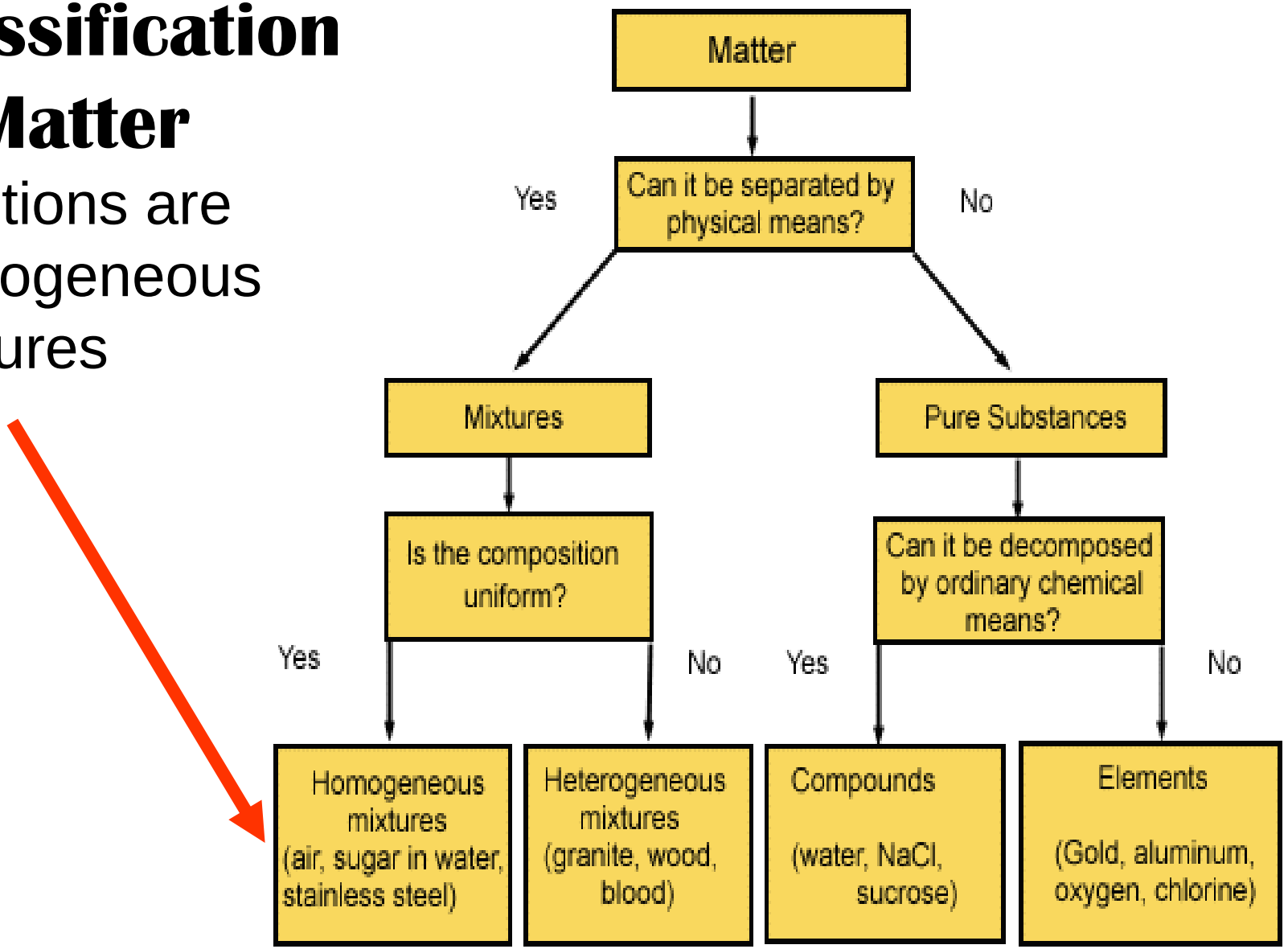
N-39 - Properties of Solutions

Target: I can use vocabulary related to solutions, and can describe some properties/behaviors of solutions.

Link to YouTube Presentation: https://youtu.be/rbui4x_CyvA

Classification of Matter

Solutions are homogeneous mixtures



Solute

A solute is the substance that is being dissolved in a solution.

Salt in salt water *Sugar in soda drinks*

Carbon dioxide in soda drinks

Solvent

A solvent is the thing that something is being dissolved into.

