Solutions

A. What are solutions?

- Homogeneous Mixtures

B. What are the parts of a solution?

- Solute = gets dissolved
- Solvent = does the dissolving

- Solute + Solvent = Solution

C. Types of Solutions

Example	Solute	Solvent	Solution
Air			
Rubbing Alcohol			
Brass			
Soda			
Seawater			

D. What Terms Are Associated With Solutions?

1. Saturated = a solution containing the *maximum* amount of solute that can be dissolved
2. Unsaturated = a solution containing *less than* the maximum amount of solute

D. What Terms Are Associated With Solutions?

3. Concentrated = a solution with a relatively *large* amount of solute

4. Dilute = a solution with a relatively *small* amount of solute

LIKE DISSOLVES LIKE

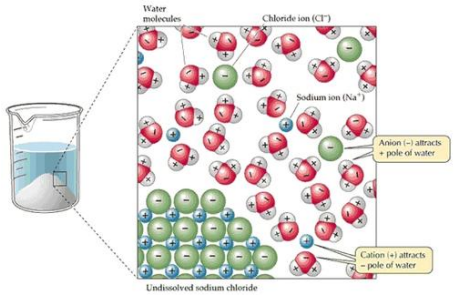
The universal solvent is water.

What substances are soluble in it?

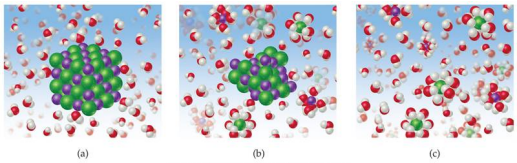
A. Substances with ionic bonds.
   Diagram: Page 476 (bottom of page)

B. Substances with polar covalent bonds.
   Diagram: Page 477 (part b)

SUBSTANCES WITH IONIC BONDS



SUBSTANCES WITH IONIC BONDS



LIKE DISSOLVES LIKE

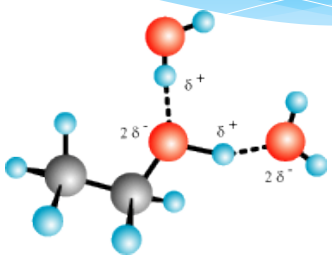
The universal solvent is water.

What substances are soluble in it?

A. Substances with ionic bonds.
   Diagram: Page 476 (bottom of page)

B. Substances with polar covalent bonds.
   Diagram: Page 477 (part b)

SUBSTANCES WITH POLAR COVALENT BONDS



LIKE DISSOLVES LIKE

Why are substances containing nonpolar covalent bonds insoluble in water?

No charges.

LIKE DISSOLVES LIKE

Factors Affecting Rates of Dissolution:

1. Movement
2. Temperature
3. Surface Area

Mass and Volume Percent

Mass Percent:

$$\text{Mass } \% = \frac{\text{grams solute}}{\text{grams solution}} \text{ x } 100\%$$

Note: The solution is the solute and the solvent.

Mass and Volume Percent

Volume Percent:

$$\text{Volume } \% = \frac{\text{mL solute}}{\text{mL solution}} \text{ x } 100\%$$

-or-

$$\text{Volume } \% = \frac{\text{volume of solute}}{\text{volume of solution}} \text{ x } 100\%$$

Note: The solution is the solute and the solvent.

Molarity

Molarity (M):

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{1 liter of solution}}$$

Note: The unit of molarity is always mol/L.

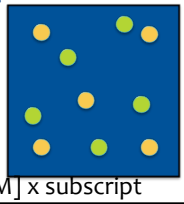
Special Note: "M" is the **unit** of molarity & "M" is also the **symbol** for molar mass

$$\text{Molarity} = \frac{n}{V};\ \frac{\text{mol}}{\text{L}}$$

Molarity

What do aqueous solution of ionic compounds look like?

KCl (K: ● ;Cl: ●)



1.0 M KCl =

1.0 M K^{1+}

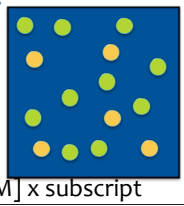
1.0 M Cl^{1-}

Ionic Concentration = [M] x subscript

Molarity

What do aqueous solution of ionic compounds look like?

