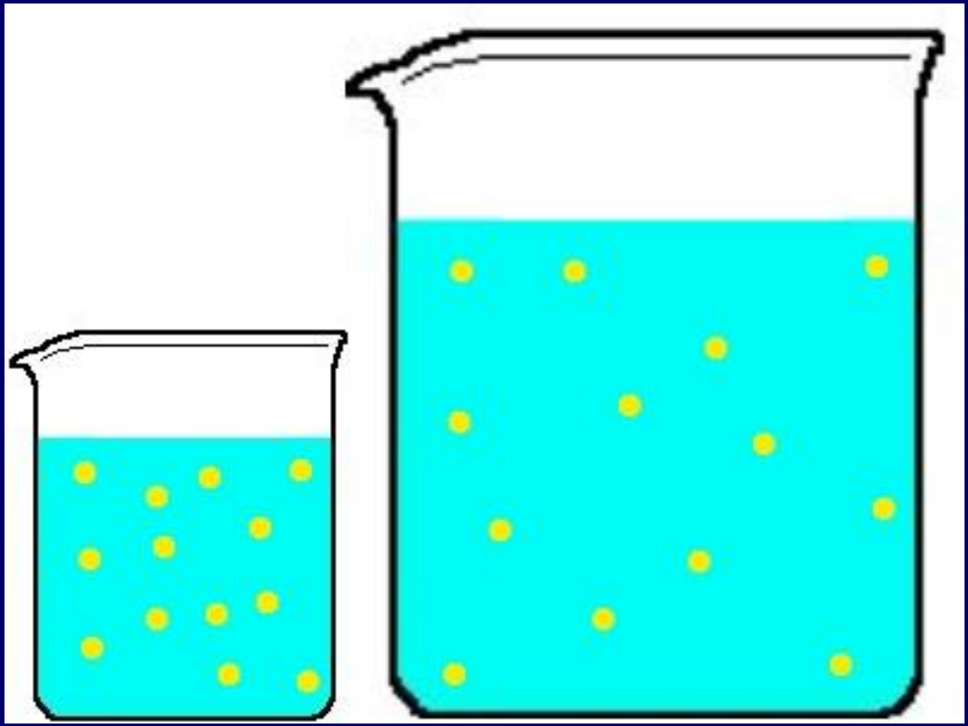
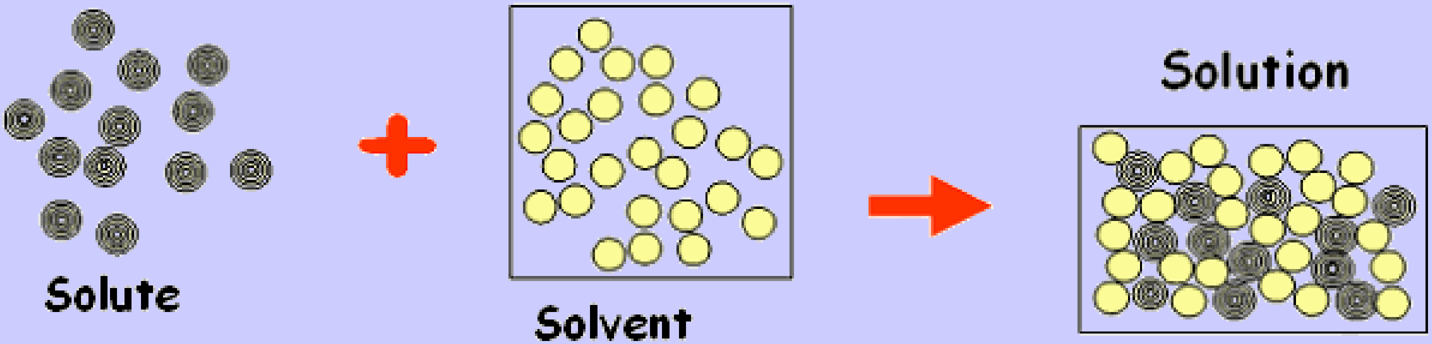
Ch 8 Solutions

8.1 A Solution is a Type of Mixture



The parts of a solution are mixed evenly

- A solution is homogeneous
  - Solute—part that is dissolved
  - Solvent—part that does the dissolving



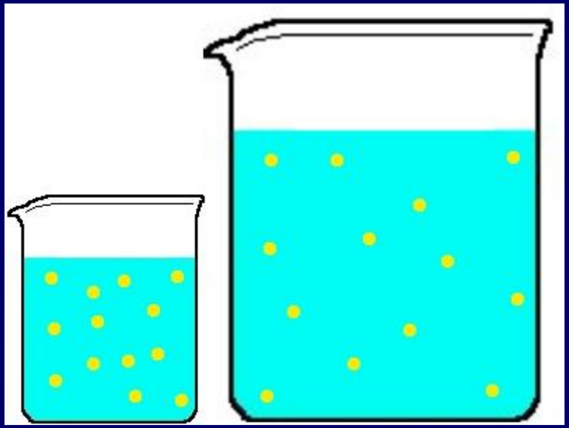
Water is considered to be a universal solvent.

Solutions can be:

