Solutions
Day 16

**Definitions**

- A solution is a mixture in which one substance, called the solute is uniformly distributed in another substance called the solvent.
- The most common solvent is water.
- Examples: Kool Aid, vodka

**Properties**

- Homogeneous (uniform)
- Almost always transparent, clear.
- Does not separate on standing
- Cannot be separated by filtration.
- Can be separated by other physical means such as distillation.
- Differing concentrations can be made.

**Solutions, Colloids, Suspensions**

| Property | Solutions | Colloids | Mixtures |
|---|---|---|---|
| example | saline soln. | milk | mud pie |
| Particle size | .1-1 nm | 1-1000 nm | >1000 nm |
| Behavior to light | clear | opaque | opaque |
| Separated by filtration* | no | no | yes |
| settles on standing | no | no | yes |
| homogeneous | yes | borderline | no |

*Using ordinary filter paper

**Solubility**

Solubility: The maximum amount of a substance that will dissolve in a given amount of solvent at a given temperature. Increasing temperature generally increases solubility.

- Saturated: At the maximum
- Unsaturated: Less than the maximum
- Supersaturated: more than the maximum.

## Measuring concentrations

$$\textbf{concentration} = \frac{\textbf{amount of solute}}{\textbf{amount of solution}}$$

Amounts can be in grams, moles, liters, ml

## W/W%

$$\textbf{w/w\%} = \frac{\textbf{grams of solute}}{\textbf{grams of solution}} \times 100\%$$

- A 10% (w/w) solution of glucose means that there are 10 g of glucose in every 100 g of solution. (Parts per hundred)
- If a patient has to be fed 80.0 grams of glucose, how many ml of a 10% solution is needed?

What is the density of water?
What is the density of the soln?

## Similar

$$\textbf{w/v\%} = \frac{\textbf{grams of solute}}{\textbf{ml of solution}} \times 100\%$$

**A 0.8% (w/v) saline solution has 0.8 g of NaCl in every 100 ml.**

$$\textbf{ppm} = \frac{\textbf{grams of solute}}{\textbf{grams of solution}} \times 1{,}000{,}000$$

## V/V%

$$\text{v/v\%} = \frac{\text{ml of solute}}{\text{ml of solution}} \times 100\%$$

- A 20% (v/v%) has 20 ml of ethanol per 100 ml of solution.
- How do you make 2.00L of a 20%(v/v) ethanol solution?

Are volumes additive? 50 ml of acetone +50 ml of water = ml


**Molarity**

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{Liters of solution}}$$

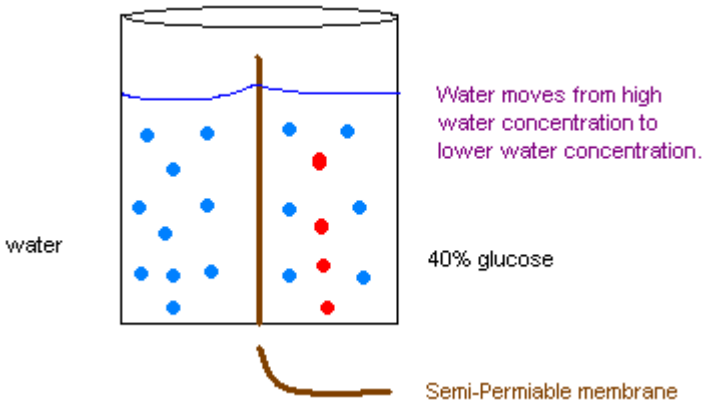
- Units are moles/L given the abbreviation M.
- M*V=moles
- for dilutions $M_1V_1=M_2V_2$

**Making a solution from a solid solute.**
How do you make 2.00L of a 0.660 M NaOH solution?

**A dilution problem.**
How do you make 2.00 L of a 0.800 M HCl solution of a 12.1 M stock solution?

**Osmosis**

**Osmosis:** The flow of a solvent through a semi-permeable membrane into a solution of higher solute concentration.




**More on osmosis**

**Osmotic pressure: The** pressure that prevents the flow of additional water into a more concentrated solution.

- isotonic: same solute concentration
- hypotonic lower solute concentration, water flows into the cell
- hypertonic: higher solute concentration, water flows out of the cell.

1M glucose vs 1M NaCl  1%LiF vs 1%KI

**Henry's Law**

- The solubility of a gas in a liquid is directly proportional to the partial pressure of that gas above the liquid.
- Important in the carbonation of soda.
- The Bends.