Mixtures

(Solutions)

Mixtures

- a combination of two or more substances that do not combine chemically, but remain the same individual substances; can be separated by physical means
- Two types:
  - Heterogeneous
  - Homogeneous

Based on the prefixes "hetero" and "homo," what do you think are characteristics of these two types of mixtures?

Creating Mixtures – Part 1

- Procedures/Questions
  1. Describe and draw what you see in the cups.
  2. Pour the contents of cups A and cup B into a beaker and mix with a glass stirring rod.
  3. Describe and draw what you see in the beaker after cups A and B are combined.
  4. Using any means necessary, try to separate the mixture back into its original parts. Was it possible to separate the mixture? Why or why not?

Heterogeneous Mixture

- "Hetero" means different
- consists of visibly different substances or phases (solid, liquid, gas)
- a suspension is a special type of heterogeneous mixture of larger particles that eventually settle
- Example:

Trail Mix

Notice the visibly different substances

Creating Mixtures – Part 2

- <u>Procedures/Questions</u>
  1. Describe and draw what you see in the cups.
  2. Pour the contents of cups C and cup D into a beaker and mix with a glass stirring rod.
  3. Describe and draw what you see in the beaker after cups C and D are combined.
  4. Using any means necessary, try to separate the mixture back into its original parts. Was it possible to separate the mixture? Why or why not?

Homogeneous Mixture

- "Homo" means the same
- has the same uniform appearance and composition throughout; maintain one phase (solid, liquid, gas)
- Commonly referred to as solutions
- Example:

Salt Water

Notice the uniform appearance

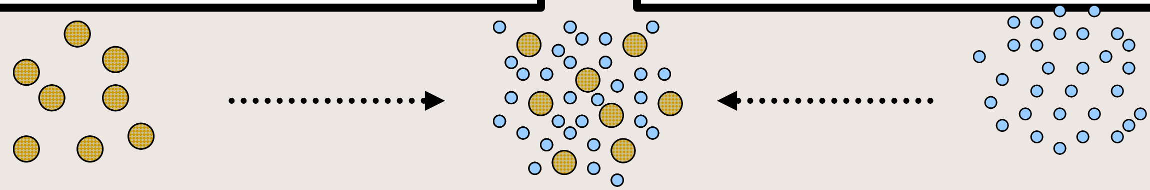
Solution

- a mixture of two or more substances that is identical throughout
- can be physically separated
- composed of <u>solutes</u> and <u>solvents</u>

Salt water is considered a solution. How can it be physically separated?

the substance in the smallest amount and the one that dissolves in the solvent

the substance in the larger amount that dissolves the solute



Iced Tea Mix (solute)

Iced Tea (solution)

Water (solvent)

Colloids (milk, fog, jello) are considered solutions

Solutes Change Solvents

- The amount of solute in a solution determines how much the physical properties of the solvent are changed
- Examples:

Lowering the Freezing Point

The freezing point of a liquid solvent decreases when a solute is dissolved in it.

<u>**Ex**</u>. Pure water freezes at 32^{0}F (0^{0}C), but when salt is dissolved in it, the freezing point is lowered. This is why people use salt to melt ice.

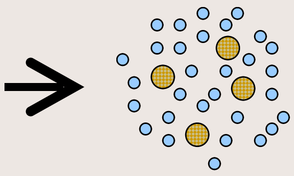
Raising the Boiling Point

The boiling point of a solution is higher than the boiling point of the solvent. Therefore, a solution can remain a liquid at a higher temperature than its pure solvent.

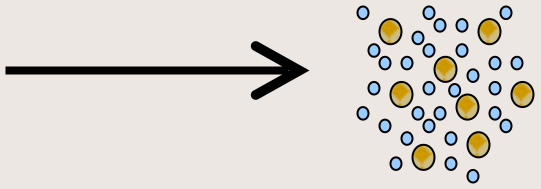
<u>**Ex**</u>. The boiling point of pure water is 212^{0}F (100^{0}C), but when salt is dissolved in it, the boiling point is higher. This is why it takes salt water longer to boil than fresh water.

Concentration

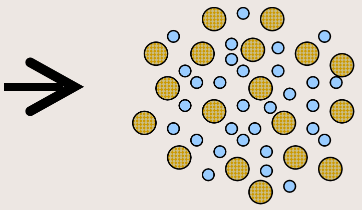
- the amount of solute dissolved in a solvent at a given temperature
  - described as **dilute** if it has a low concentration of solute



  - described as **saturated** if it has a high concentration of solute



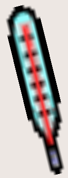
  - described as **supersaturated** if contains more dissolved solute than normally possible



Solubility

- the amount of solute that dissolves in a certain amount of a solvent at a given temperature and pressure to produce a saturated solution
- influenced by:

What do we call things that are not soluble?