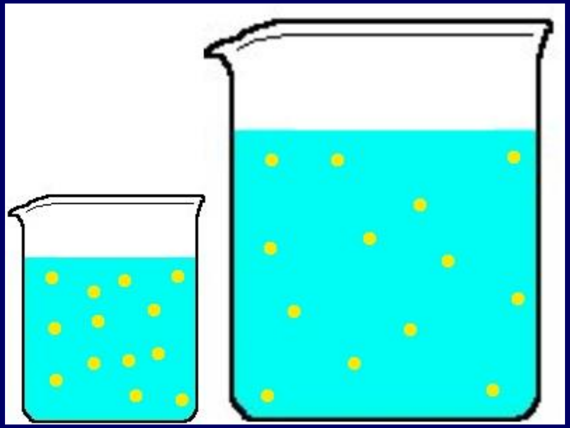
Solids

Liquids

Gases



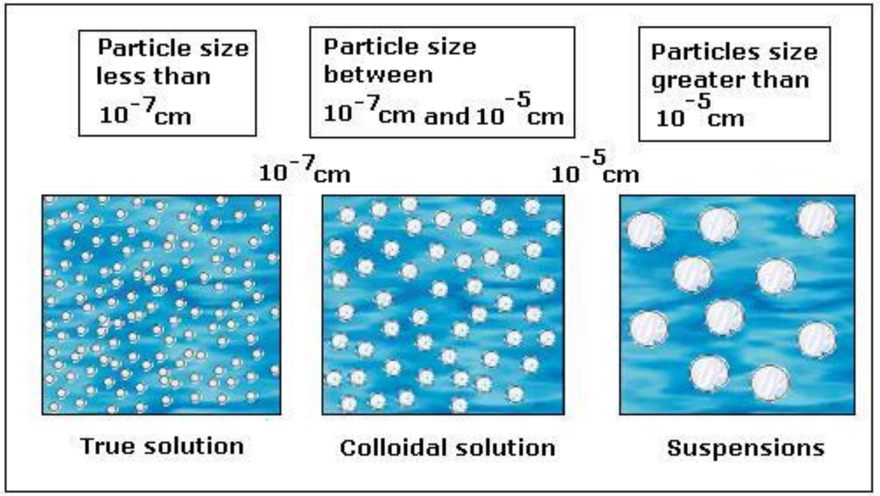
If the solute & solvent are in the same physical state, the one in greater proportion is the solvent.



Suspension (heterogeneous mixture)

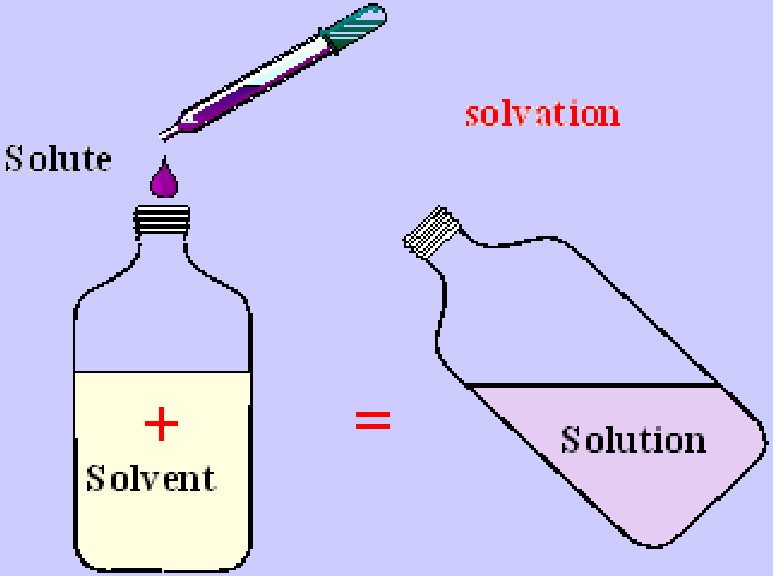
A mixture with large particles that do not dissolve

- this mixture is NOT a solution
- usually have to shake or stir it before using

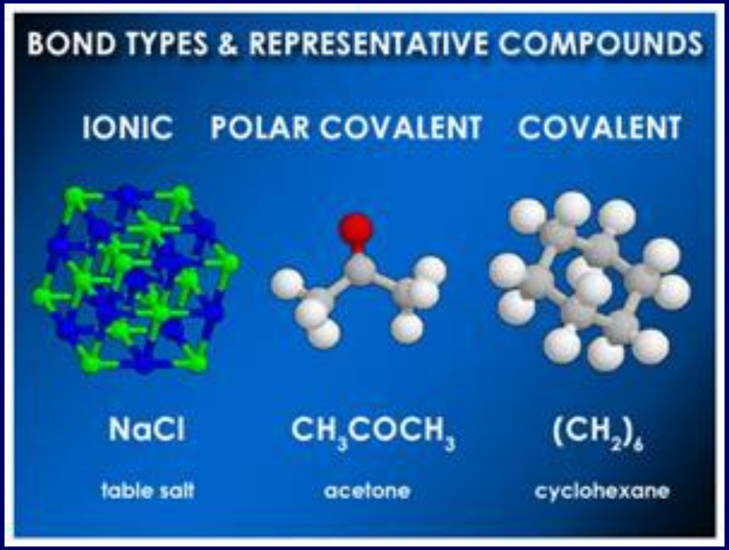


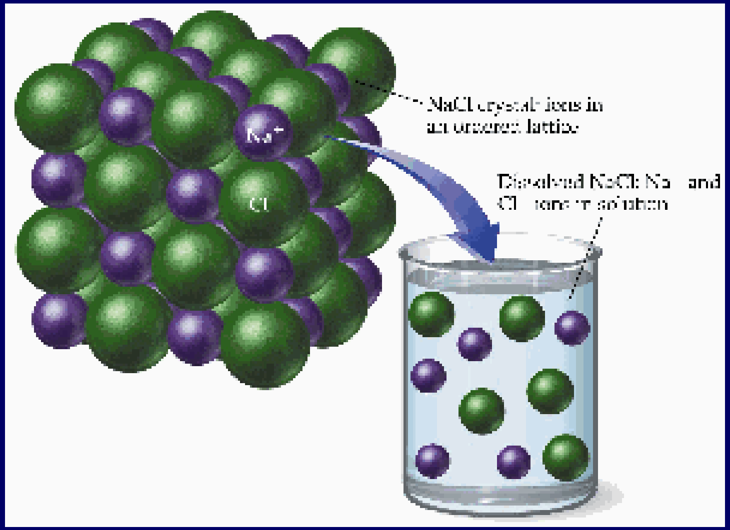
Solvent & Solute Particles Interact In Solutions

- When a solid dissolves in a liquid, the solute breaks apart
- Solute particles are surrounded by solvent particles and are evenly distributed in the solution

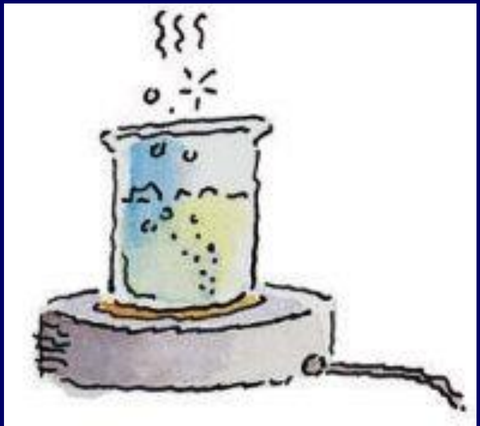


- Ionic compounds break apart in solutions
- Covalent compounds stay intact when dissolved in solutions