Water in salt water *Water in soda*

Solution

The solute + solvent combined is then called the “solution”

Salt water	*Soda*

Types of Solutions

Solution Phase	Solute Phase	Solvent Phase	Example
Gaseous Solutions	Gas Liquid *Solid**	Gas Gas *Gas**	Air (mostly N_2 and O_2) Humid air (H_2O droplets in air) *Moth balls**
Liquid solutions	Gas Liquid Solid	Liquid Liquid Liquid	Soda (CO_2 in H_2O) Rubbing Alcohol (alcohol in H_2O) Seawater (NaCl in H_2O)
Solid solutions	*Gas** Liquid Solid	*Solid** Solid Solid	*Gas Stove Lighter (H_2 and Pd)** Dental fillings and other Amalgams Brass Alloy (Zn in Cu)
*Combinations in italics and with a * are rare, very few "normal" examples. Most charts leave them off because there are so few examples – they are still possible, just rare*			

Colloids…not really solutions… tricky…

- When “large” particles are suspended in a substance (*5 – 200 nm is considered “big”)*
- Fat molecules suspended in milk, whipped cream, butter, mayo
- Air bubbles suspended in foam rubbers
- Color particles suspended in glass, paint, cosmetics,
- Fog, smoke, clouds, aerosols

Dissolve

When molecules of solute are surrounded by molecules of solvent and are pulled apart from other solute molecules

Dissociate

When an ionic compound has it's ionic bond disrupted by solvent molecules and breaks into its individual ions

Electrolytes:

Ionic solutes that dissociate (come apart) into ions in a solution

$$NaCl_{(s)} \rightarrow Na^{+}_{(aq)} + Cl^{-}_{(aq)}$$

They can conduct electricity because there are charged particles for the electrons to move between!

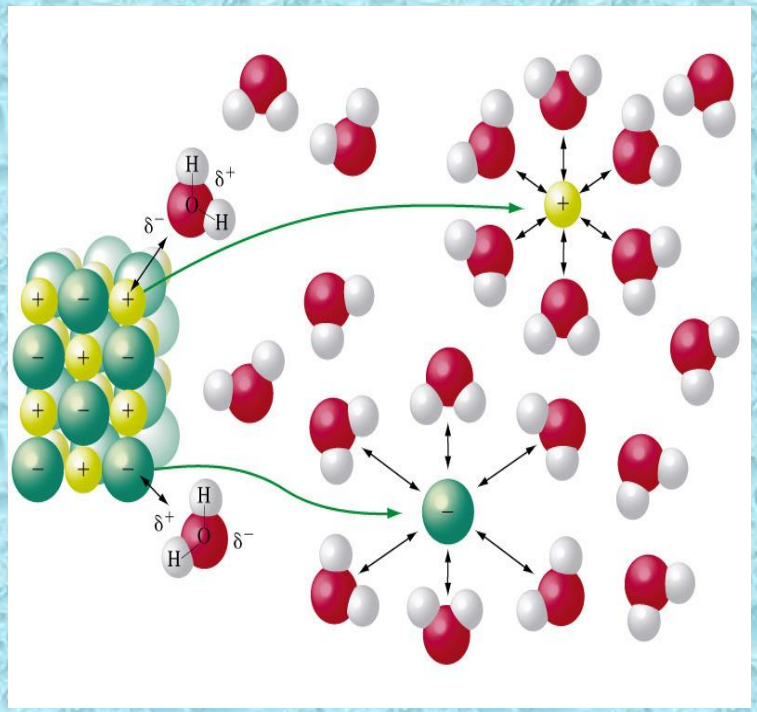
Non-Electrolytes:

Covalent solutes that do not dissociate,
but that can still potentially dissolve in a solvent

