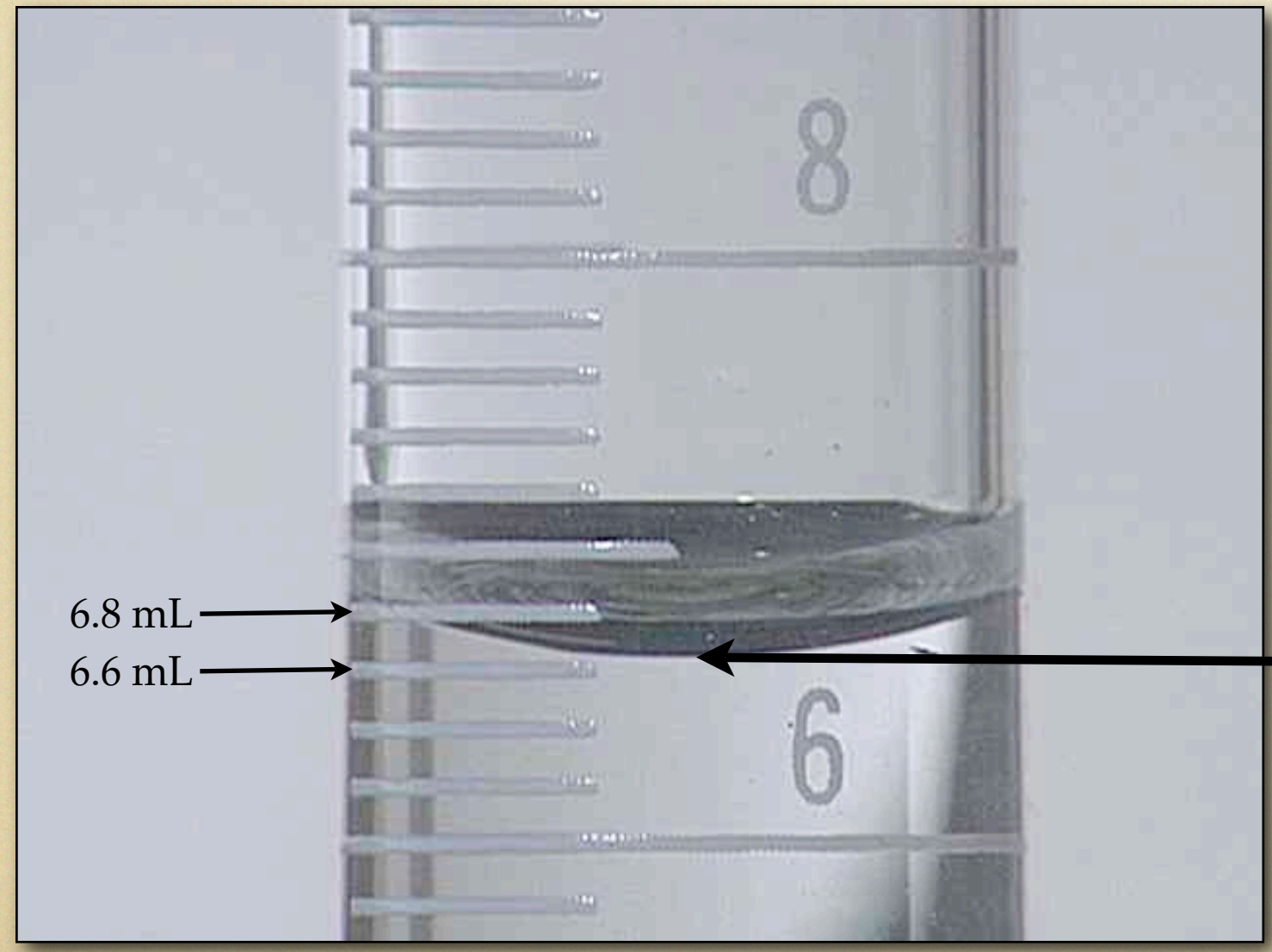
$$\frac{10.0\ \text{mL}}{10.0\ \text{spaces}} = \frac{1.0\ \text{mL}}{\text{space}}$$

Volume:

52.8 mL

known estimate

What is the calibration & volume?