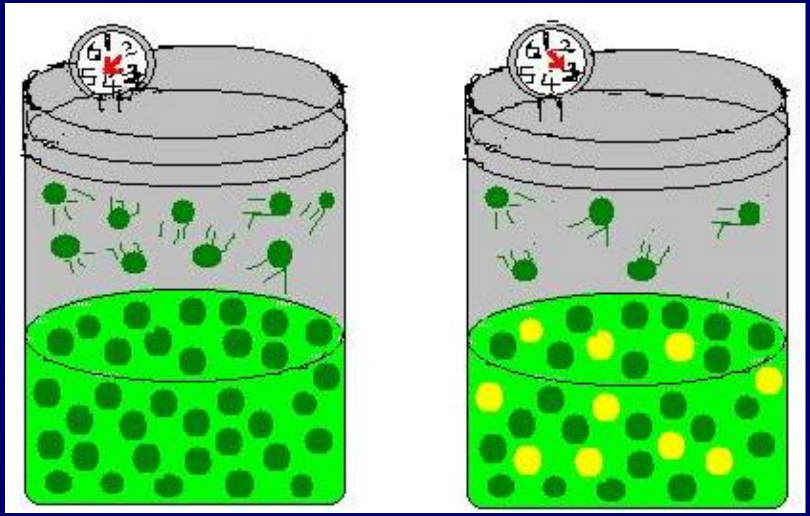


Properties of Solvents Change in Solutions



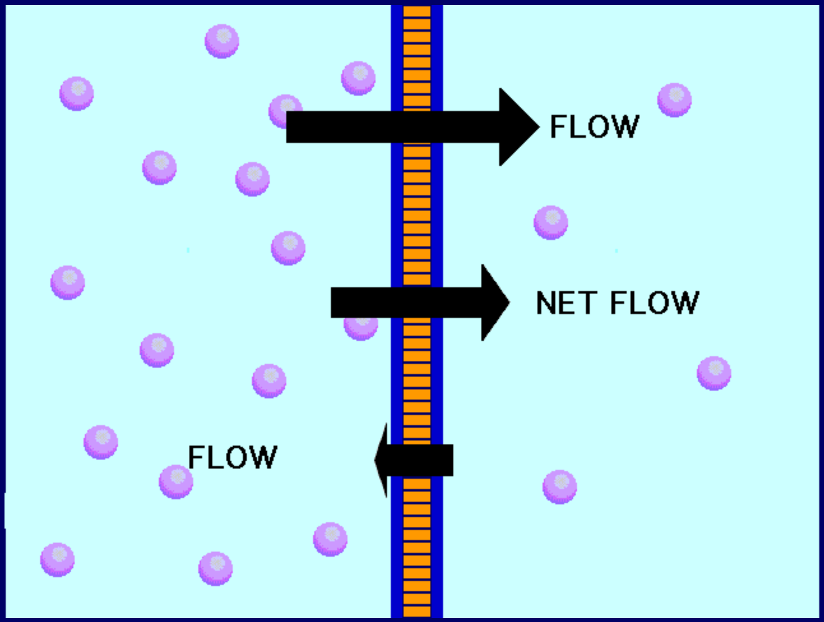
A solute changes the *physical properties* of a solvent (they become more <u>extreme</u>)

- Freezing point of a solution <u>becomes lower</u>
- Boiling point of a solution becomes <u>higher</u>



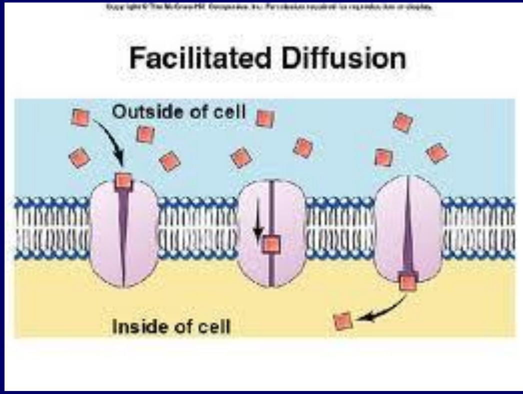
Diffusion & Osmosis

- Diffusion—molecules spread from an area of *higher* to *lower* concentrations
- Osmosis—diffusion of *water only*



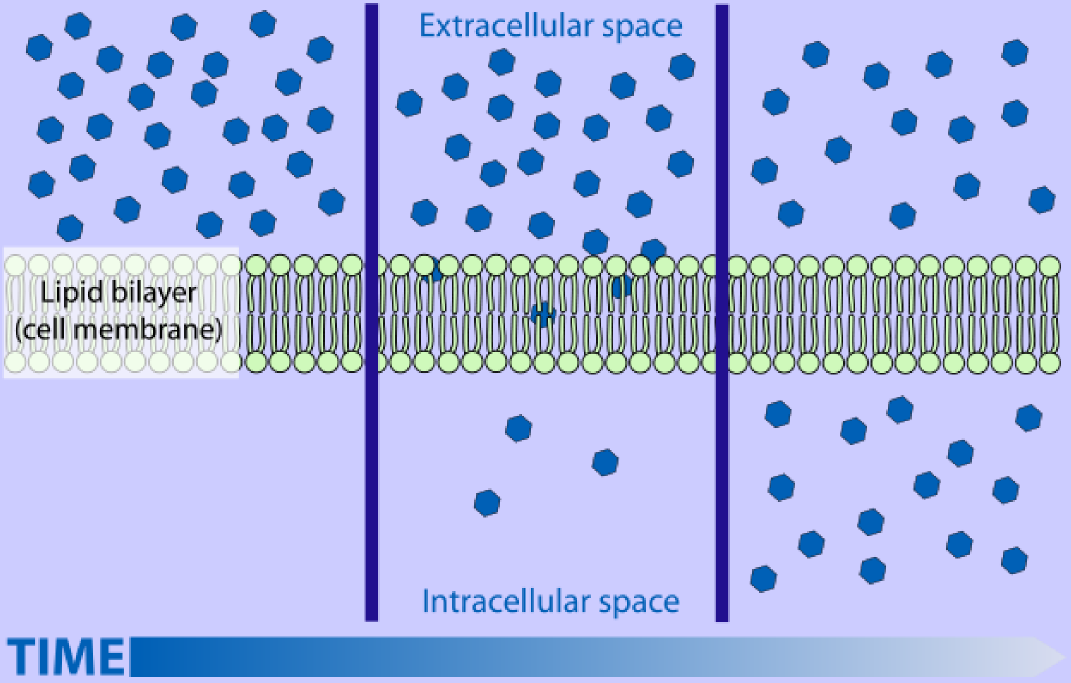
Diffusion & Cells

- Permeable—allows things to pass
- Cells have selectively permeable membranes that allow *some* substances to pass through, but not all.
- Criteria for being allowed to pass depends on:
  - Size
  - Shape
  - Electrical charge



