Understandings

- Atoms of different elements combine in fixed ratios to form compounds which have different propertied from their component elements.
- Mixtures contain more than one element and/or compound that are not chemically bonded together and so retain their individual properties.
- Mixtures are either homogeneous or heterogeneous.

1.1 Intro to the Particulate Nature of Matter

States of Matter:
- There are 3 (excluding plasma) states of matter:
1. Solid
2. Liquid
3. Gas

Temperature:
- The SI unit for temperature is **kelvin (K)**
temperature (K) = temperature (Celcius) + 273.15

Ions:
An **ion** is a charged species. **Anions** are negatively charged and **cations** are positively charged.
- you can remember this by remembering "-CATions are PAWSitive"

The Atom Economy:
The Atom Economy looks at the level of efficiency of chemical reactions by comparing the molecular mass of atoms in the reactants with the molecular mass of useful compounds.
percentage of atom economy = molecular mass of atoms of useful products/molecular mass of atoms in reactants x 100%

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1.2 The Mole Concept

Relative Atomic Mass, Relative Formula Mass, and Molar Mass
- **Isotopes** are atoms of the same element that have the same number of protons in the nucleus but different numbers of neutrons.
- **relative abundance** of each isotope is a measure of the percentage that occurs in a sample of the element.
- **Relative Atomic Mass** a weighted average of the atomic masses of its isotopes.
- **Relative Molecular Mass** (Relative Formula Mass) combining the **Relative Atomic Mass** values of the individual atoms or ions
- **Molar Mass** is the mass of one mole of substance
- A mole (Avogadro's constant, L) is 6.02x10^23

Mole Calculations
no. of particles x L = moles
moles x molar mass = mass (g)

Experimental Empirical and Molecular Formula Determination
- **Qualitative analysis**: what elements are present within the substance, and what is the purity of the substance
- **Quantitative Analysis**: what is the relative mass, and what is the exact composition

1.2 The Mole Concept (cont)

- **Empirical Formula** is the simplest whole number ratio of atoms or amount of each element present in a compound.
- **Molecular Formula** the actual number of atoms or amount of each element present in a compound.

1.3 Reacting Masses and Volumes

The Limiting Reagent

- the **Liniting Reagent** is the reactant that will be completely consumed during the reaction (it is usually the more expensive one)

Theoretical and Experimental Yields

- the **theoretical yield** is the expected amount of products which is theoretically possible if the reaction is done under ideal conditions.
- the **experimental yield** is the actual amount of product produced during experimentation.
- **percentage yield**=experimental yield/theoretical yield

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Avogadro's Law and the Molar Volume of Gases

The Kinetic Theory of Gases:

1. Gases are made up of very small particles, separated by large distances. Most of the volume occupied by a gas is empty space.
2. Gaseous particles are constantly moving in straight lines, but random directions
3. Gaseous particles undergo elastic collisions with eachother and the walls of the container. No loss of kinetic energy occurs
4. Gaseous particles exert no force of attraction on other gases.

1.3 Reacting Masses and Volumes (cont)

Under conditions of **Standard Temperature and Pressure (STP)** an ideal gas obeys the four postulates stated above.

- The molar volume of any gas is identical at a given temperature and pressure.

The Gas Laws

- Pressure is inversely proportional to 1/volume
- pressure 1 x volume 1 = pressure 2 x volume 2
- volume 1/temperature 1 = volume 2/temperature 2

pV = nRT

pressure x volume = number of moles x ideal gas constant x temperature

Concentration

- **Solution** is a homogeneous mixture of a **solute** that has been dissolved in a **solvent**.
- concentration = no. of moles/volume