Mass & Weight -- Two Properties of Matter

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:

\[
\frac{1 \text{ kg}}{2.205 \text{ lbs}} \quad \text{or} \quad \frac{2.205 \text{ lbs}}{1 \text{ kg}}
\]

Pure Substances, Elements, & Compounds

Homogeneous & Heterogeneous Mixtures

This chart should help you sort out these similar terms. Be able to use chemical symbols to represent elements and compounds. For example...

CuSO₄•5H₂O, 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”

Mixtures are substances that 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.

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
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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 O₂)

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.

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.

In the atmosphere:
- 78% nitrogen gas, N₂
- 21% oxygen gas, O₂
- <1% argon gas, Ar

In the earth’s crust:
Most of the crust is made up of SiO₂ (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, H₂... then He (fusion product)

Name: Dephlogisticated Air - Oxygen gas, O₂
Recipe: Catalytic Decomposition of hydrogen peroxide (H₂O₂) by yeast
Test: Glowing Splint Test (oxygen supports combustion)

Name: Inflammable Air - Hydrogen gas, H₂
Recipe: Drano™ (NaOH) + Al° → Na⁺ + AlO₃⁻ + H₂
Test: Burning Splint Test (H₂ + O₂ → H₂O + energy)

Name: Fixed Air - Carbon Dioxide gas, CO₂
Recipe: chalk (CaCO₃) + vinegar (acetic acid) (HC₂H₃O₂) → H₂O + CO₂ + Ca(C₂H₃O₂)₂
Test: Limewater (Ca(OH)₂ + CO₂ → CaCO₃(s) + H₂O

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Conservation of Mass
Symbols of the Elements (6 of 8)

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Relative Abundance of Elements (7 of 8)

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