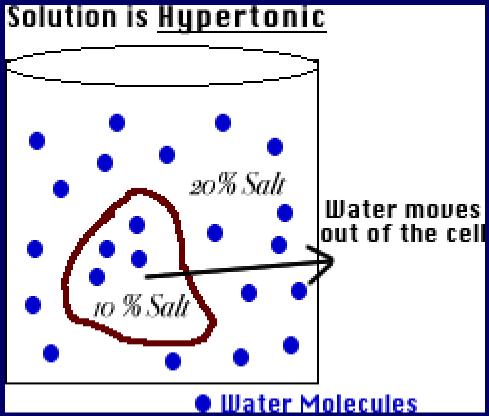
3 Types of Solutions

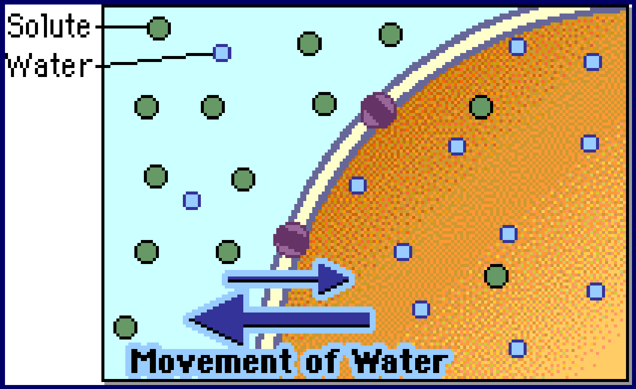
1. Hypertonic
2. Hypotonic
3. Isotonic



Hypertonic

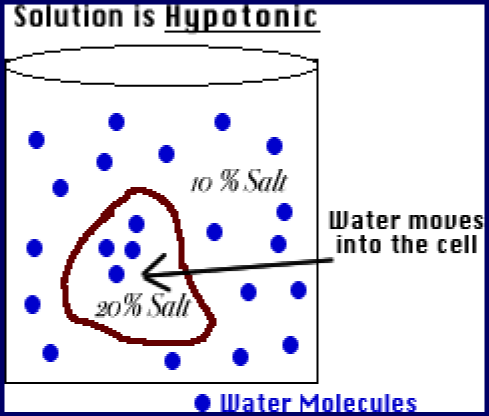
- If a cell is immersed in this, it will shrink because water flows out of the cell
- The solute concentration is greater in the solution (outside of the cell)





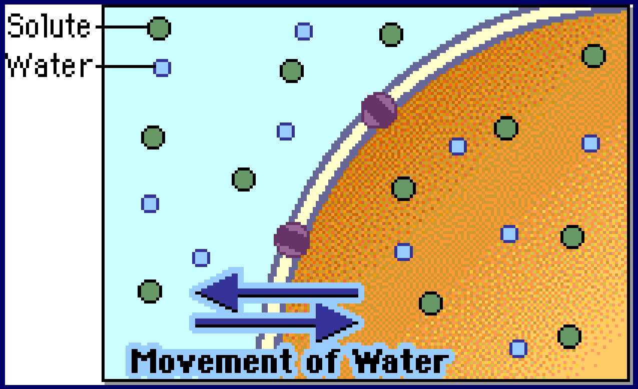
Hypotonic

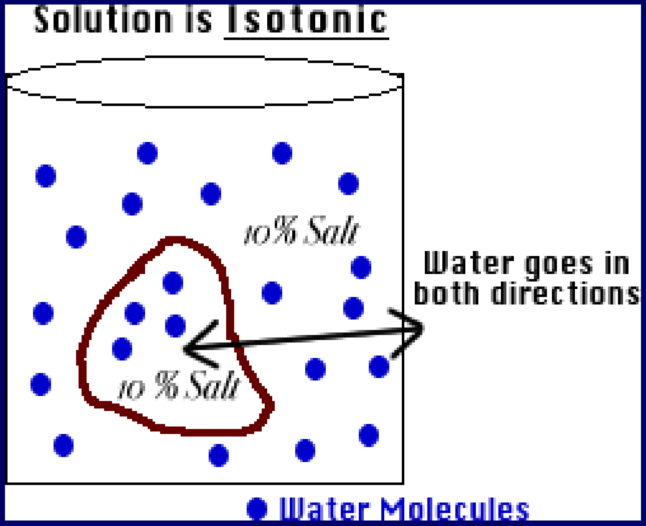
- If a cell is immersed in this, it will swell & possibly explode because water flows into the cell
- The solute concentration is greater inside the cell (not in the solution)



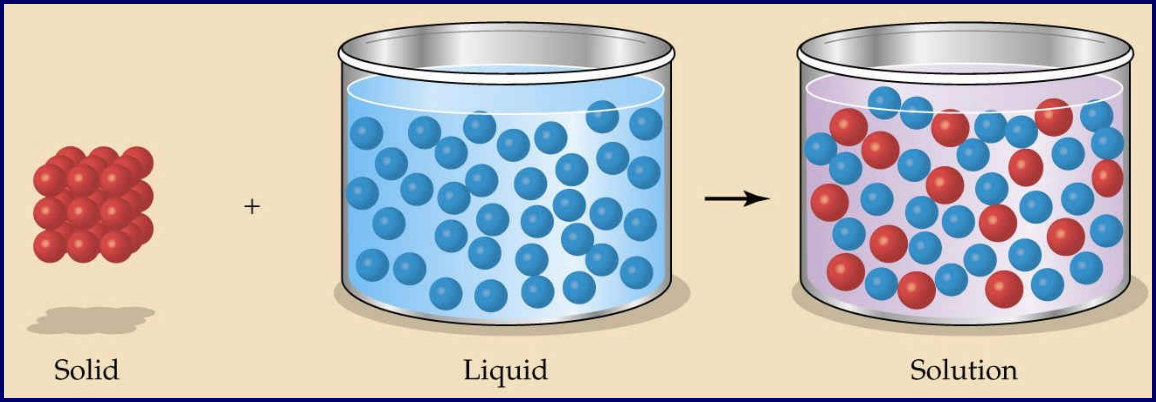
Isotonic

- Has no effect on the direction of diffusion
- Concentration is equal on both sides of the membrane