Temperature

Solids → increased temperature causes them to be more soluble and vice versa

Gases → increased temperature causes them to be less soluble and vice versa

Ex. Iced Coffee

Pressure

Solids → increased pressure has no effect on solubility

Gases → increased pressure causes them to be more soluble and vice versa

Ex. Soda, "The Bends"

Acids

- from the Latin word acere → "sharp" or "sour"
- taste sour (but you wouldn't taste an acid to see)
- change litmus paper red
- corrosive to some metals (reacts to create hydrogen gas – H_2)
- a substance that can donate a hydrogen ion (H^+) to another substance
- create a hydrogen ion (H^+) or hydronium ion (H_3O^+) when dissolved in water

$$HCl \xrightarrow{H_2O} H^+ + Cl^-$$

HCl		H^+		Cl^-
Hydrochloric Acid		Hydrogen ion		Chloride ion

Notice how the hydrogen ion is released when the acid is in water

Examples: hydrochloric acid, vinegar, lemon juice, rainwater

Bases (Alkalis)

- taste bitter (but you wouldn't taste a base to see)
- feel slippery or soapy
- change litmus paper blue
- react with oils and grease
- a substance that can accept a hydrogen ion (H^+) from another substance
- create a hydroxide ion (OH^-) when dissolved in water

Notice how the hydroxide ion is released when the base is in water; this ion can accept a hydrogen ion (H^+)

$$NaOH \xrightarrow{H_2O} Na^+ + OH^-$$

NaOH		Na^+		OH^-
Sodium Hydroxide		Sodium ion		Hydroxide ion

<u>Examples</u>: sodium hydroxide, Drano, Tums, baking soda

Neutralization Reaction

- occurs when acids and bases react with each other to produce water and salt
  - acids release a hydrogen ion (H^+) and bases release a hydroxide ion (OH^-) → water (H_2O)
  - the negative ion from the acid joins with the positive ion of a base → salt

$$HCl + NaOH \rightarrow H_2O + NaCl$$

HCl	NaOH	H_2O	NaCl
Hydrochloric Acid (acid)	Sodium Hydroxide (base)	Water	Sodium Chloride (salt)

Both the salt and water are neutral substances; therefore, that is why this is referred to as a neutralization reaction.

Acid, Base, or Neutralization?

$Zn + 2H^{+} \rightarrow Zn^{2+} + H_2$

Acid – because H_2 gas was given off

$NH_3 + H_2O \rightarrow NH_4^{+} + OH^{-}$

Base – because OH^{-} is present in the products

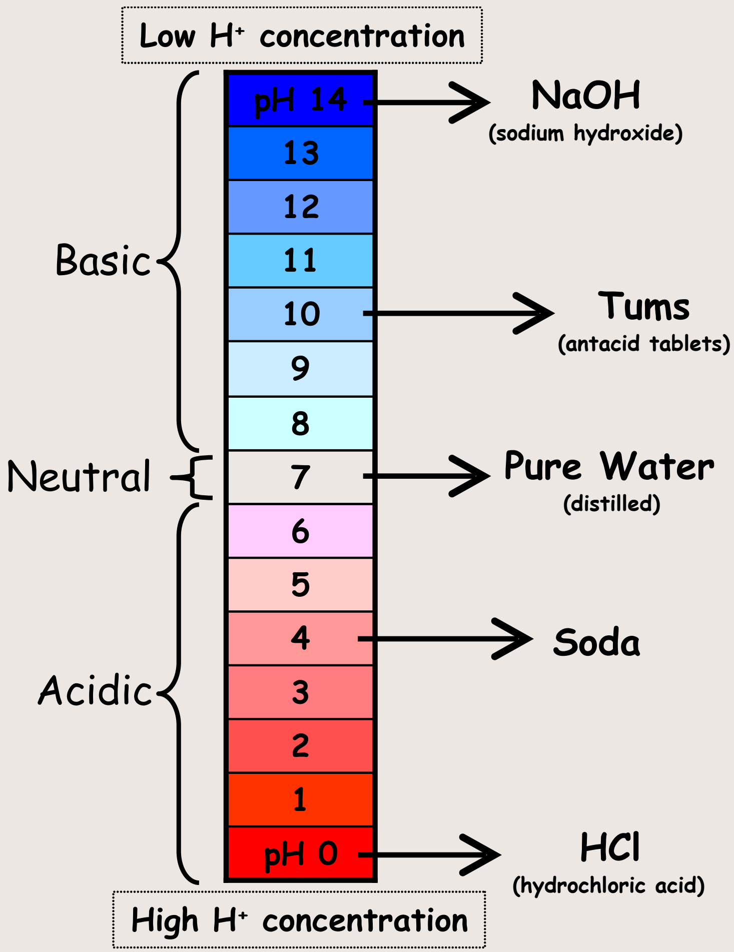
$HClO + LiOH \rightarrow LiClO + H_2O$

Neutralization – because of the salt and water in the products

$HCl + H_2O \rightarrow H_3O^{+} + Cl^{-}$

Acid – because H_3O^{+} is present in the products

pH Scale



- ranges from 0-14
  - Acids → found between a number close to 0 & 7
  - Bases → found between 7 & 14
  - Neutral → 7
- measures the acidity or basicity of a solution by focusing on the concentration of hydrogen ions (H^+) in a solution
- equals the negative log of the concentration of H^+