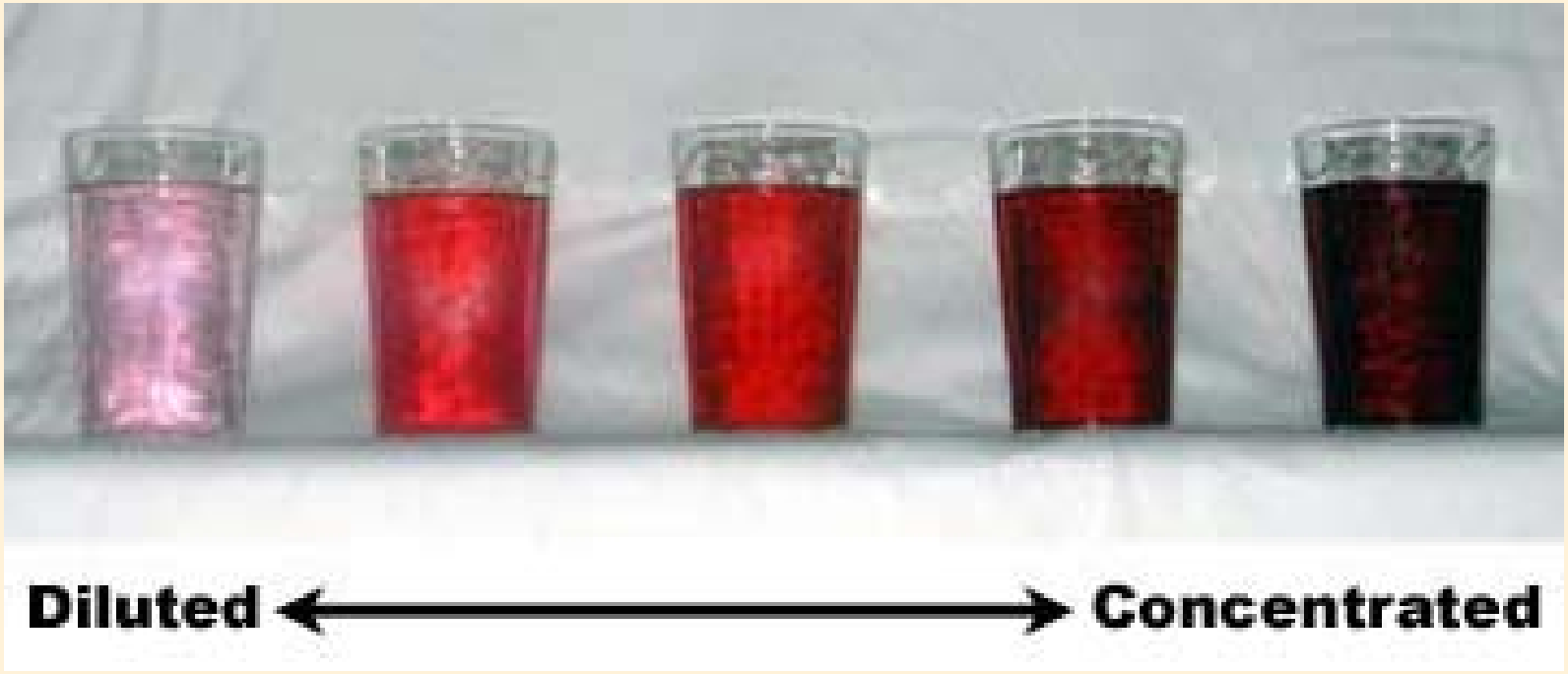
Types of Mixtures

Notes 5 – Mixtures and Concentration



Types of Mixtures

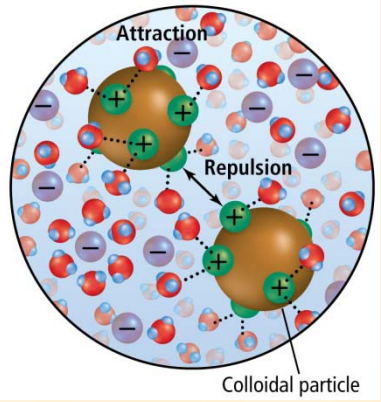
Heterogeneous Mixtures

- A heterogeneous mixture is a mixture that does not have a uniform composition and in which the individual substances remain distinct.
- **Suspensions** are mixtures containing particles that settle out if left undisturbed. Suspensions can also be separated by filtering.
  - **Ex.** Muddy water, some clays

Types of Mixtures

Heterogeneous Mixtures (cont.)

- **Colloids** are heterogeneous mixtures of intermediate sized particles (between 1 nm and 1000 nm) and do not settle out, nor can they be filtered apart.
  - **Ex.** Milk
- The most abundant substance in a mixture is the dispersion medium.
- Colloids are categorized according to the phases of their particles.