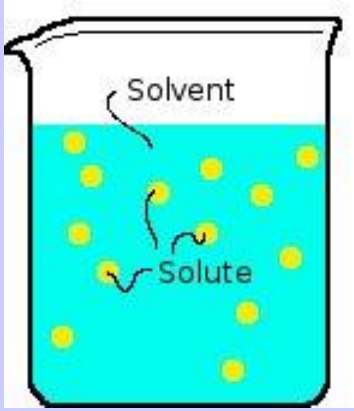


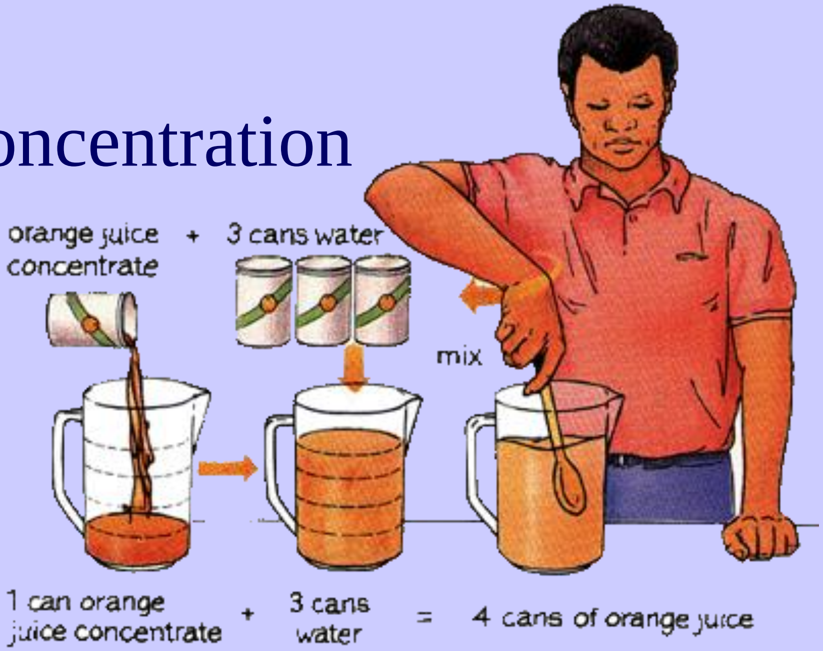
8.2 The Amount of a Solute that Dissolves Can Vary



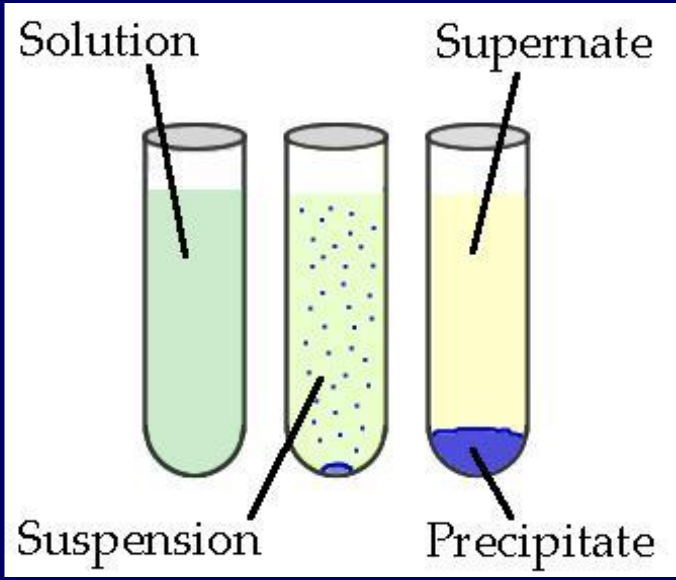
A solution with a high concentration contains a large amount of a solute

- Concentration of a solution—the amount of solute dissolved in it at a particular temp.
  - *Add solute* = increased concentration
  - *Add solvent* = lowers concentration *(making it more dilute)*



