

## Unit 5: Solutions, Acids & Bases

### Solutions:

**What is a solution?** Solutions are mixture and they come in a variety of forms. However, every solutions is made of a solute and a solvent.

**Solute:** The substance that is being dissolved in the solutions

**Solvent:** The substance that dissolves the solute.

Example: Salt Water

Solute: *Salt*  
Solvent: *water*

Example: Sweet Tea

Solute: *sugar*  
Solvent: *water*

Example: Air

Solute: *oxygen*  
Solvent: *nitrogen*

Phase of Solvent	Phase of Solute	Example:
Gas	Gas	<i>Air</i>
<del>Liquid</del> <i>GAS</i>	<del>Gas</del> <i>liquid</i>	<i>Soda</i>
Liquid	Liquid	<i>gasoline</i>
Liquid	Solid	<i>Dental Fillings</i>
Solid	Solid	<i>steel</i>

How do substances dissolve?

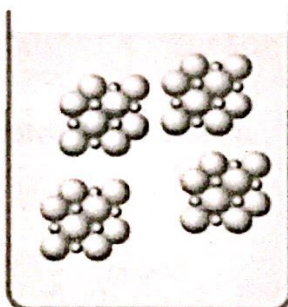
*they dissociate - they break up into ions in the solution*

- sodium ion
- chloride ion



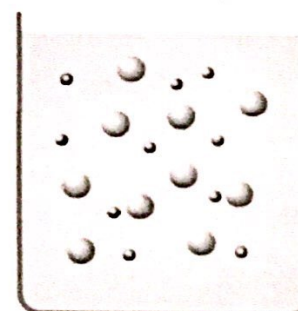
A

*Salt as a solid*



B

*Begins to break apart into smaller molecules*



C

*Are broken down into positive and negative ions.*



**Properties of solutions:**

1. **Solubility:** the maximum amount of solute that will dissolve in a given amount of solvent at a particular temperature and pressure.

<u>Term</u>	<u>Example</u>	<u>Definition</u>
Soluble:	Salt Water	<u>is able to be dissolved</u>
Insoluble:	Oil and Water	<u>cannot be dissolved</u>

Factors that affect the dissolving rate (solubility) of solids in liquids:

a. **Collisions:**

↑ collisions    ↑ solubility

b. **Temperature:**

↑ temp    ↑ solubility

c. **Mixing/Agitation:**

↑ Agitation    ↑ solubility

d. **Surface Area:**

↑ Surface area    ↑ solubility  
(to increase surface area you make the solid smaller)

e. **Similarity of the solvent and solute:**

"like dissolves like"

