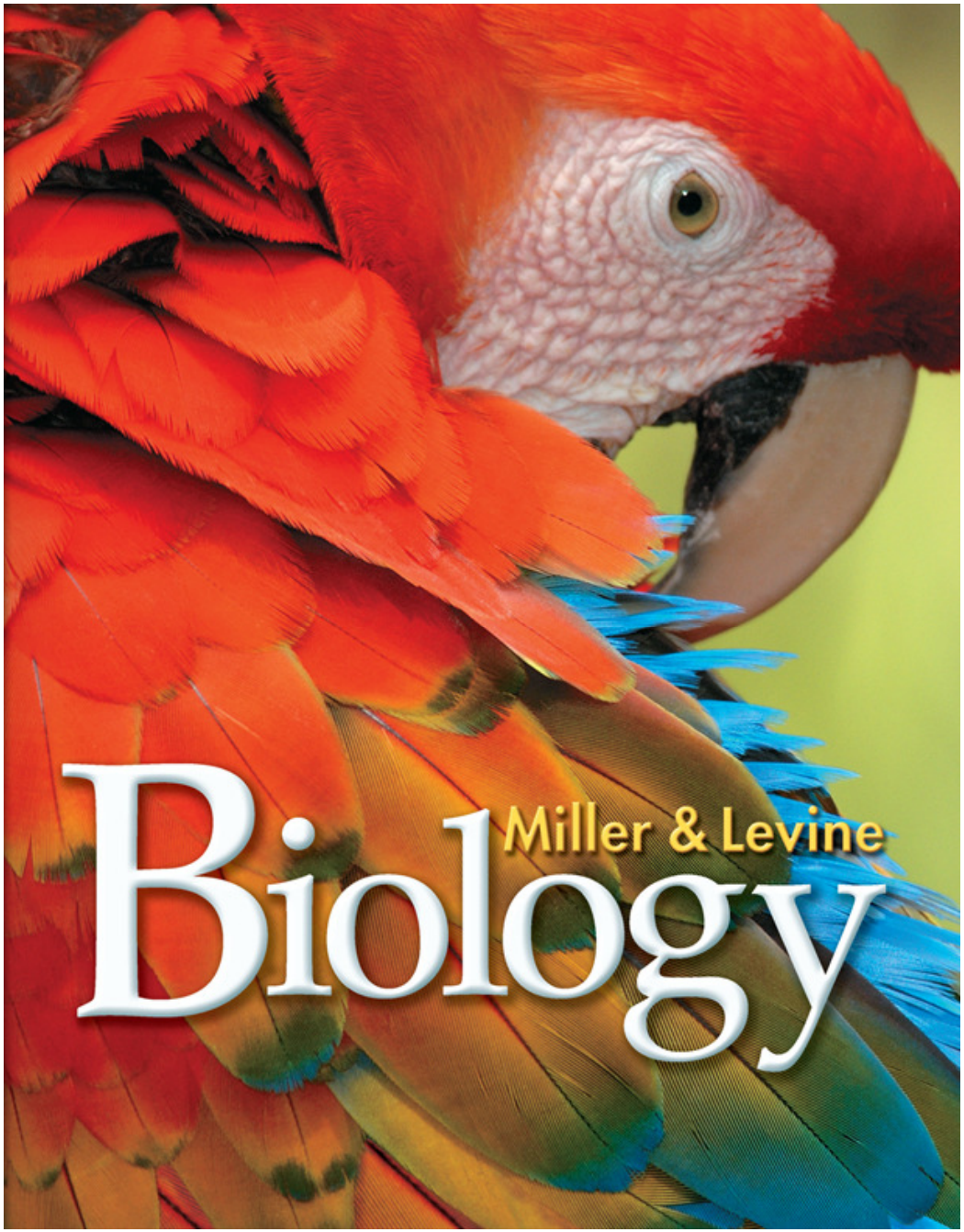

Scientific Measurement

The Metric System

Most scientists use the metric system when collecting data and performing experiments

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- The metric system is a decimal system of measurement whose units are based on multiples of 10

The basic unit of length, the meter, can be multiplied or divided to measure objects and distances much larger or smaller than a meter.

The same process can be used when measuring volume and mass.