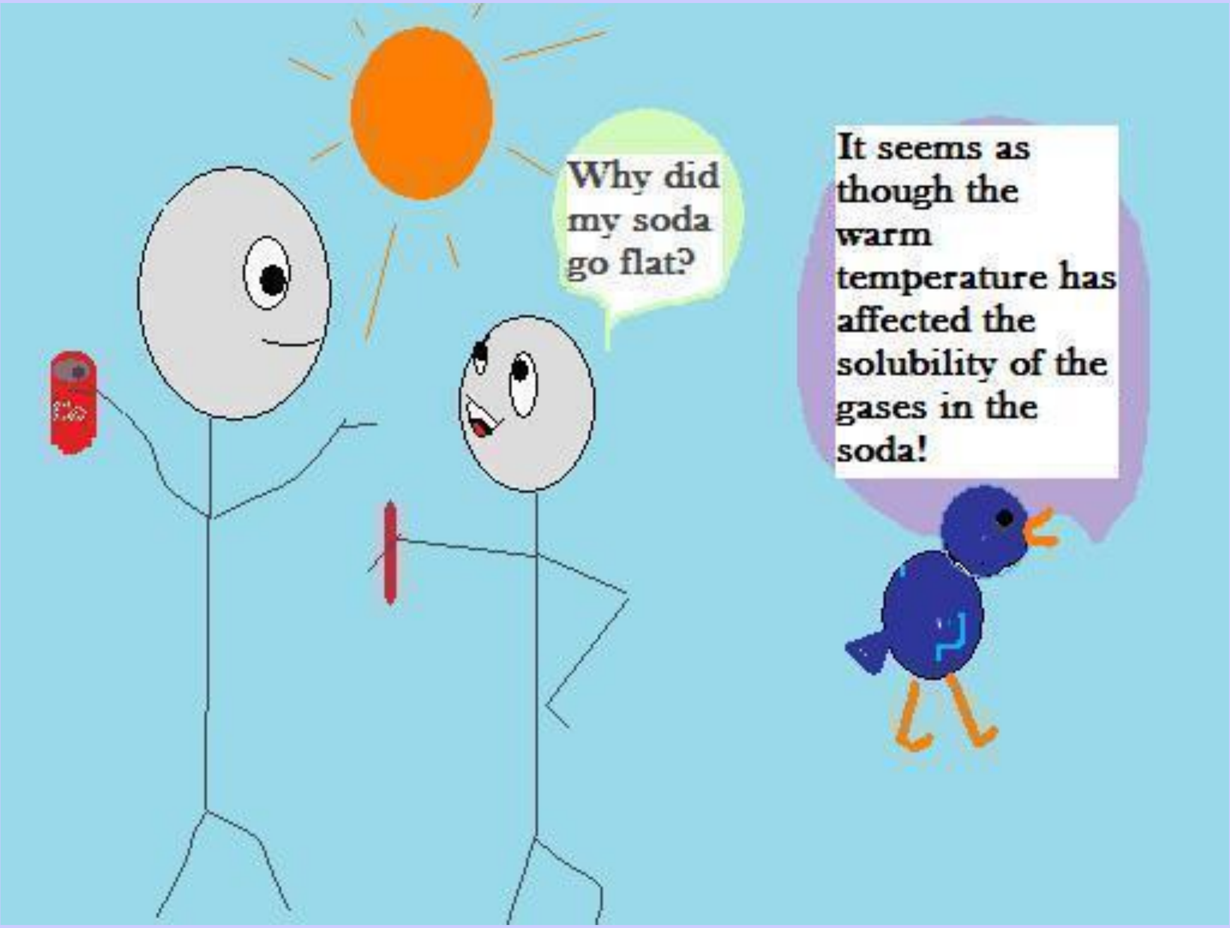


Saturated Solution



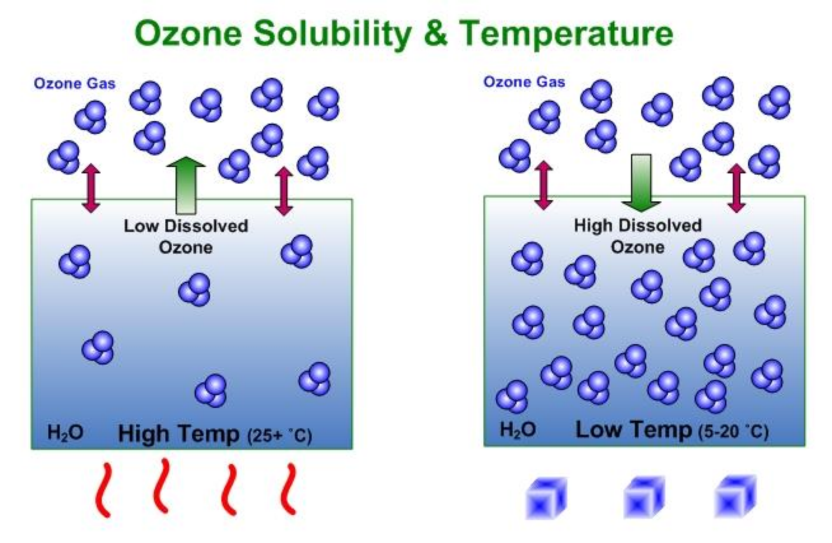
- Holds the maximum amount of a solute at a certain temp.
- Supersaturated solution contains more solute than can be dissolved at a certain temp
  - Achieved by heating the solution then slowly cooling it down
  - A disturbance can cause the excess solute to come out of the solution as a precipitate (solid)

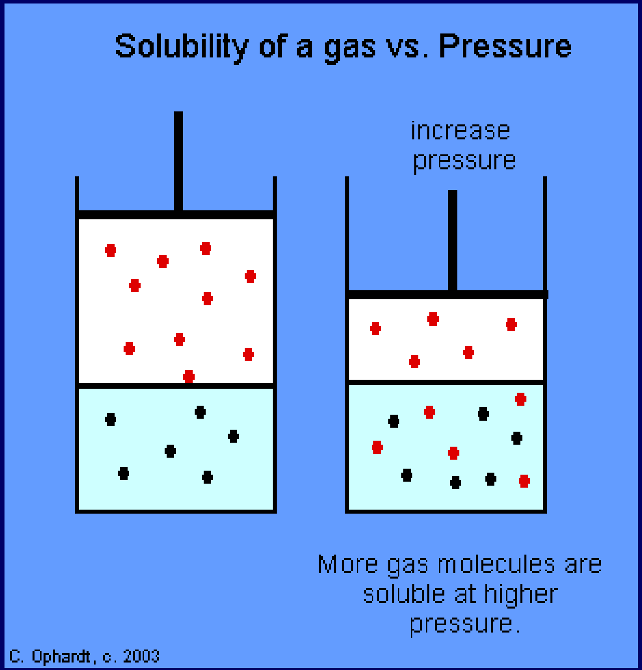
Every substance has a characteristic solubility (amount that will dissolve in a certain amount of a certain solvent at a given temp)



Solubility of a solute can be changed

- *Increasing temp*
  - increases solubility of most solids in liquid solution
  - decreases solubility of gases in a solution
- *Increasing pressure*
  - increases solubility of gases in a solution
  - does not affect solid & liquid solutes

