Mixtures

(Chapter 16)

Student Learning Outcomes: Recall methods for separating a mixture, classify mixtures, and compare solubility properties.

1. *What is a mixture?*
2. *How can mixtures be separated?*
3. *How are mixtures classified?*
4. *What are the properties of a solution?*

What is a mixture?

- **A mixture has 2 or more substances together but each maintains its individual chemical properties.**

Soda Pop	Coffee + Milk
Tap Water	Tea + sugar

- When two or more substances are mixed, this is a physical change.

How can mixtures be separated?

- A mixture of solids and liquids can be separated using a filter to catch the solids; this is **filtration**.

- A mixture can be separated according to different vaporization temperatures; this is **distillation**.

Question: Why isn't distillation used to obtain more fresh water from salt water?

- Salt water can also be changed into fresh water through a **desalination** process that combines distillation and reverse osmosis.

  - **Osmosis is the net flow of water across a semi-permeable membrane from** *less to more* **concentrated solution.**

  - **Reverse osmosis is the net flow of water across a semi-permeable membrane from** *more to less* **concentrated solution.**

How are mixtures classified?

- A substance that is **pure** contains only one element (copper), or only one compound (salt).

- Mixtures are **impure** substances.

  - **Heterogeneous:** individual substances are easy to distinguish

  - **Homogeneous**: all particles are uniformly distributed in the mixture

  - **Solution**: all components in mixture are in the same phase

  - **Suspension**: different components are in different phases

Question: How would each substance be classified?

1. 7-up
2. Children's Amoxicillin
3. Air
4. Aluminum
5. Homogenized milk
6. Raw milk
7. Oil and water
8. Carbon monoxide
9. Tap water

What are the properties of a solution?

- Solutions have a solvent and a solute.

  - **Solvent**: the medium in which the solute is dissolved.

  - **Solute**: the material dissolved in a solvent.

Example: Sugar + water

- Liquids may or may not mix, may or may not dissolve into each other.

  - If the liquids mix to form a solution, the liquids are **miscible**.

  - If the liquids will not mix, the liquids are **immiscible**.

Questions: What is an example of liquids that are miscible? What is an example of liquids that are immiscible?

- Whether a solute will dissolve depends on the chemical interactions between the two substances.

- **Concentration** is how much solute is in the solution.

$$\textbf{Concentration} = \frac{\textbf{Amount solute (grams)}}{\textbf{Volume solution (Liters)}}$$

- There is a limit, based on each individual substance and physical conditions, of how much solute can be dissolved.

  - **Concentrated**: large amount of solute per solution

  - **Dilute**: small amount of solute per solution

  - **Saturated**: solution can not dissolve anymore solute

- **Molarity** (M) is the used to describe the concentration of moles in a solution.

$$\textbf{Molarity} = \frac{\textbf{Amount solute (moles)}}{\textbf{Volume solution (Liters)}}$$

- The mole is used to represent a large number of particles.

$$N_A = \frac{6.022 \times 10^{23} \text{ atoms}}{\text{mole}}$$

Questions:

1. If you cannot dissolve anymore sugar in your coffee, your coffee is?

2. What is the concentration when 5 grams of sugar is added to ½ a liter of water?

3. Commercial hydrochloric acid has a molarity of 6 M. How many moles of hydrochloric acid would there be in 2.5 liters of an aqueous solution?

- **<u>Solubility</u> is a measure of how much material will dissolve in some amount of solvent to produce a stable solution.**

- Solubility depends on 5 properties.

    1) <u>Bond strength of solute and solvent</u>: stronger bonds are more difficult to dissolve.

    2) <u>Type of solute and solvent</u>: solutes will dissolve easiest in solvents with the same type of bonding. "Like dissolves like."

    3) <u>Temperature</u>: it is usually easier to break chemical bonds at higher temperatures.

    4) <u>Pressure</u>: an increase in pressure increases the solubility of gaseous solutes.

    5) <u>Molecular attractions</u>: many strong molecular attractions can pull chemical bonds apart.

- If a solute will not dissolve in a solvent, then the solute is **<u>insoluble</u>** in that particular solvent.

<u>Question</u>: What is an example of a solute that is insoluble?