Chapter 1

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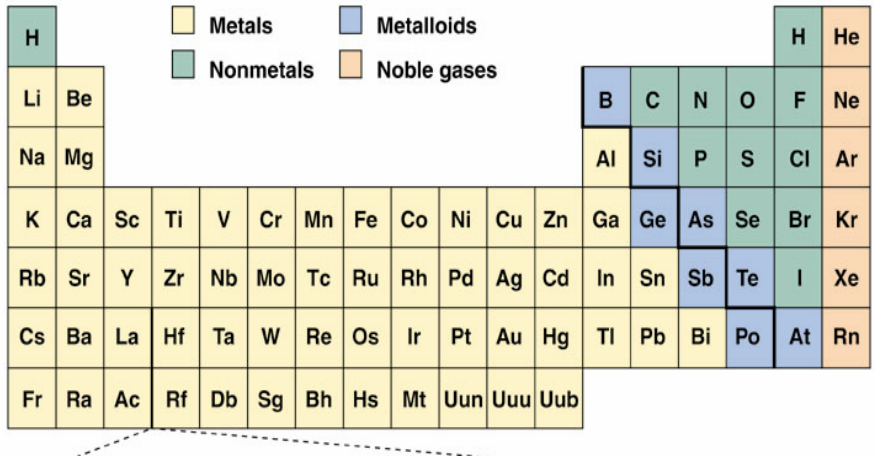
- Chemistry is the study of matter and energy.
- Phases of matter: solid, liquid and gas.
- Matter is composed of atoms. An atom is one of the 100+ elements.
- Each element has a name and a chemical symbol.
- The symbol is 1 to 2 letters. The first is capitalized, the second, is there is one, is lowercase. Example: F , Cl

Periodic table

- Columns are called groups. Elements in the same group have similar properties.
- Rows are called periods.



- Groups (vertical)
- 1A = alkali metals
- 2A = alkaline earth metals
- 7A = halogens
- 8A = noble gases
- Periodic table shows Symbol, mass number and atomic number.

Matter

- Element: A substance made of atoms of one element.

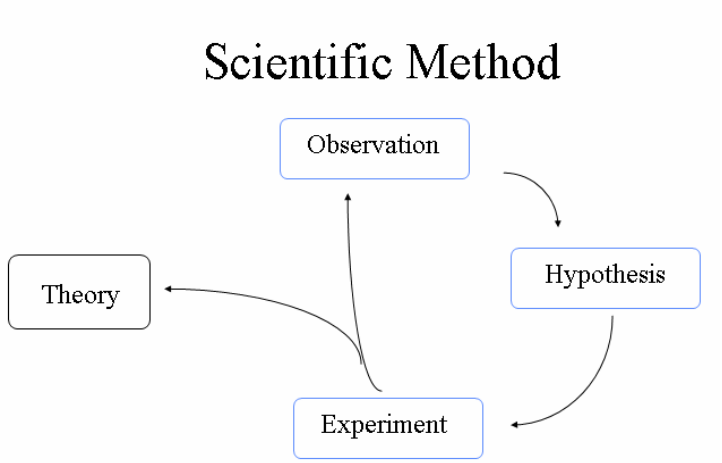
- Compound: A substance made of atoms of 2 or more elements chemically bound together. Example: H2O
- Mixture: 2 or more elements and /or compounds not chemically bound together. Example: saline solution
  - Homogeneous
  - Heterogeneous

Energy

- Energy is the ability to do work.
- Types of Energy
  - kinetic: energy of motion
  - potential: stored energy
- Forms of Energy

Scientific Method

- Observation
- Hypothesis: A possible explanation of the observation.
- Experiment: A test of the hypothesis.
- Theory: A hypothesis supported by experimentation.



Properties

- Extensive: does matter how much you have. Example: mass, volume, length

- Intensive: does not matter how much you have. Example color, temperature, density.

Measurement

- N+mM+uU **unit**
  - N is the last labeled mark
  - M is the value of the unlabeled marks and m is the number of unlabeled marks
  - U is the value of some imaginary marks and is always M/10, u is the number of unlabeled marks.

Precision and Accuracy

- Precision: how closely individual measurements agree with each other. In the case of the eraser they should be within +/- 0.01 cm of each other.
- Accuracy: closeness to correct value.

Usually, precise measurements are also accurate.

Significant figures

An indication of precision

- All non-zero numbers are significant
- Captive zeros are always significant. (203)
- Leading zeros are never significant. (0.032)
- Tailing zeros are significant only if there is a decimal point. (124,000 or 0.3100)

The number of significant figures in a measurement tells something about the instrument that took the measurement.

Examples

- 203,000,000
- 0.03590
- 127.0
- 300
- 300.
- 0.03

Scientific notation
For very large or very small numbers

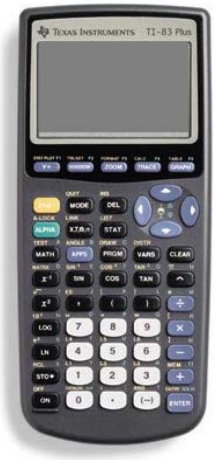
- Form: 1-10 x 10power
- Large numbers: Move decimal point to the left. 275 is 2.75 x 100 which is 2.75 x 102

150000000 miles is 1.5 x 108 miles

- Small numbers: Move decimal point to the left, power of 10 becomes negative.