The Metric System

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Length (meter) = The distance from one point to another

Mass (gram) = A measure of how much matter is in an object

Volume (liter) = The amount of space that matter occupies

Temperature (degrees Celsius) = The amount of heat in something

Finding Mass

Mass can be found using either a digital scale or a triple-beam balance

When using a digital balance, be sure to zero the scale and then place the object on the pan

Finding Mass

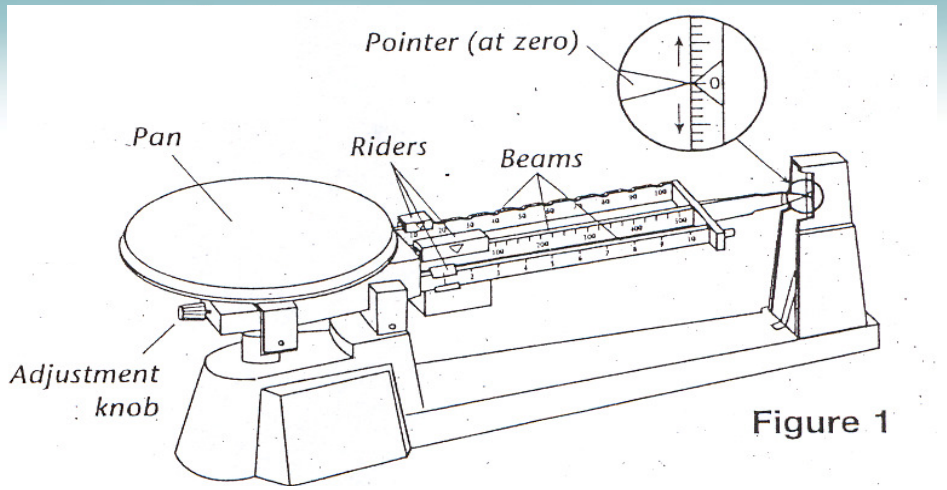


Figure 1

Triple-beam balances have three beams that show the mass of the object.

- The middle beam is 0-500 grams and the rider is 100 grams
- The back beam is 0-100 grams and the rider is 10 grams
- The front beam is 0-10 grams and the rider is 1 gram

To find the mass of an object you place the object on the pan and move the riders until the pointer on the right of the balance stays pointed to zero

- Be sure that the pointer is at zero before you place the object on the pan

Finding Mass

SOLID…

- Place object on the pan and move the riders until the pointer stays at zero
- Add up the numbers on the beams where the riders are positioned to find the mass

LIQUID…

- Measure the mass of an empty container that can hold the liquid
- Measure the combined mass of the container and the liquid
- Subtract the mass of the container from the combined mass

CHEMICAL…

- Find the mass of a piece of weighing paper or empty container that will hold the chemical
- Add this amount to the desired mass of the chemical and preset the riders to this number
- Add the chemical to the weighing paper a little at a time until the pointer points to zero.

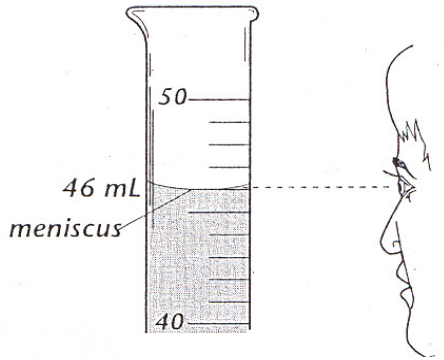
Finding Volume

To find the volume of a regular object, such as a block, you multiply the length by the width by the height (Volume = LxWxH)

- Cubic centimeter

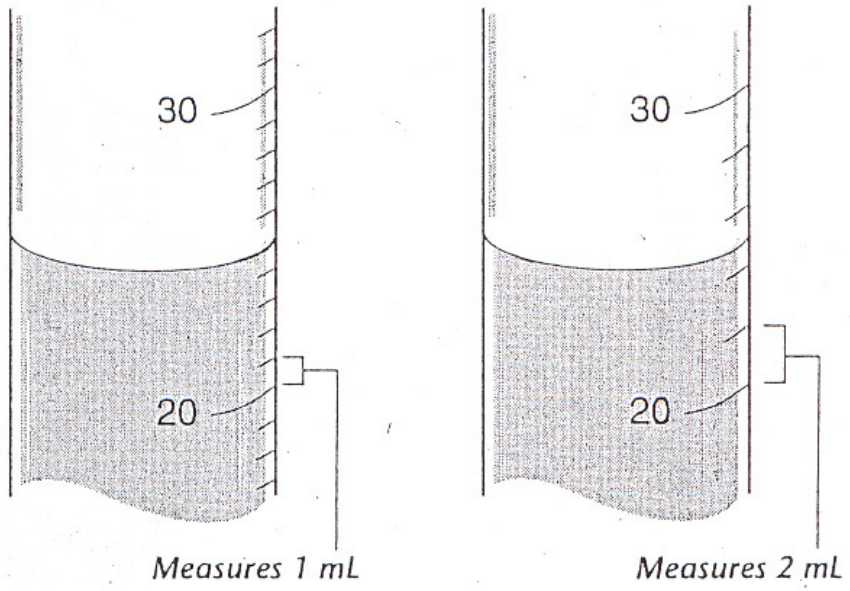
To find the volume of a liquid you would use a graduated cylinder