Types of Mixtures

Heterogeneous Mixtures (cont.)

Table 14.1 Types of Colloids

Category	Example	Dispersed Particles	Dispersing Medium
Solid sol	colored gems	solid	solid
Sol	blood, gelatin	solid	liquid
Solid emulsion	butter, cheese	liquid	solid
Emulsion	milk, mayonnaise	liquid	liquid
Solid foam	marshmallow, soaps that float	gas	solid
Foam	whipped cream, beaten egg white	gas	liquid
Solid aerosol	smoke, dust in air	solid	gas
Liquid aerosol	spray deodorant, fog, clouds	liquid	gas

Types of Mixtures

Heterogeneous Mixtures (cont.)

- **Brownian motion** is the jerky, random movements of particles in a liquid colloid, from the results of particle collisions.
- The **Tyndall effect** is the scattering of light by dispersed colloid particles.

Types of Mixtures

Homogeneous Mixtures

- Solutions are homogeneous mixtures that contain two or more substances called the solute and solvent.
- Most solutions are liquids, but gaseous and solid solutions exist.

Types of Mixtures

Homogeneous Mixtures (cont.)

Table 14.2 Types and Examples of Solutions

Type of Solution	Example	Solvent	Solute
Gas	air	nitrogen (gas)	oxygen (gas)
Liquid	carbonated water	water (liquid)	carbon dioxide (gas)
	ocean water	water (liquid)	oxygen gas (gas)
	antifreeze	water (liquid)	ethylene glycol (liquid)
	vinegar	water (liquid)	acetic acid (liquid)
	ocean water	water (liquid)	sodium chloride (solid)
Solid	dental amalgam	silver (solid)	mercury (liquid)
	steel	iron (solid)	carbon (solid)

Concepts In Motion

Types of Mixtures

Homogeneous Mixtures (cont.)

- A substance that dissolves in a solvent is **soluble**.
- Two liquids that are soluble in each other in any proportion are **miscible**.
- A substance that does not dissolve in a solvent is **insoluble**.
- Two liquids that can be mixed but separate shortly after are **immiscible**.

Section Check

Miscible substances are:

A. two liquids that are not soluble in each other

B. solids that dissolve in liquids

C. solids that do not dissolve in liquids

D. two liquids that are soluble in each other

Section Check

The jerky, random movement of particles in a liquid colloid is known as _____.

A. Brownian motion

B. Tyndall effect

C. Charles's Law

D. kinetic energy

Solution Concentration

Expressing Concentration

- The **concentration** of a solution is a measure of how much solute is dissolved in a specific amount of solvent or solution.
- Concentration can be described as concentrated or dilute.

Solution Concentration

Expressing Concentration (cont.)

Table 14.3 Concentration Ratios

Concentration Description	Ratio
Percent by mass	$\frac{\text{mass of solute}}{\text{mass of solution}} \times 100$
Percent by volume	$\frac{\text{volume of solute}}{\text{volume of solution}} \times 100$
Molarity	$\frac{\text{moles of solute}}{\text{liter of solution}}$
Molality	$\frac{\text{moles of solute}}{\text{kilogram of solvent}}$
Mole fraction	$\frac{\text{moles of solute}}{\text{moles of solute} + \text{moles of solvent}}$

Solution Concentration

Expressing Concentration (cont.)

$$\text{percent by mass} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100$$

$$\text{percent by volume} = \frac{\text{volume of solute}}{\text{volume of solution}} \times 100$$

Solution Concentration

Expressing Concentration (cont.)

Example Problem 1, pg. 481

EXAMPLE Problem 1 — Find help with **percents.**

CALCULATE PERCENT BY MASS In order to maintain a sodium chloride (NaCl) concentration similar to ocean water, an aquarium must contain 3.6 g NaCl per 100.0 g of water. What is the percent by mass of NaCl in the solution?

Once you have calculated the percent by mass, calculate the ppm (parts per million)

Solution Concentration

Expressing Concentration (cont.)

- **Molarity** is the number of moles of solute dissolved per liter of solution.

$$\text{molarity}(M) = \frac{\text{moles of solute}}{\text{liters of solution}}$$

- Dilution equation: $M_1V_1 = M_2V_2$

Solution Concentration

Expressing Concentration (cont.)

$$\text{molarity}(M) = \frac{\text{moles of solute}}{\text{liters of solution}}$$

Practice Problem, pg. 508

71. Calculate the molarity of a solution that contains 15.7 g of $CaCO_3$ dissolved in enough water to make 275 mL of solution.

Solution Concentration

Expressing Concentration (cont.)

- Dilution equation: $M_1V_1 = M_2V_2$

Practice Problem, pg. 508

76. How much 5.0*M* nitric acid (HNO_3), in milliliters, is needed to make 225 mL of 1.0*M* HNO_3?