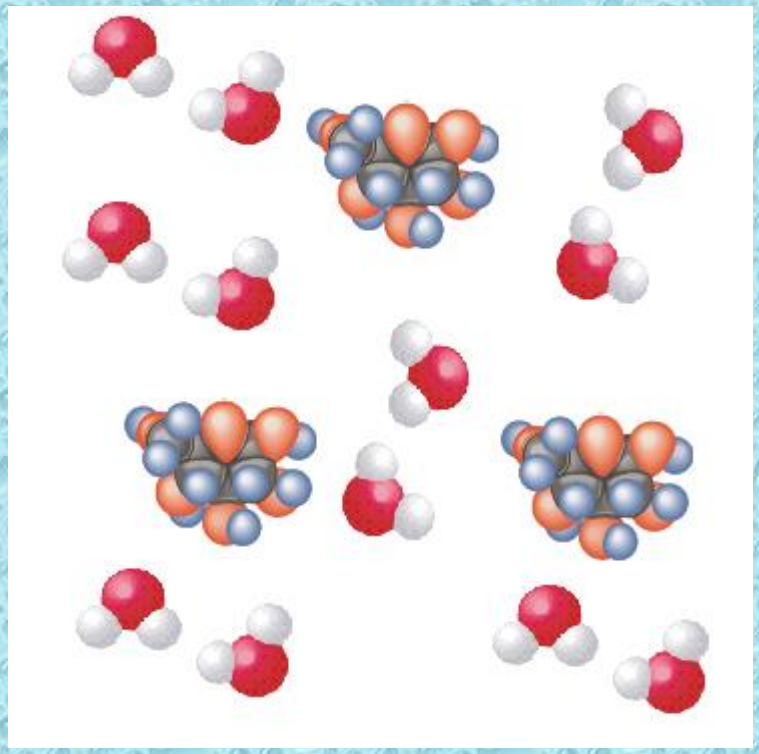
$$C_6H_{12}O_6(s) \rightarrow C_6H_{12}O_6(aq)$$

Which is dissolving and which is dissociating?

Dissociating



Dissolving



Dissolving Process

Heat of Solution

Can either be exothermic or endothermic

"Like Dissolves Like"

- Polar things dissolve in polar things,
- Non-polar things dissolve in non-polar things

Solubility Chart

How do you know which substances will dissolve (be soluble)? Use the chart!

MEMORIZE THE ALWAYS SOLUBLE ONES!

Solubility of Some Ionic Compounds in Water

Always Soluble		
Alkali metals =	Li^+, Na^+, K^+, Rb^+, Cs^+	AAA CNP
Ammonium =	NH_4^+	
Acetate =	$C_2H_3O_2^-$	
Chlorate =	ClO_3^-	
Nitrate =	NO_3^-	
Perchlorate =	ClO_4^-	
Generally Soluble		
Cl^-, Br^-, I^-	Soluble *except*: Ag^+, Pb^{2+}, Hg_2^{2+}	AP-H
F^-	Soluble *except*: Ca^{2+}, Ba^{2+}, Sr^{2+}, Pb^{2+}, Mg^{2+}	CBS-PM
Sulfate = SO_4^{2-}	Soluble *except*: Ca^{2+}, Ba^{2+}, Sr^{2+}, Pb^{2+}	CBS-P
Generally Insoluble		
O^{2-}, OH^-	Insoluble *except*: Alkali metals and NH_4^+	AA
	Somewhat soluble: Ca^{2+}, Ba^{2+}, Sr^{2+}	CBS
CO_2^{2-}, CO_3^{2-} S^{2-}, SO_3^{2-} PO_4^{3-} CrO_4^{2-}, $Cr_2O_4^{2-}$	Insoluble *except*: Alkali metals and NH_4^+	AA

Not Soluble = forms precipitate

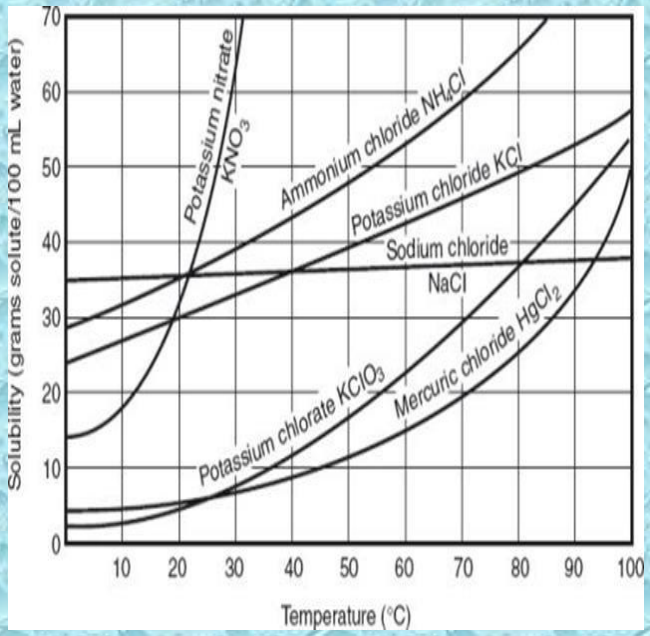
Soluble = dissolves in water (aqueous)