- Liter, milliliter, etc.
- Always read a graduated cylinder at eye level and from the bottom of the meniscus (the curved surface)



Finding Volume

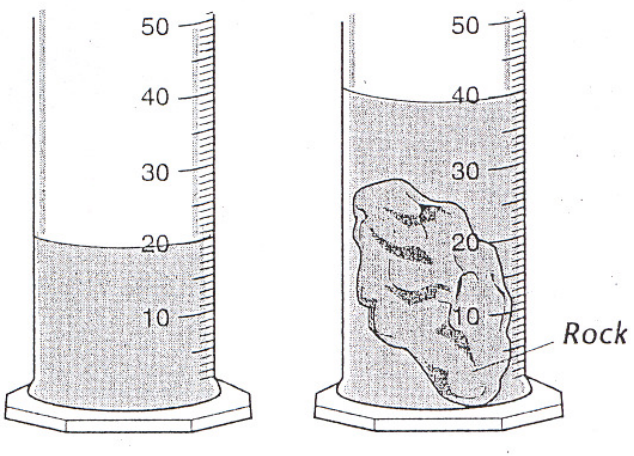
Always check the unnumbered marks on a graduated cylinder to see how many sections there are and what they measure. Also, sometimes you have to estimate a measurement between two marks. You should find that both graduated cylinders to the right contain 25mL.



Finding Volume

To find the volume of an irregular object you would use a graduated cylinder

- Add enough water to the graduated cylinder to cover the object
- Hold the graduated cylinder at an angle (to prevent cracking and splashing) and place the object into the graduated cylinder
- Slowly bring the graduated cylinder upright
- The volume of the object is the difference in water levels before and after the object was added



Finding Density

Density is the ratio of mass to volume

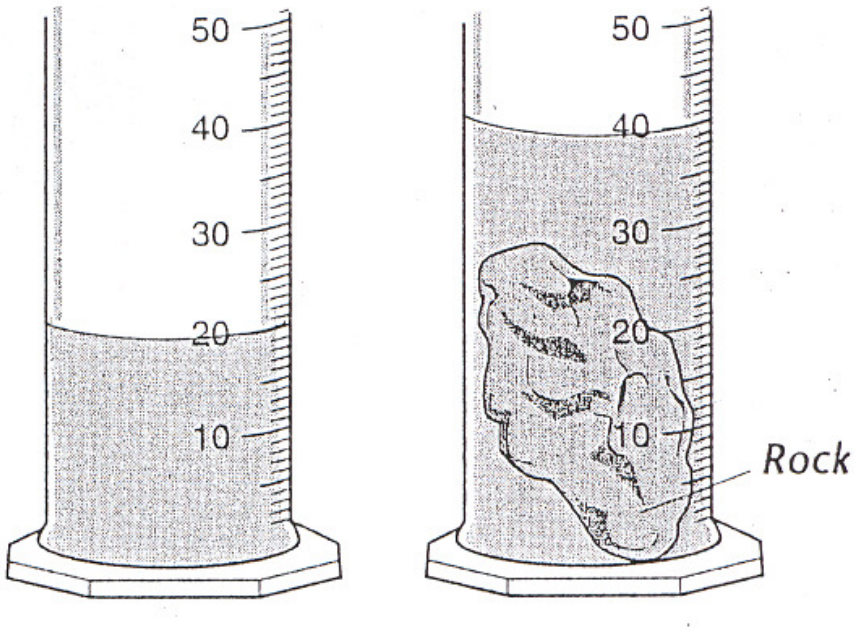
The density of a specific kind of matter helps to identify it and to distinguish it from other kinds of matter

