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Matter and Its Properties

Matter is anything that has mass and takes up space. It exists in three primary states:

- **Solid**: Defined shape and volume, particles are tightly packed.
- **Liquid**: Defined volume but takes the shape of its container, particles are less tightly packed.
- **Gas**: No fixed shape or volume, particles move freely.

Physical properties (color, density, melting point) and chemical properties (reactivity, flammability) defin

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Atoms and Elements

An atom is the fundamental unit of matter, consisting of:

- **Nucleus**: Contains protons (positive charge) and neutrons (neutral charge).
- **Electrons**: Negatively charged particles orbiting the nucleus.

Elements are substances made of only one type of atom, represented in the periodic table. For exampl

- **Hydrogen (H)**: Lightest element.
- **Oxygen (O)**: Essential for respiration.
- **Carbon (C)**: Basis of organic molecules.

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Chemical Bonds and Reactions

Chemical reactions occur when atoms combine, separate, or rearrange to form new substances.

Types of Bonds:

- **Ionic Bonds**: Transfer of electrons (e.g., NaCl - table salt).
- **Covalent Bonds**: Sharing of electrons (e.g., H2O - water).
- **Metallic Bonds**: Electrons move freely among metal atoms.

Reaction Types:

- Synthesis: A + B $\rightarrow$ AB
- Decomposition: AB $\rightarrow$ A + B
- Combustion: Fuel + O2 $\rightarrow$ CO2 + H2O

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Solutions and Their Properties

A solution is a homogeneous mixture with a solvent (major component) and solute (minor component).

- **Types of Solutions**:
- **Gaseous**: Air (O2 and N2)
- **Liquid**: Saltwater (NaCl in H2O)
- **Solid**: Alloys (Brass - Cu & Zn)
- **Concentration Terms**:
- **Dilute**: Low solute concentration.
- **Concentrated**: High solute concentration.
- **Solubility Factors**:
- Temperature: Higher temp increases solubility (except gases).
- Pressure: Higher pressure increases gas solubility.

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Acids, Bases, and pH Scale

Acids and bases are classified based on their ability to donate or accept protons.

- **Acids**: Release H+ ions (e.g., HCl $\rightarrow$ H+ + Cl-)
- **Bases**: Release OH- ions (e.g., NaOH $\rightarrow$ Na+ + OH-)
- **pH Scale (0-14)**:
- **Acidic (0-6)**: Lemon juice (pH 2)
- **Neutral (7)**: Pure water
- **Basic (8-14)**: Baking soda (pH 9)
- **Buffer Solutions**: Maintain pH stability by neutralizing excess acids or bases.