

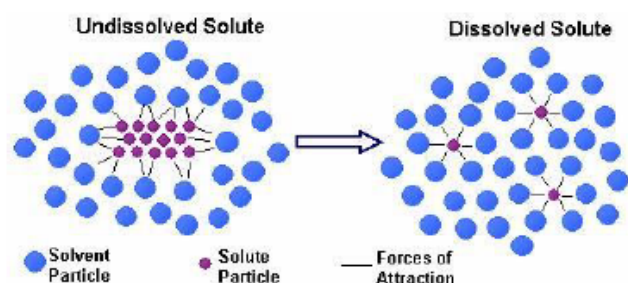
What is a solution?

- A solution is a _____ mixture. It's made of 2 parts:
 - _____ - the part that gets dissolved
 - _____ - the part that does the dissolving
 - Both parts can be solids, liquids, or gases
 - If the solution is aqueous, the _____ is _____.

Examples of solutions:

**Solutions vs. Colloids vs. Suspensions**

Solutions	Colloids	Suspensions
<ul style="list-style-type: none"> Homogeneous mixture Made of particles that are small in size (diameters from 0.1 – 2 nm) Transparent May be colored Cannot be separated by filtration Do not separate on standing 	<ul style="list-style-type: none"> Homogeneous mixture Made of particles that are larger in size (diameters from 2 – 500 nm) Particles are large enough to scatter light Cannot be separated by filtration Often murky or opaque Do not separate on standing 	<ul style="list-style-type: none"> Not really homogenous b/c particles do separate on standing Made of larger particles that can be seen (sometimes) by the naked eye
Ex: salt water, soda, kool-aid	Ex: milk, fog	Ex: blood, paint, aerosol sprays

Dissolving

Things that are similar will dissolve in each other. Remember this by _____ dissolves _____

This means that:

- Solutes that are _____ will dissolve in solvents that are _____.
- Solutes that are _____ or _____ will dissolve in solvents that are _____.

Examples: CCl_4 is a solvent that is _____.
 Water is a solvent that is _____.

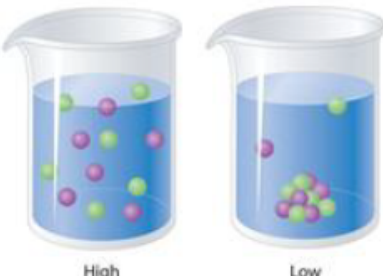
Which of these solutes should dissolve in CCl_4 and which should dissolve in water?**Dissociating**

- Dissociation happens when a compound breaks down into the _____ that make it up. This is different from decomposition! Decomposition happens when a compound breaks down into the _____ that make it up.
 - Write the reaction for the decomposition of sodium chloride: _____
 - Write the reaction for the dissociation of sodium chloride: _____
- Compounds that are _____ will dissociate because they are made of _____. (This is why ionic compounds conduct electricity when dissolved in water!)
- Compounds that are _____ will not dissociate.
- Dissociation doesn't happen until the compound is dissolved in a solvent (usually water)!

Which of these solutes will dissociate when dissolved in water?



Solubility Rules:

Soluble Salts Contain: (these salts will dissolve in water)		Insoluble Salts Contain: (these salts will not dissolve at all in water, or only dissolve a tiny bit)
Nitrate (NO_3^-) Any alkali metal ion (Li^+ , Na^+ , K^+ , Cs^+ , Rb^+) Ammonium (NH_4^+) Chloride, bromide, and iodide (Unless paired with Ag^+ , Pb^{2+} , or Hg_2^{2+}) Sulfate (unless paired with Ba^{2+} , Pb^{2+} , Hg_2^{2+} , or Ca^{2+})		Hydroxide (unless paired with an alkali metal) Sulfide (S^{2-}), Carbonate (CO_3^{2-}) Chromate (CrO_4^{2-}) Phosphate (PO_4^{3-})

Determine whether the following salts (ionic compounds) are soluble in water:

NaCl

AgBr

BaSO_4

$\text{Cu}(\text{OH})_2$

FeCO_3

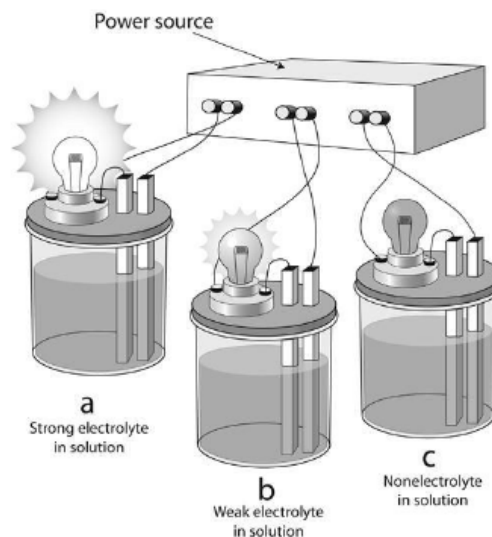
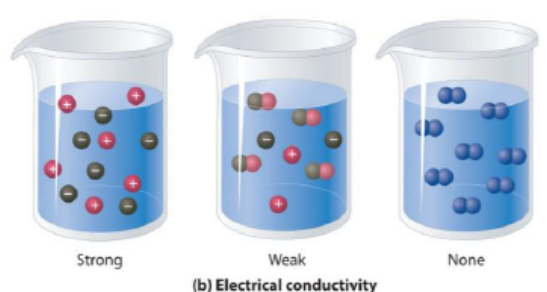
LiBr

PbCl_2

Electrolytes

Electrolyte - _____

Properties of an Electrolyte:



Factors Affecting Solubility

- Structure/Polarity**

The structure and polarity of a molecule determine the _____ forces present which determine how likely the molecule is to dissolve. ("Like dissolves like.")

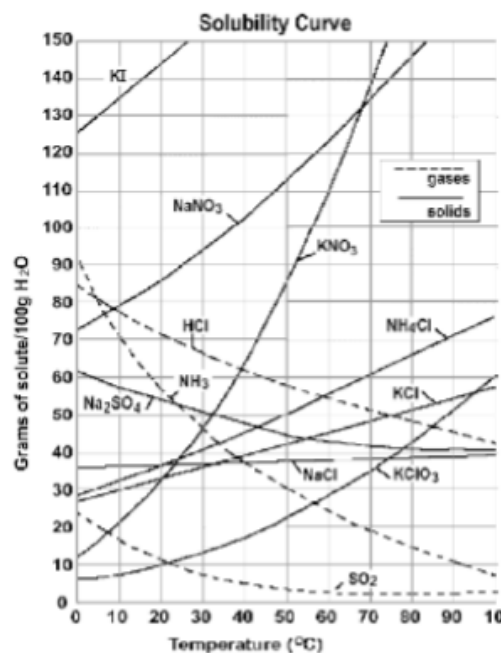
- Pressure**

- Pressure does not affect the solubility of _____.
- Pressure has a huge effect on the solubility of _____.
- As pressure increases, the solubility of a gas _____.

- Temperature**

Temperature increases solubility of solids, but decreases the solubility of gases. Solubility Curves (left) show this trend.

- Which solid is most soluble at 50°C ? _____
- How many grams of SO_2 will dissolve at 30°C ? _____
- How many grams of KNO_3 will dissolve in 200 g of water at 42°C ? _____



Concentration of Solutions

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{L of solution}} \quad \text{Mass Percent} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100$$

Ex: A solution is prepared by mixing 1.00 g of ethanol with 100.0 g of water. Calculate the mass percent of the ethanol solution.

Ex: Calculate the molarity of a solution prepared by dissolving 11.5 g of solid NaOH in enough water to make 1.50 L of solution.

Diluting Solutions

When diluting solutions, the goal is to make the solution LESS concentrated. To do this more SOLVENT is added – the amount of SOLUTE stays the same.

In the lab, to dilute a solution, we generally take a sample from a more concentrated solution and add more solvent (usually water) to it. To figure out how much of the concentrated solution we need, we use this formula:

$$M_1V_1 = M_2V_2$$

Ex: What volume of a 6.0 M HCl solution is needed to make 100 mL of a 2.0 M HCl solution?

Colligative Properties

Colligative properties – properties of a solution that depend on the concentration of the solute particles in a solution

*Adding a solute to a solvent always lowers the vapor pressure. The more solute is added, the more the vapor pressure will be lowered.

*A liquid boils when vapor pressure equals external (usually atmospheric) pressure. If adding a solute lowers vapor pressure, the temperature of the solvent must be greater to reach vapor pressure required for boiling. So, the boiling point will be increased if a solute is added. This is called boiling point elevation. The more solute is added, the higher the boiling point will be.

*Freezing point is lowered with the addition of a solute. This is called freezing point depression. The more solute is added, the lower the freezing point will be.

