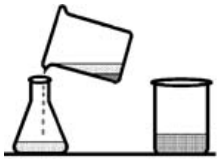
Solutions



PGCC CHM 101 Sinex

Comparison of Solutions, Colloids, and Suspensions

< 1 nm > 100 nm

solutions	colloids	suspensions
-single atoms -small molecules -ions -polyatomic ions	-aggregates of atoms, molecules or ions -macromolecules (proteins)	-clumps of particles, -mineral grains such as sand

More Comparison…

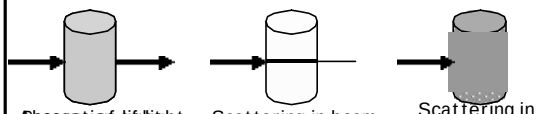
< 1 nm > 100 nm

solutions	colloids	suspensions
transparent (clear) molecular motion never settle	transparent with Tyndall effect Brownian motion-colloidal particles moved by solvent coagulation – can settle	translucent (cloudy) movement by gravity

Light passage…

< 1 nm > 100 nm

solutions	colloids	suspensions



Passage of light Scattering in beam Scattering in all directions

Using whole blood as an example…

< 1 nm > 100 nm

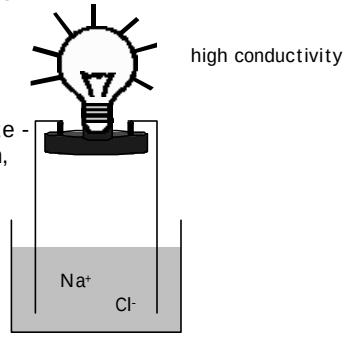
solutions	colloids	suspensions
-dissolved in water electrolytes (salts) gases glucose	-plasma proteins albumins globulins fibrinogen	-cellular stuff red blood cells white blood cells platelets

Solutions: homogeneous mixtures

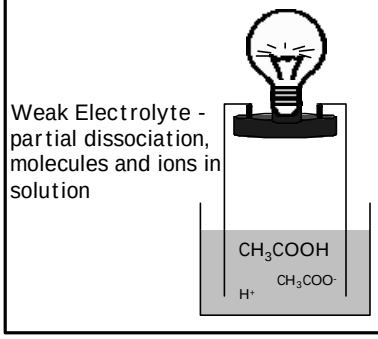
- Absence of settling
- Two components (at the least)-
  - Solute – the substance being dissolved
  - Solvent – the dissolving medium
    - usually water – aqueous solution

can have multi-solute solutions - seawater

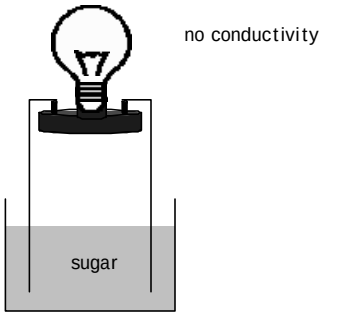
Types of solutes



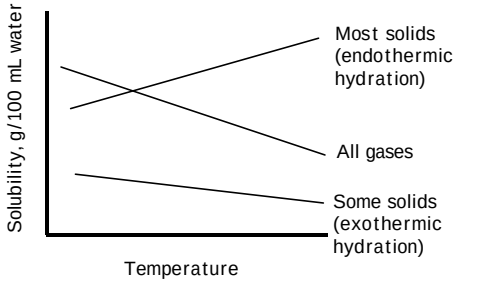
Types of solutes



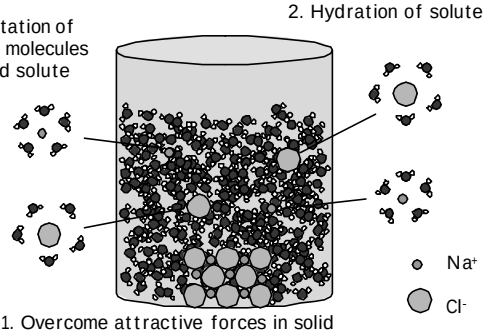
Types of solutes



Solubility of Solutes in Water

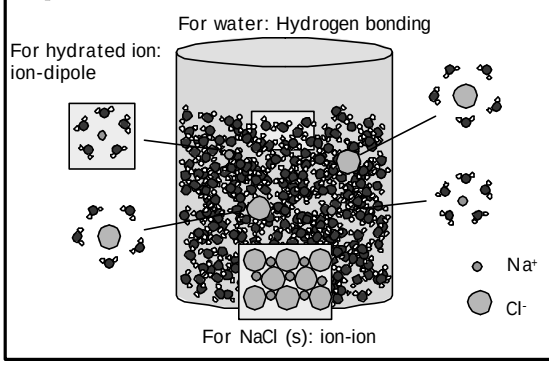


Dissolving process in water



Click here for Chime structure

Types of attractive forces



How do I get sugar to dissolve faster in my iced tea?

Stir, and stir, and stir
- Fresh solvent contact and interaction with solute

Add sugar to warm tea then add ice
- Faster rate of dissolution at higher temperature

Grind the sugar to a powder
- Greater surface area, more solute-solvent interaction

Units of Concentrations

amount of solute per amount of solvent or solution

$$\text{Percent (by mass)} = \frac{\text{g solute}}{\text{g solution}} \times 100 = \frac{\text{g solute} \times 100}{\text{g solute + g solvent}}$$

$$\text{Molarity (M)} = \frac{\text{moles of solute}}{\text{volume in liters of solution}}$$

$$\text{moles} = M \times V_L$$

Examples

What is the percent of KCl if 15 g KCl are placed in 75 g water?

$$\%KCl = 15g \times 100/(15\ g + 75\ g) = 17\%$$

What is the molarity of the KCl if 90 mL of solution are formed?

$$\text{mole KCl} = 15\ g \times (1\ \text{mole}/74.5\ g) = 0.20\ \text{mole}$$

$$\text{molarity} = 0.20\ \text{mole}/0.090L = 2.2\ M\ KCl$$

How many Tums tablets, each 500 mg $CaCO_3$, would it take to neutralize a quart of vinegar, 0.83 M acetic acid (CH_3COOH)?

$$2CH_3COOH(aq) + CaCO_3(s) \rightarrow Ca(CH_3COO)_2(aq) + H_2O + CO_2(g)$$

a quart

moles acetic acid = 0.83 moles/L x 0.95 L = 0.79 moles AA

the mole ratio

mole $CaCO_3$ = 0.79 moles AA x (1 mole $CaCO_3$/2 moles AA)
= 0.39 moles $CaCO_3$

molar mass

mass $CaCO_3$ = 0.39 moles x 100 g/mole = 39 g $CaCO_3$

number of tablets = 39 g x (1 tablet/0.500g) = 79 tablets