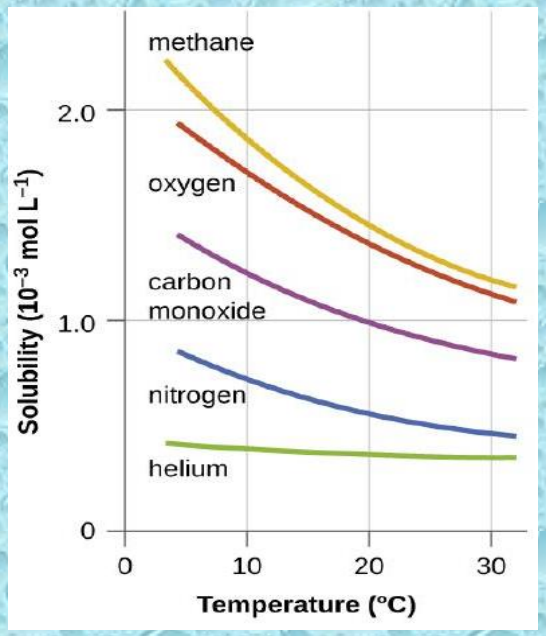
Solubility

The amount of solute that can be dissolved at a given temperature.

You can't just dissolve infinite amounts of solute!

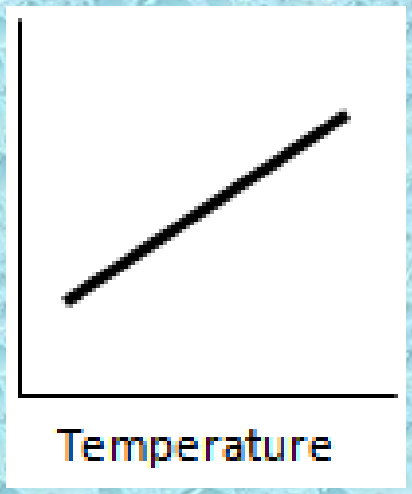
Solubility Curves



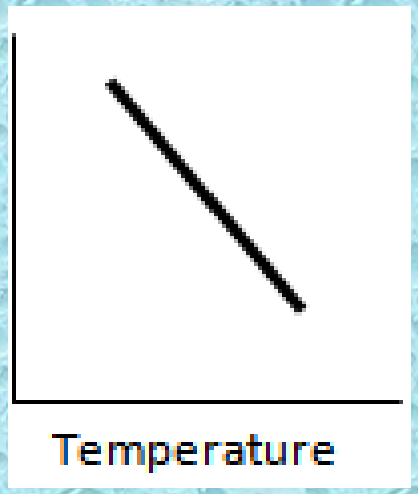


Changes to Solubility

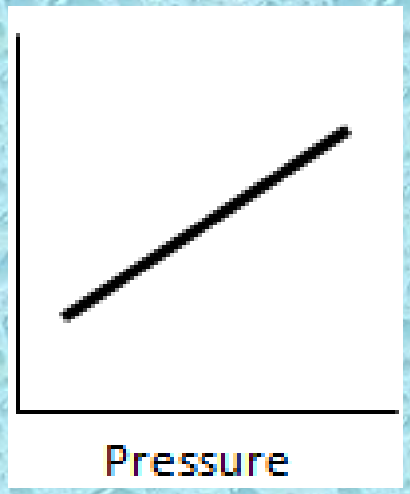
Temperature and Pressure can affect the amount of solute that can be dissolved. Gases and solids are affected differently sometimes.



(most) Solids



Gases



Gases

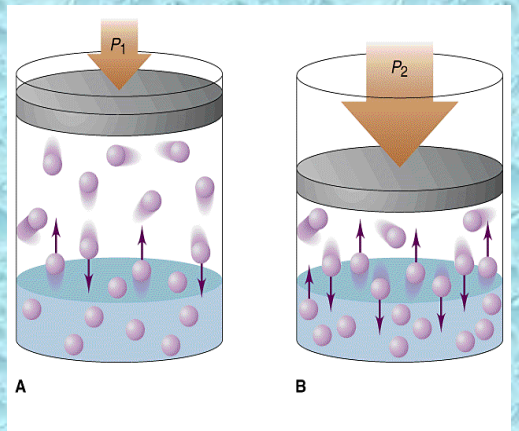
Increasing Rate of Dissolution (how FAST something dissolves)

