

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, if 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.

Metals		Metalloids		Nonmetals		Noble gases											
H						H	He										
Li	Be																
Na	Mg																
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub						

- 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.

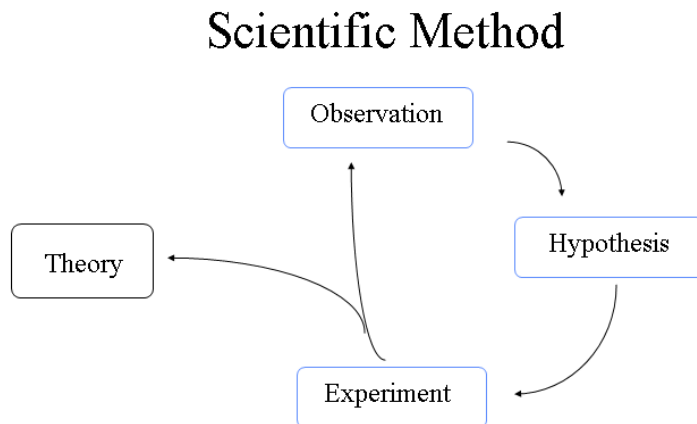
- Compound: A substance made of atoms of 2 or more elements chemically bound together. Example: H₂O
- Mixture: 2 or more elements and /or compounds not chemically bound together. Example: saline solution
 - Homogeneous
 - Heterogeneous

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: $1-10 \times 10^{\text{power}}$
- Large numbers: Move decimal point to the left. 275 is 2.75×100 which is 2.75×10^2
- Small numbers: Move decimal point to the left, power of 10 becomes negative.

150000000 miles is 1.5×10^8 miles

0.0000007823 cm becomes 7.823×10^{-7} cm

Using your calculator

•Multiply:

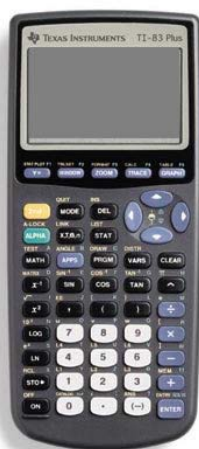
$$6.02 \times 10^{23}$$

$$\times 2.3 \times 10^{-5}$$

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

- o 453.6g = 1 pound
- o 1.06 quarts = 1 liter
- o 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

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

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

Approach

- Find the starting point
- Collect your conversions.
- Come up with a plan
- Apply your plan.

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 precise measurement.
- When adding or subtracting, report your answer to the decimal place of the least precise 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

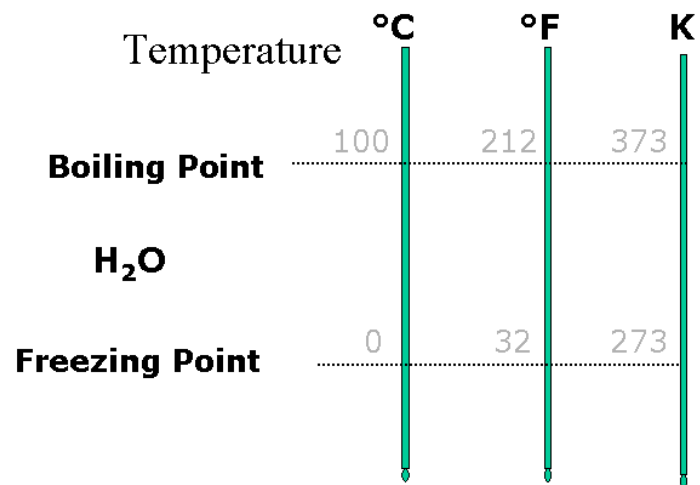
$$D = \frac{\text{mass}}{\text{volume}} = \frac{M}{V}$$

- $D = M/V$
- 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

What is the mass in pounds of 357 mL of mercury?



Temperature Conversions

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

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