- Polar dissolves polar
- nonpolar dissolves nonpolar

H<sub>2</sub>O is polar  
and oil is non-polar

f. **Catalyst/Emulsifiers (ex. Eggs in cakes)/ Inhibitors:**

↳ Ex. laundry detergent

- allows things to dissolve in water that wouldn't typically

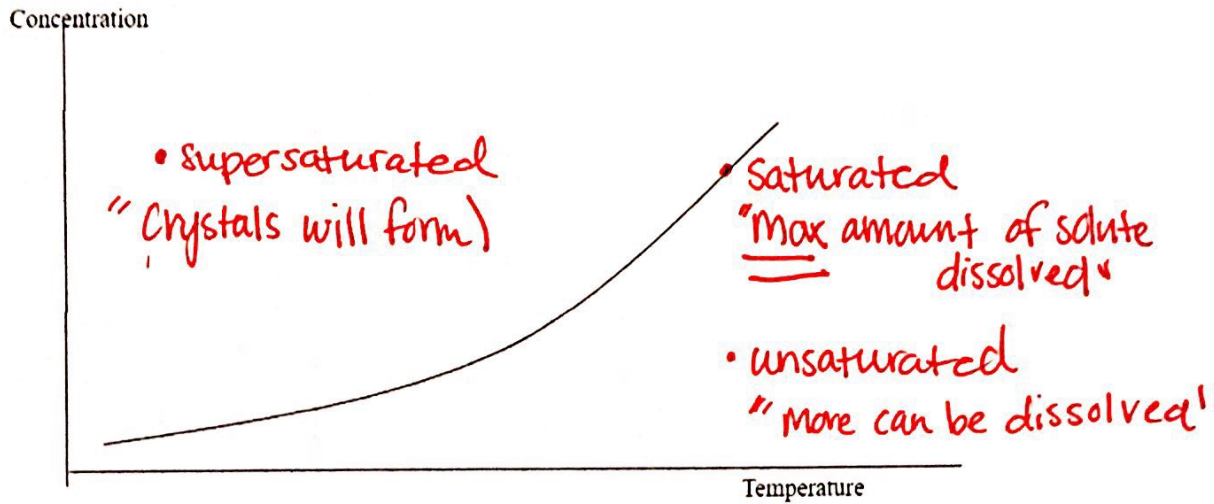
g. **Pressure:**

★ does not affect a solid's solubility

↑ pressure    ↑ gases solubility.

2. **Concentration:** measure of how much solute has dissolved in a solution.

- a. **Unsaturated:** more can dissolve
- b. **Saturated:** No more can dissolve
- c. **Supersaturated:** crystals formed when we cooled the solution



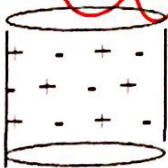
3. **Conductivity:** a measure of a material's ability to conduct electrical current, or to allow the movement of electrical charges through it.

- a. **Ionic Compounds:** conduct electricity, because of charged ions
- b. **Covalent Compounds:** do not conduct electricity - no charged ions

Question: What makes salt water conduct, but not sugar water?

NaCl (ionic)

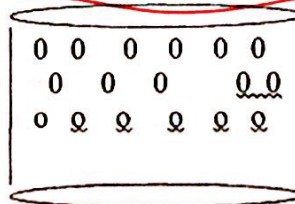
Ions: Na<sup>+</sup>, Cl<sup>-</sup>



The charged particles (ions) are attracted to the opposite terminals, so they move in the water, therefore conducting electricity

C<sub>12</sub>H<sub>22</sub>O<sub>11</sub> (covalent)

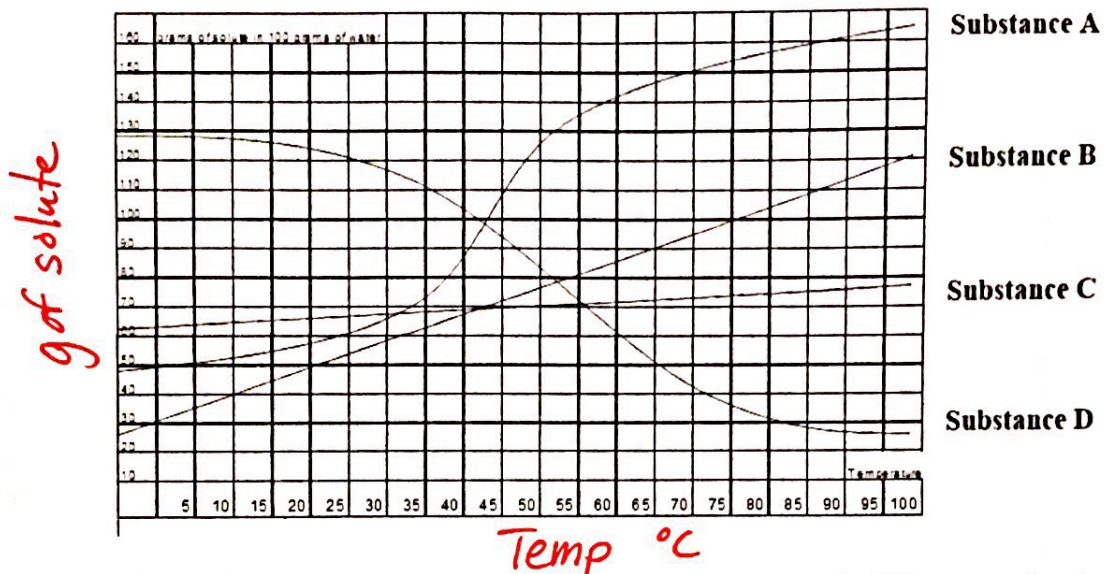
Uncharged molecules



The uncharged particles (molecules) are not attracted to the terminals (do not move), so electricity is not conducted.