Solids

- Increase temperature for more collisions
- Stir it to expose more surface area
- Crush it up so more surface area

Gases

- Decrease temperature
- Increase pressure

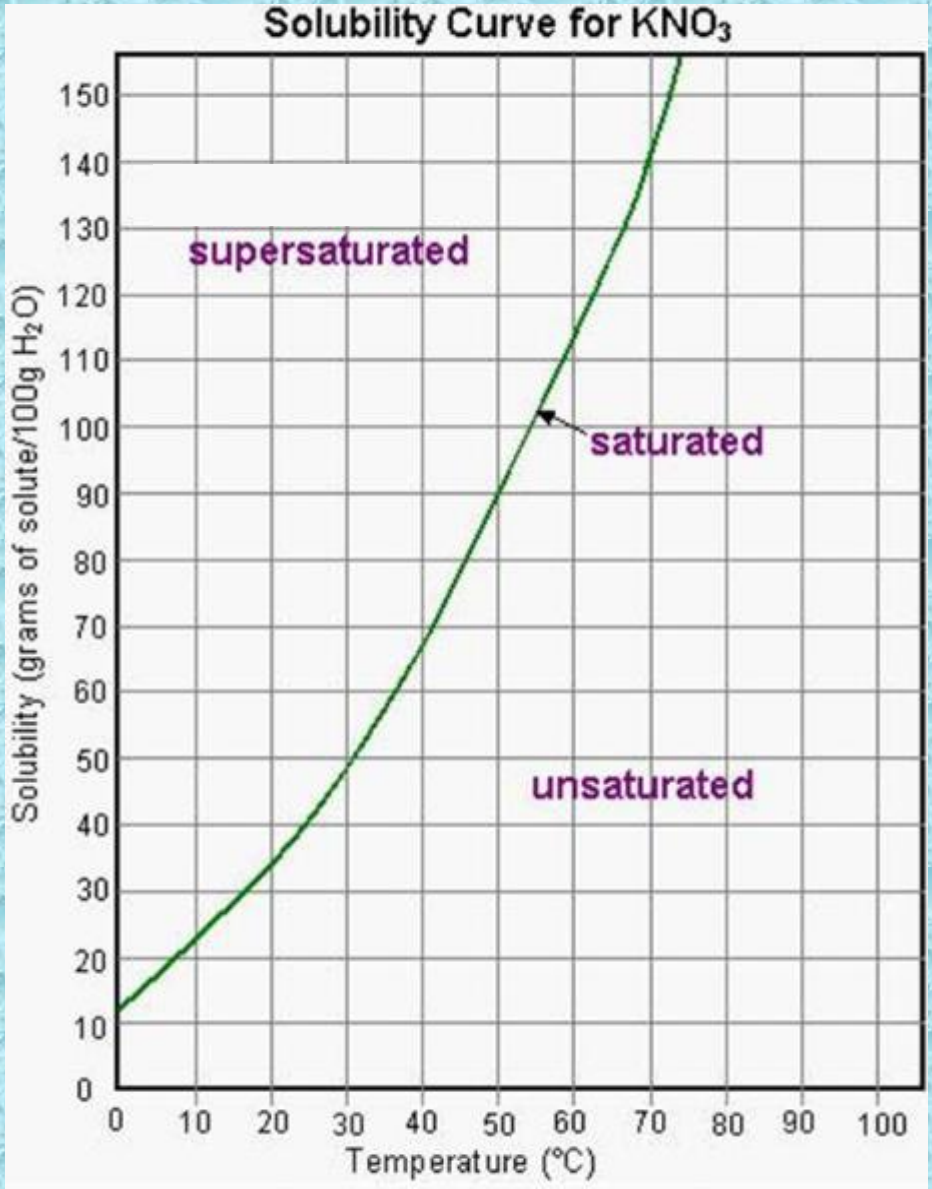


Saturation

- **Saturated solution:** The maximum amount of solute dissolved
- **Unsaturated solution:** Less than the maximum amount of solute dissolved
- **Supersaturated solution:** More than the maximum amount of solute dissolved
  http://www.youtube.com/watch?v=0wifFbGDv4I

Saturation

Can identify saturation points using a solubility curve.



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