0.0000007823 cm becomes 7.823 x 10-7 cm

Using your calculator



•Multiply:
6.02 x 10^{23}
x 2.3x 10^{-5}

Plug in
6.02 EE 23 X
2.3 EE (-) 5 Enter

The Metric System

•Base Units: Meter (m),
Liter(L), Gram (g)
•The scales of these units are adjusted in powers of ten and are described by prefixes.

- 1000 is kilo (k)
- 1/100 is centi (c)
- 1/1000 is milli (m)

Three metric to English Conversions

- 453.6g = 1 pound
- 1.06 quarts = 1 liter
- 2.54 cm = 1 inch

The Factor Label Method

•Based on the fact if the numerator (top #) and the denominator (bottom #) of a fraction are equal, than the value of the fraction is equal to 1.

•Based on the fact that multiplying a measurement by one will not change the value of that measurement.

How many eggs are there in three dozen?

- 12 eggs = 1 dozen

$$3 \text{ dozen} \times \frac{12 \text{ eggs}}{\text{dozen}} = 36 \text{ eggs}$$

Conversion factors

- Each equality can be used in to ways:
- 12 inches = 1 ft
- To convert inches to ft

$$\mathbf{1 = \frac{1 \text{ foot}}{12 \text{ inches}}}$$

- Or to convert ft to inches

$$\mathbf{1 = \frac{12 \text{ inches}}{1 \text{ foot}}}$$

Convert 72.0 inches to feet using the Factor Label method.

The steps:

•Find the starting point **72.0 inches = ? feet**

• Collect your conversions.

•Come up with a plan

•Apply your plan.

$$72.0 \text{ inches} \times \frac{1 \text{ foot}}{12 \text{ inches}} = 6.00 \text{ feet}$$

•

A newborn baby is measured at 0.47 m long. How many inches is she?

Reporting your Answer to the Correct Number of Significant Figures

- When multiplying or dividing, report your answer to the number of significant figures of the least precisely measured measurement.
- When adding or subtracting, report your answer to the decimal place of the least precisely measured measurement.
- Some numbers have an infinite number of significant figures and so just do not play a role. Counted numbers or defined numbers are such numbers.

A train is traveling at 45.0 miles/hour and has to make a trip of 100 miles. How many minutes will it take to get there?

Density

$$\mathbf{D = \frac{mass}{volume} = \frac{M}{V}}$$

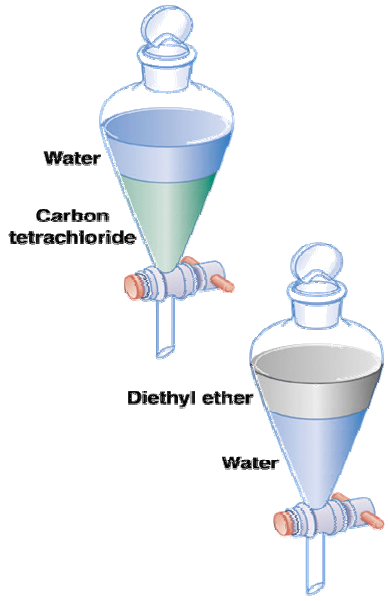
- D=M/V
- Density is a conversion factor that inter-converts mass and volume.
- The density of water is 1.00 g/ml

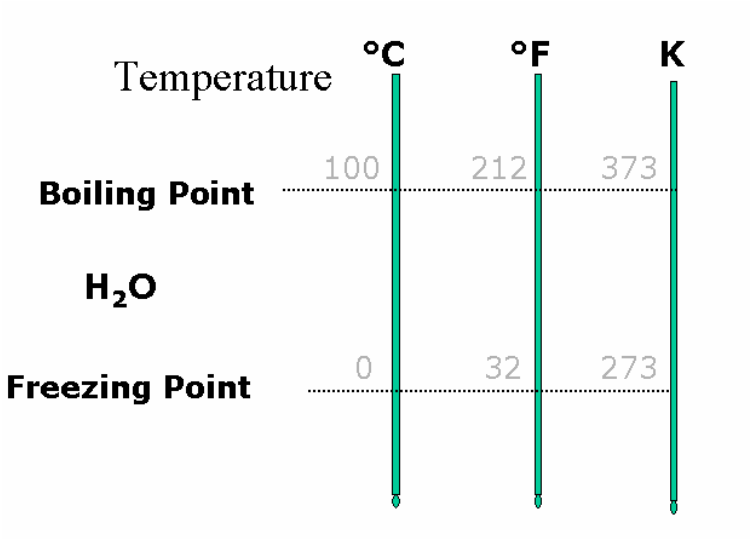
Densities of some things

Gasoline	0.66 g/ml
Oil	0.92 g/ml
water	1.00 g/ml
Aluminum	2.70 g/ml
Lead	11.3 g/ml
Mercury	13.6 g/ml

Density

•Rank water, ether and carbon tetrachloride in terms of density.





Temperature Conversions

$F = \frac{9}{5}C + 32$ K=C+273

If body temperature is 98.6°C, what is my temperature in F? How about K?

Heat and Specific Heat

- E= m x SH x DT
  - –m is mass (in g)
  - –SH is Specific heat. The specific heat for water is 1.00 cal/g °C
  - –DT is change in temperature
- How many calories are required to raise 30 grams of water from 25 °C to 50 °C?