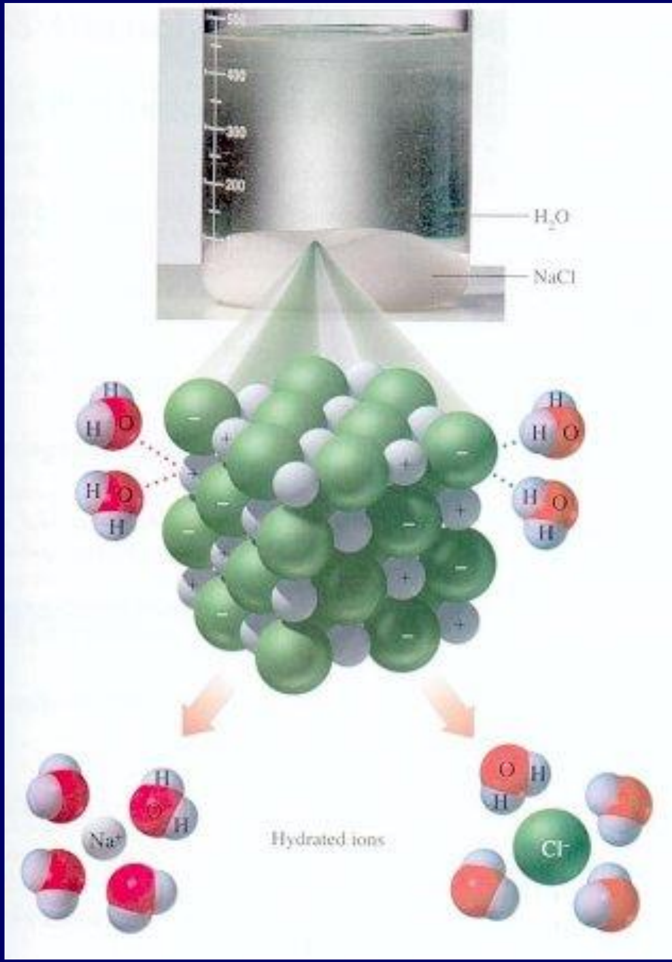




Solubility depends on molecular structure

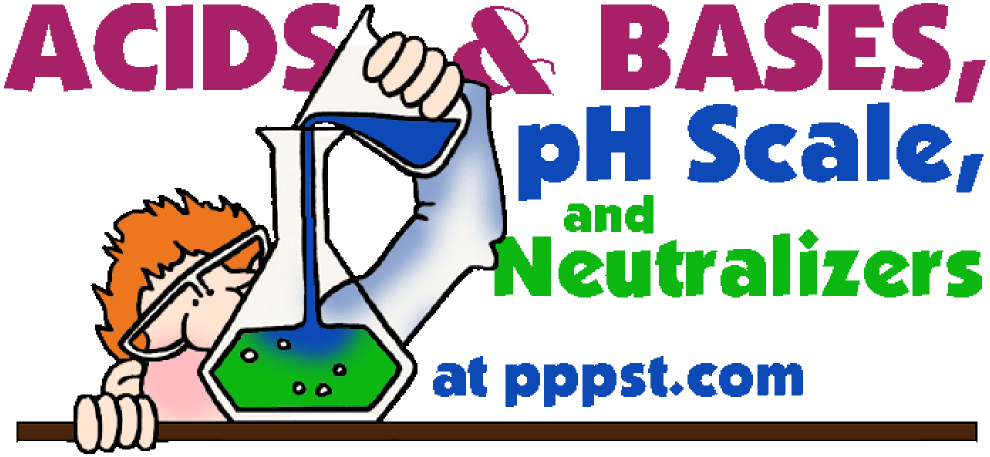
Depends on electrical charges of solute & solvent particles

- Polar molecules & ions dissolve in polar solvents (like water)



- Non-polar molecules (like oils)
  - do not dissolve in polar solvents
  - do dissolve in non-polar solvents

8.3 Solutions can be acidic, basic, or neutral



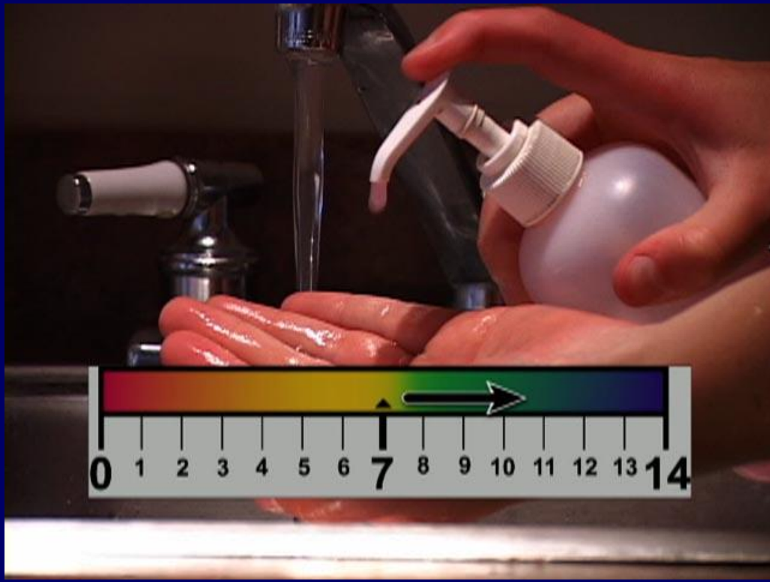
Term	Adjective
Acid	*acidic*
Base	*alkaline* or *basic*

Acids & Bases have distinct properties

<u>Acids</u>—<u>donate</u> hydrogen ions (proton) to other substances when dissolved in water

- HCl (hydrochloric acid) is an example
- They taste *sour*
- React with carbonates to form carbon dioxide
- React with many metals

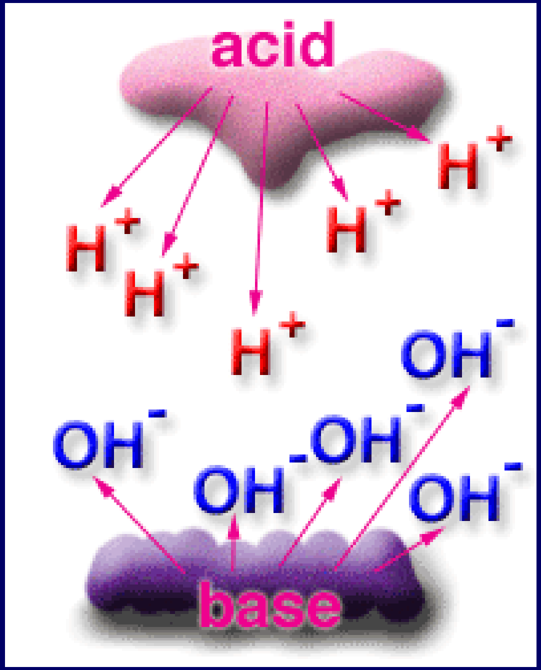
OH…It's a Base



Bases—accept hydrogen ions from other substances

OH- = hydroxide ion (proton acceptors)

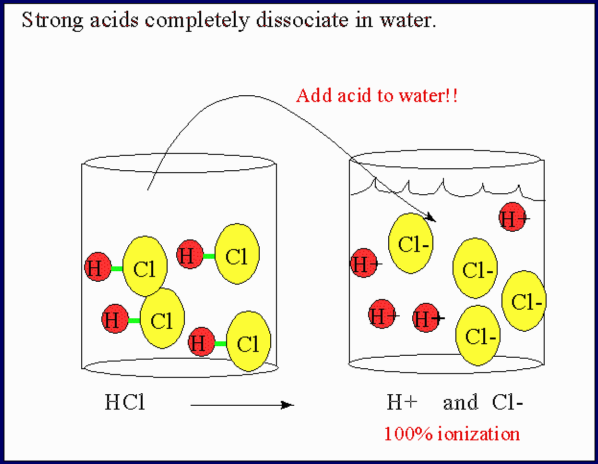
- In water, the base NaOH (sodium hydroxide) *releases* a hydroxide ion, which can accept a hydrogen ion
- Taste *bitter*
- Feels *slippery* or *soapy*



