**Percents:**

Percent literally means "out of 100", so to say that something is 15 percent translates to "15 out of 100". A generic equation for percents looks like this: $\frac{\text{specific PART of a sample}}{\text{entire sample}} \times 100 = \%$. One of the hard parts about percentages is identifying what is the "part", and what makes up the "entire sample'. Here is an example: If 8.3% of the people in Sacramento are left-handed, it means that 8.3 out of every 100 people are left-hand dominant. The specific part of the sample being discussed is left-handed people and the entire sample is the population of Sacramento. It makes sense that left-handed people are part of Sacramento, but it makes no sense to say Sacramento is part of left-handed people. It takes some practice, but once you get the hang of identifying the part and the entire sample, percentages get much easier. Here are a couple more examples:

**Example:** Of the 29,011 students at CSUS in the Fall of 2009, 58.495% were female.

Specific part of the sample: female students (females were part of the student body at CSUS)
Entire sample: all 29,011 students at CSUS

**Example:** The letter "e" is the most common letter in the English language, accounting for roughly 12.479% of all letters in all the English words written in the world.

Specific part of the sample: The letter "e"
Entire sample: all letters written

**Practice:** Give it a try. I want you to try to identify the "part" and the "whole sample" in each of the following.

a) Selenium makes up 28.17% of the compound barium selenate.
b) Water is 11.2% hydrogen
c) A certain solution is 95% isopropyl alcohol
d) The other 5% of the above solution is water
e) Seawater is about 3.5% sodium chloride
f) Silicon makes up about 25.7% of the Earth's mass
g) The average human body is $2.9 \times 10^{-4}$ % gold

Percents as conversion factors:

While there are times when you will have to use the equation given above when dealing with percentages, most of the time, you will be able to use them simply as conversion factors. Turning a percentage into a conversion factor is actually not all the tricky, and FAR easier than dealing with the metric system. If something is stated to 15%, then it is written as $\frac{15}{100}$. If something is 8.3%, then it is written as $\frac{8.3}{100}$. The trick comes with making sure that the units on the numbers is correct (remember, no naked numbers!) The units are always related to each other, so if the top units have something to do with grams, then the bottom units will also have something to do with grams. If the top units have to do with kL, then the bottom units will also have to do with kL. This is also where knowing the "part" and "whole" comes into play. For my example of left-handed people in Sacramento, it would look something like this: $\frac{8.3 \text{ left handed people}}{100 \text{ people}}$. Like any conversion factor, percentages can also be flipped upside down giving in this case: $\frac{100 \text{ people}}{8.3 \text{ left handed people}}$.

**Example:** Of the 29,011 students at CSUS in the Fall of 2009, 58.495% were female.

Conversion factors: $\frac{58.495 \text{ females}}{100 \text{ students}}$ or $\frac{100 \text{ students}}{58.495 \text{ females}}$

**Example:** The letter "e" is the most common letter in the English language, accounting for roughly 12.479% of all letters in all the English words written in the world.

Conversion factors: $\frac{12.479 \text{ "e"s}}{100 \text{ letters}}$ or $\frac{100 \text{ letters}}{12.479 \text{ "e"s}}$

**Practice:** Write the 2 possible conversion factors for each of the following. Be sure to include proper units.

a) Selenium makes up 28.17% of the compound barium selenate.
b) Water is 11.2% hydrogen
c) A certain solution is 95% isopropyl alcohol
d) The other 5% of the above solution is water
e) Seawater is about 3.5% sodium chloride
f) Silicon makes up about 25.7% of the Earth's mass
g) The average human body is $2.9 \times 10^{-4}$ % gold

The nice thing here is that percentages, once turned into conversion factors, act exactly the same way as all the other conversion factors do. You make sure that units are going to cancel and away you go!

**Example:** Of the 29,011 students at CSUS in the Fall of 2009, 58.495% were female. How many females were there?

From above, we know that the conversion factors are: $\frac{58.495 \text{ females}}{100 \text{ students}}$ or $\frac{100 \text{ students}}{58.495 \text{ females}}$ so we set the problem up like this: $29,011 \text{ students} \times \frac{58.495 \text{ females}}{100 \text{ students}} = 16,970. \text{ females}$

**Example:** This review has approximately 1857 letters in it. If the letter "e" makes up 12.479% of all the letters, how many "e"s are there in this review?

From above, we know that the conversion factors are: $\frac{12.479 \text{ "e"s}}{100 \text{ letters}}$ or $\frac{100 \text{ letters}}{12.479 \text{ "e"s}}$ so we set the problem up like this: $1857 \text{ letters} \times \frac{12.479 \text{ "e"s}}{100 \text{ letters}} = \sim 232 \text{ "e"s}$

**Practice:** Solve each of the following:

a) A sample of barium selenate weighs 56.113 grams. If selenium makes up 28.17% of the compound barium selenate, how many grams of selenium are in the sample?
b) Water is 11.2% hydrogen. If a bowl of water contains 1.44 kg of hydrogen, how many kg of water are there?
c) 750 mL of a certain solution is 95% isopropyl alcohol. How many mL of isopropyl alcohol does the solution contain?
d) Seawater is about 3.5% sodium chloride. How many $m^3$ of seawater contains 500.0 $m^3$ of sodium chloride?
e) Silicon makes up about 25.7% of the Earth's mass. If the Earth weighs about $5.9752 \times 10^{24}$ kg, what is the mass of silicon available for making stuff?
f) The average human body is $2.9 \times 10^{-4}$ % gold. If the average human weighs 2250 troy-ounces, how many troy-ounces of gold are in the human body? If the price of gold is $1257 per troy-ounce, how much is that gold worth?