4 • Matter
Mass & Weight -- Two Properties of Matter
(1 of 8)

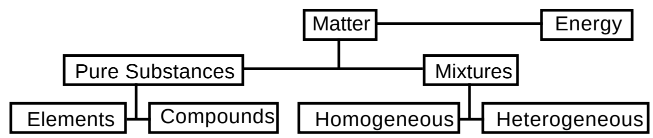
mass is the **amount** of something...
weight is how much gravity is pulling on the mass.
(Weight will be proportional to the mass at a given spot.)

Mass is what we REALLY want to use... measured in grams. You use a balance to measure mass... you compare your object with objects of known mass.

Weight is measured with a **scale** (like your bathroom scale or the scale at the grocery store). If there is no gravity, it doesn't work. Note: electronic balances are really scales!

You convert mass / weight using: $\frac{1 \text{ kg}}{2.205 \text{ lbs}}$ or $\frac{2.205 \text{ lbs}}{1 \text{ kg}}$

4 • Matter
Pure Substances, Elements, & Compounds
Homogeneous & Heterogeneous Mixtures
(2 of 8)



This chart should help you sort out these similar terms.
Be able to use chemical symbols to represent elements and compounds. For example...
$CuSO_4 \cdot 5H_2O$, a hydrate, contains 21 atoms & 4 elements.

Memorize the 7 elements that exist in diatomic molecules: HONClBrIF or BrINClHOF or "H and the 6 that make a 7 starting with element #7"

4 • Matter
Separating Mixtures by Filtration, Distillation, and Chromatography
(3 of 8)

Mixtures are substances the are NOT chemically combined... so if you want to separate them, you need to **exploit** differences in their **PHYSICAL** properties.

Filtration: some components of the mixture dissolve & some do not. Filtrate is what passes through the filter.

Distillation: some components vaporize at different temperatures or one component may not vaporize at all (e.g.: salt+water) complete separation may not be possible.

Chromatography: differences in solubility vs. adhesion to the substrate. Substratemay be filter paper (paper chromatography), or other substances, GLC, TLC, HPLC, column, etc.

4 • Matter
Mass, Volume, and Density
Intensive vs. Extensive Properties
(4 of 8)

Extensive properties depend on the **amount** of substance. We **measure** these properties frequently... (mass & volume... mostly).

Intensive properties are **independent** of the size of the sample. These are useful for **identifying** substances... (melting point, boiling point, density, etc.)

It is interesting that an intensive property, density = $\frac{\text{mass}}{\text{volume}}$ is the ratio of two extensive properties... the size of the sample sort of "cancels out." Be able to do density problems (3 variables). See Sample Problems on pages 72 & 73

4 • Matter
Physical and Chemical Properties
Physical and Chemical Changes
(5 of 8)

Equations to symbolize changes: **reactants → products**

Physical Properties can be measured from a sample of the substance **alone**... (density, MP, BP, color, etc.)
Chemical Properties are measured when a sample is **mixed with another chemical** (reaction with acid, how does it burn in O_2)
Physical Changes imply that no new substances are being formed (melting, boiling, dissolving, etc.)
Chemical Changes imply the substance is decomposing into new substances or mixing with another chemical to form new substances. This change is accompanied by heat, light, gas formation, color changes, etc.

4 • Matter
Conservation of Mass
Symbols of the Elements
(6 of 8)

Conservation means the quantity does not change during a reaction. If you carefully measure the reactants before a reaction and the products after the reaction, no mass is gained or lost. This is called Conservation of Mass.

Know your **symbols** of the elements (make Flash Cards).
Be careful with the spelling of:
Cl, chlorine F, fluorine Ni, nickel
Mn, manganese vs. Mg, magnesium

Recall that many of the symbols come from the Latin name.

Refer to page 80 for a nice listing with the Latin names.

4 • Matter
Relative Abundance of Elements
(7 of 8)

In the **atmosphere**:
78% nitrogen gas, N_2
21% oxygen gas, O_2
<1% argon gas, Ar

In the **earth's crust** :
Most of the crust is made up of SiO_2 (quartz, sand, glass)
46.7% oxygen (mostly combined with silicon)
27.7% silicon (mostly combined with oxygen)
8.1% aluminum (in combined form)
5.0% iron (in combined form)
In the **universe**:
almost all hydrogen gas, H_2... then He (fusion product)

4 • Matter
Natural History of Airs Lab
The Chemistry of the Airs, the Recipes, and the Tests for the Three Gases
(8 of 8)

Name: Dephlogisticated Air - Oxygen gas, O_2
Recipe: Catalytic Decomposition of hydrogen peroxide (H_2O_2) by yeast
Test: Glowing Splint Test (oxygen supports combustion)

Name: Inflammable Air - Hydrogen gas, H_2
Recipe: Drano™ (NaOH) + Al° $\rightarrow Na^+ + AlO^{3-} + H_2$
Test: Burning Splint Test ($H_2 + O_2 \rightarrow H_2O$ + energy)

Name: Fixed Air - Carbon Dioxide gas, CO_2
Recipe: chalk ($CaCO_3$) + vinegar (acetic acid) ($HC_2H_3O_2$) $\rightarrow H_2O + CO_2 + Ca(C_2H_3O_2)_2$
Test: Limewater ($Ca(OH)_2 + CO_2 \rightarrow CaCO_3(s) + H_2O$