Copy the pH scale from the board

Strengths of acids & bases can be *measured*

- Strong acids & bases break apart *completely* into individual ions in solution



- A weak acid or base does not break apart completely into ions in solution

Acidity of a solution is measured on the pH scale

pH scale is like a number line 0-14

- Acids = 0-6
- Bases = 8-14
- Neutral = 7

p = power of
H = hydrogen

Acids & Bases *Neutralize* Each Other

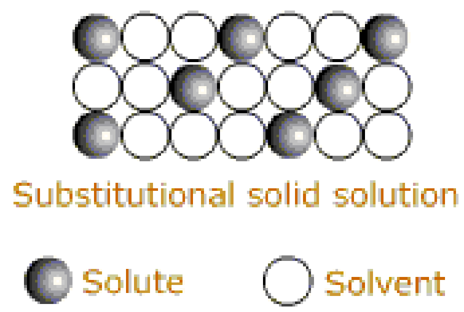
- **Acid + Base = neutralization reaction**

- **Hydrogen ion (from acid) bonds with hydroxide ion (from base) to form water**
- **Products of neutralization reactions are *water & salt***

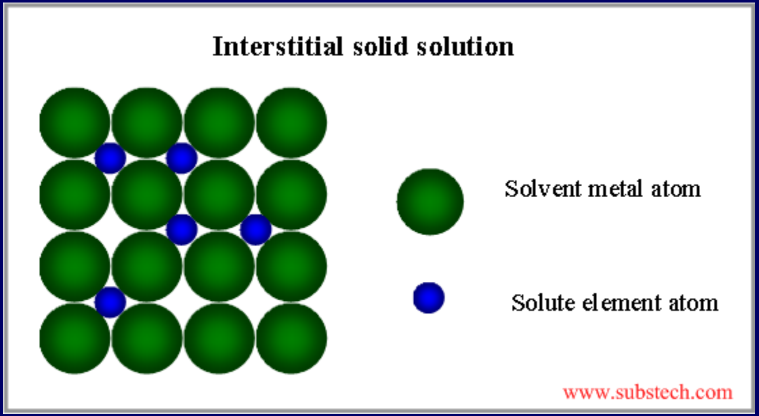
$$HCl + NaOH \rightarrow NaCl + H_2O$$

8.4 Metal *Alloys* are Solid Mixtures

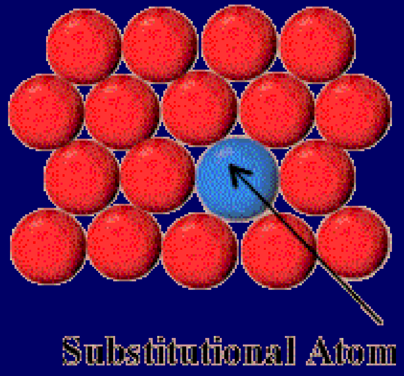
Humans have made alloys for thousands of years



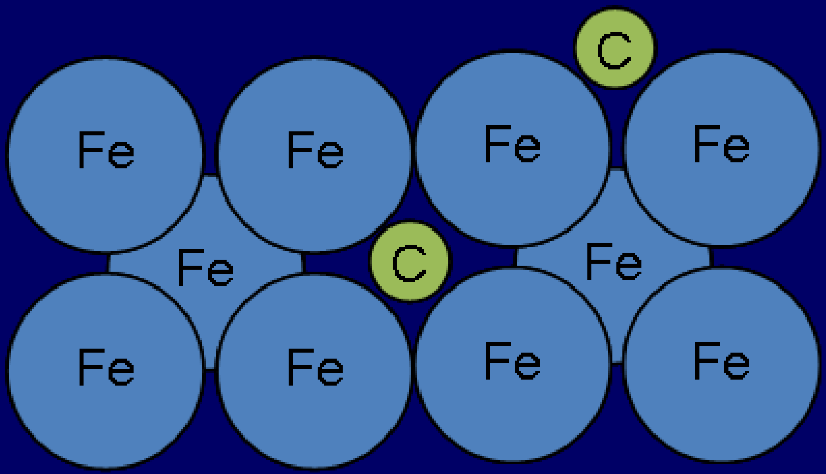
- Alloy—solid mixture that has many of the characteristics of a solution
  - Solid (usually metal) solute is mixed with a solid metallic solvent
  - Made by melting the metal components & mixing them in the liquid state
  - Physical properties of an alloy are different from those of the solvent metal

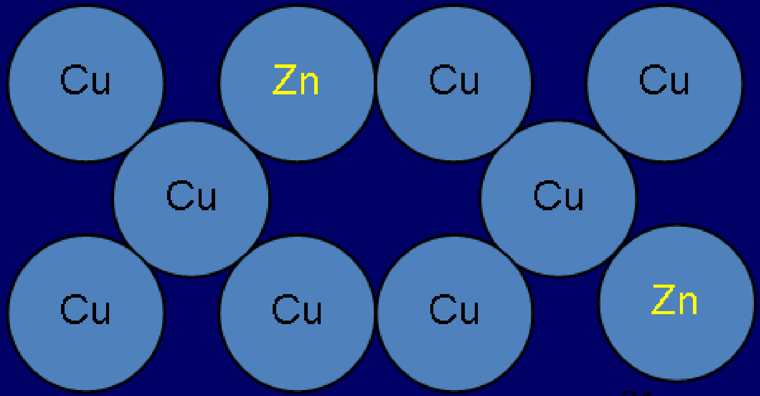


2 General Types of Alloys



- Substitutional alloy—example = brass
  - Some of the Cu atoms are replace by Zn
- Interstitial alloy—example = steel
  - C atoms occupy gaps between Fe atoms





Alloys have many uses in modern life

Aluminum

- New alloys are constantly being produced in response to new technology
- Mostly includes transportation, medicine, & aerospace industries
  - Aluminum alloys are light weight, strong, & have low densities (good for cars & aircraft)
  - More dense alloys (like steel) are used in application in which weight is not an issue

Steel