Calibration:

$$\frac{2.0\ \text{mL}}{10\ \text{spaces}} =$$

$$\frac{0.2\ \text{mL}}{\text{space}}$$

Volume:

6.6 mL

Beaker

Beakers are used in the lab to hold, pour, heat or mix liquids.

The calibrations increase on one side and decrease on the other - depending as to whether you are pouring into or out of the beaker.

Erlenmeyer Flask

Flasks are also used to hold or heat liquids and are sometimes used to temporarily store liquid since a stopper can be used to seal the container.

Note: Sketch these on your paper.

Graduated Cylinder

Graduated cylinders (graduates) are used to accurately measure the volume of fluids.

Many graduates, beakers and flasks have two sets of numbers:

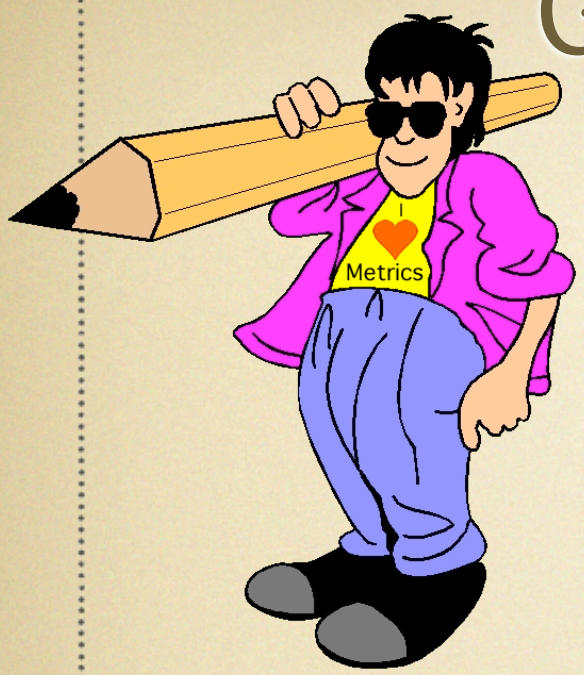
1) On the right beginning at zero on the bottom, increasing as you go up.

2) On the left beginning with a large number, decreasing as you go up.

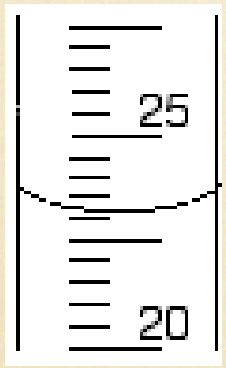
Always read the numbers on the right side (right is right!).

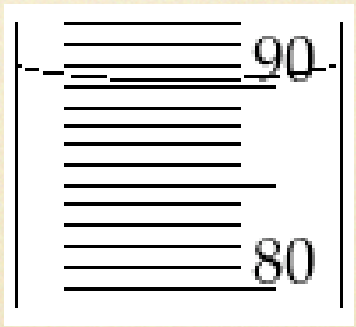
Laboratory Glassware: Grads, Beakers & Flasks

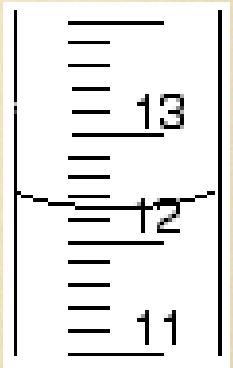
For accuracy, use a graduate when measuring the volume of a liquid. Always use the smallest graduate you can without refilling it.
The smaller the graduate the smaller the calibrations and the more accurate the measurement.



Go ahead and calibrate and read the volume of these 3 graduates (#11 on your sheet).







Calibration:	0.5 mL space	1.0 mL space	0.2 mL space
Volume:	23.1 mL	90.2 mL	12.3 mL

In this lab you will:

- Record the name and size of the graduated cylinder, beaker or flask.
- Determine the calibration of each piece of glassware, showing all your work including units and record.
- Read the volume of the liquid in the glassware and record.

Please copy this Data Table

Station	Instrument	Calibration (including work)	Volume
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			

Name and Size

Show work including units in this area.

Labeled drawings of graduate, beaker & flask.

Practice: Reading a 100 mL Graduate

Note:
To stop the movie put your mouse over the bottom of the movie. This will produce the movie controller so you will be able to stop at different volumes.

What is the volume of this liquid?