$MgCl_2$ (Mg: ● ;Cl: ●)



1.0 M $MgCl_2$ =

1.0 M Mg^{2+}

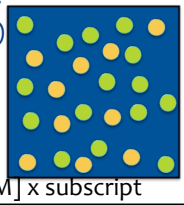
2.0 M Cl^{1-}

Ionic Concentration = [M] x subscript

Molarity

What do aqueous solution of ionic compounds look like?

$Al_2(SO_4)_3$ (Al: ● ;SO_4: ●)



1.0 M $Al_2(SO_4)_3$ =

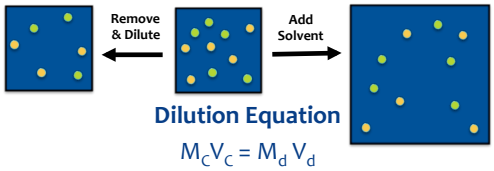
2.0 M Al^{3+}

3.0 M SO_4^{2-}

Ionic Concentration = [M] x subscript

Dilution

What happens when a solution is diluted?



Dilution Equation

$M_C V_C = M_d V_d$

Stock Solution = Starting Concentrate Soln

Dilution Problems

* Equation Review *

Molarity

$$\text{Molarity} = \frac{\text{mol}}{\text{L}}$$

Dilution

$$M_C V_C = M_d V_d$$

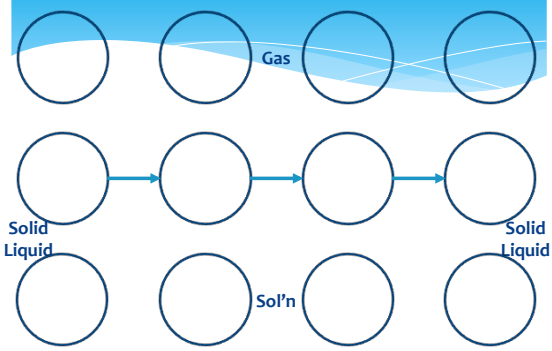
How do I prepare a solution?

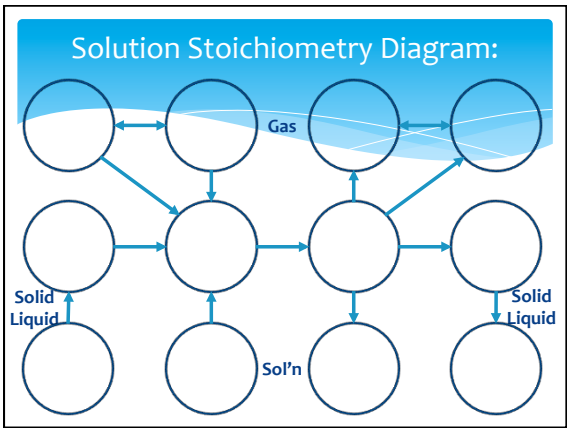
1. Given a solid? $M=\frac{mol}{L} \rightarrow g$
   1. Add the grams of solute to a volumetric flask
   2. Add water to dissolve it.
   3. Fill with water to the calibration mark

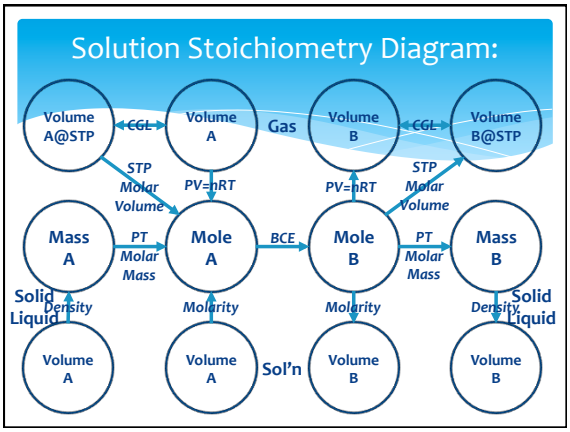
How do I prepare a solution?

2. Given a concentrated solution?
   1. Use $M_C V_C = M_d V_d$
   2. Add V_C to graduated cylinder.
   3. Add water in order to dilute to appropriate volume.

Solution Stoichiometry Diagram:







Solution Stoichiometry
Limiting Reactants – Review

1. Convert each reactant to the first product and compare.
2. The smaller value is due to the limiting reactant.
3. Use the limiting reactant for your calculations.