The formula for density is mass divided by volume

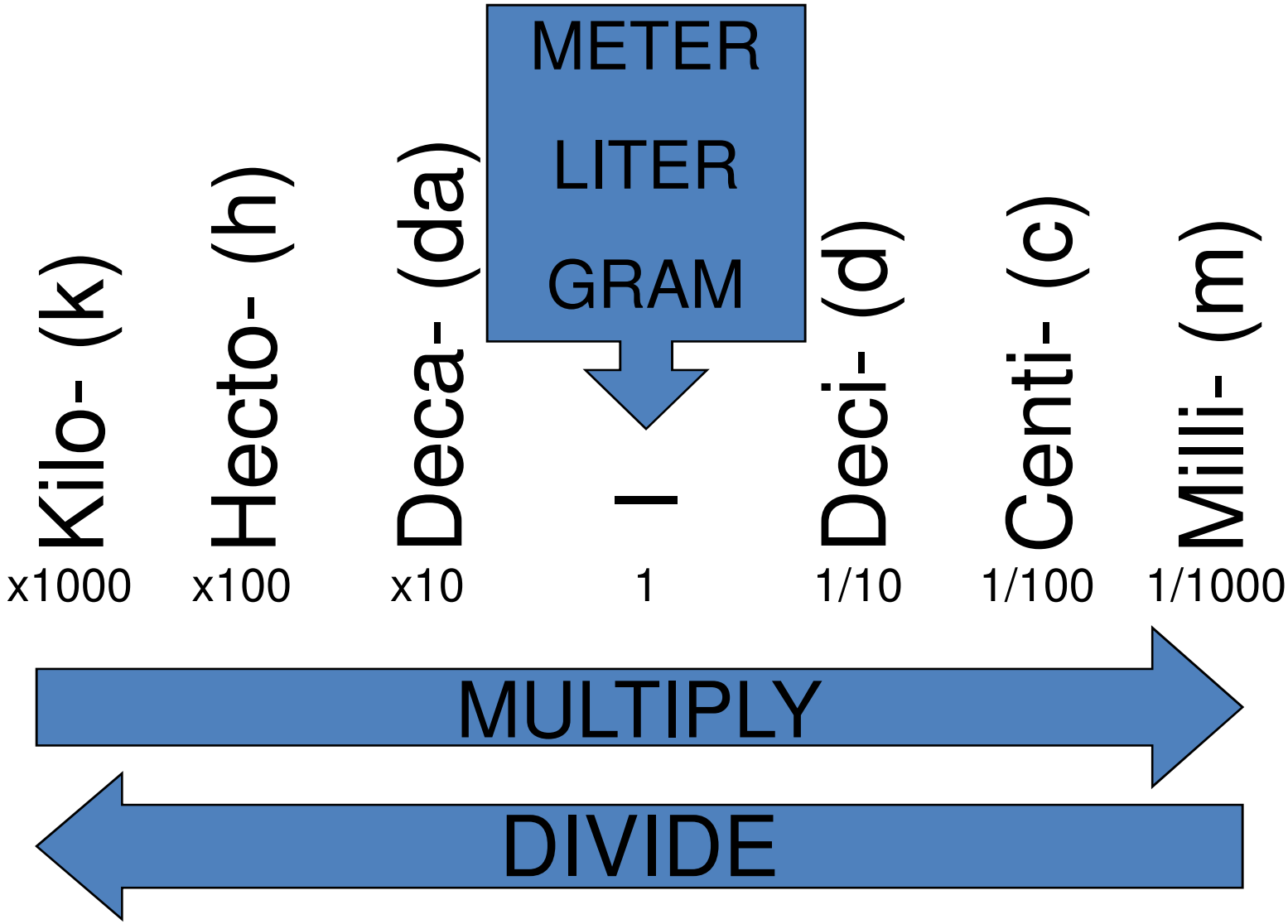
- Density = Mass / Volume

Finding Density

If the mass of the rock below is 40 grams, what is the density of the rock?



Prefixes in the Metric System



Graphing

A bar graph is used to display data in a number of separate, or distinct, categories

Example = Types of pets that students own (the categories would be dog, cat, snake, etc.)

Graphing

A line graph is used to display data that show how one variable (DV) changes in response to another variable (IV)

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Examples of continuous data include body mass, time, temperature, mass, volume, length, etc.

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A line graph is used to display data that show how one variable (DV) changes in response to another variable (IV)

- Used when both variables are continuous (meaning that there are points between the ones you tested)

Examples of continuous data include body mass, time, temperature, mass, volume, length, etc.

- Line graphs are useful because you can estimate values for conditions that you did not test in the experiment

Example = If you measured 1ºC and 2ºC, using a line graph you could predict 1.5ºC