Name: _____ **Date:** _____ **Class Notes**
Chemistry

Unit Analysis Skills

Problem solving

If you can reason and have the skills to add, subtract, multiply and divide you have all the tools you need for solving chemistry problems.

7 Stages

1. Read each problem carefully and completely.
2. Gather all the given information in the problem.
3. Determine what is being asked.
4. Decide which formula or conversion factors will be needed.
5. Write an equation to fit the information.
6. Solve the equation.
7. Does your answer make sense?

Example

There are 500 monkeys and you can put 5 monkeys in each cage. How many cages are needed?

500 monkeys 5 monkeys per cage How many cages?

Reasoning tells me, I need to divide the monkeys into groups of five.

$\frac{500}{5} = 100$ Therefore, I need 100 cages for 500 monkeys.

The above problem is a "**this per that**" problem and is typical of the problems you will encounter in a beginning chemistry class. The hardest part is recognizing the conversion factors (this/that), verifying the units and checking for sig figs. Now let's look at the above problem written as a chemistry problem.

$$500 \text{ monkeys} \times \frac{1 \text{ cage}}{5 \text{ monkeys}} = \frac{500 \times 1 \text{ cage}}{5} = 100 \text{ cages}$$

Unit Analysis

In applied mathematics, it is not uncommon to change from one system of measurement to another. The best method to accomplish this change is unit analysis. In unit analysis, the units are very important and must be treated the same way as constants and variables in algebra. Notice in the examples how the units multiply, divide and cross cancel just like numbers and variables.

Example

A German car is advertised as having a gas mileage of 15.0 km/L. Convert this rating to miles per gallon.

$$\frac{15\ \cancel{km}}{\cancel{L}} \times \frac{1000\ \cancel{m}}{1\ \cancel{km}} \times \frac{1.094\ \cancel{yd.}}{1\ \cancel{m}} \times \frac{1\ mi.}{1760\ \cancel{yd.}} \times \frac{1\ \cancel{L}}{1.06\ \cancel{qt.}} \times \frac{4\ \cancel{qt.}}{1\ gal.} = 35\ mi./gal$$

Conversions

Unit analysis requires close examination of the units in a problem. Therefore, you must know the conversion factors that allow you to make the desired changes.

***1 inch = 2.54 centimeters**	1 foot = 12 inches	1 minute = 60 seconds
***1 liter = 1.06 quarts**	1 yard = 3 feet	1 hour = 60 minutes
*1 calorie = 4.18 joules	1 mile = 5,280 feet	1 day = 24 hours
1 atm = 101.3 kilopascals	1 mile = 1,760 yards	1 gallon = 4 quarts
***1 pound = 454 grams**	1 pound = 16 ounces	1 quart = 2 pints

$$°F = 1.8°C + 32 \qquad °C = \frac{°F - 32}{1.8} \qquad K = °C + 273$$

* These are the most commonly used conversions in applied mathematics.

Practice

Directions: Perform the following conversions. Show all your work, and sig figs.

_____ 1. 908 ounces to kilograms

_____ 2. 12.8 liters to gallons

_____ 3. 4.48 pounds to gram

_____ 4. Many chemical properties are recorded at 25.0°C. Find the Fahrenheit and Kelvin values.

_____

"Forget about style, worry about results." -- Bobby Orr