4. **Solubility Curve:** a graph that shows how solubility changes with temperature. Four solid substances (A, B, C, and D) are dissolved at various temperature in water. The graph below indicates the maximum amount of each substance that will dissolve at various temperatures.



1. If we dissolve 80 grams of Substance A in the graph above in 100 grams of water at 40°C will the solution be unsaturated, saturated, or supersaturated?

unsaturated

2. Which of the substances in the graph above is most soluble at 60°C? 20°C?

A ←      → D

3. What is the maximum mass of Substance D in the graph above that can dissolve in 100 grams of water at 70°C?

45g

4. 40 grams of Substance B is dissolved in 100 grams of water at 40°C.  
 a. Would it be possible to dissolve this much solute in 25 grams of water at the same temperature? Explain your reasoning?

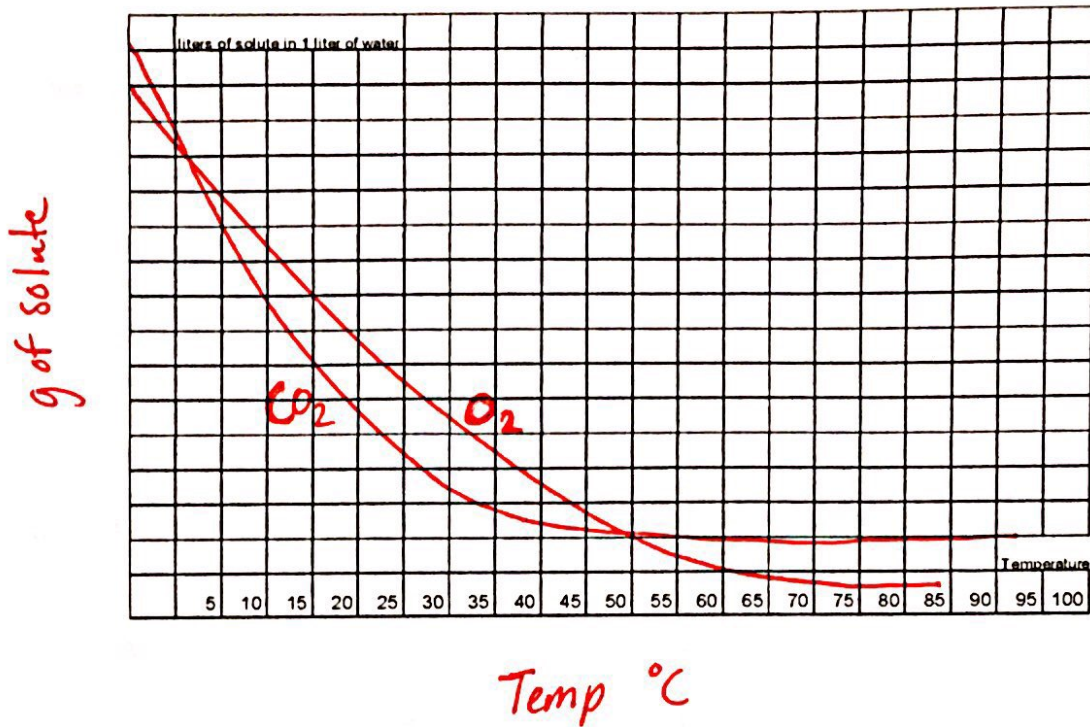
No  $\frac{60}{100} = \frac{15}{25}$

- b. At what temperature would crystals start to form as we cooled the solution?

7°C

**Solubility of Gases:** The data to the right illustrates the solubility of two gases at various temperatures. Scale the graph below, plot the data, and draw a best fit curve for each substance.

Substance	Solubility (L solute L H <sub>2</sub> O)		
	0°C	20°C	60°C
Carbon Dioxide	1.713	0.878	0.359
Oxygen	0.048	0.031	0.019



1. As a general rule, what do you think happens to the solubility of gases as temperature increases in the solution?

↑ temp      ↓ decreases solubility of gases

2. Why do you think this is true?

particles have too much kinetic energy to be dissolved into something.

### Acids and Bases:

**Acid:** any substance that releases hydrogen ions (H<sup>+</sup>) ions in a solution

**Base:** any substance that releases hydroxide ions (OH<sup>-</sup>) in a solution

Examples: HCl



**Strong Acids/Bases:**

produce lots of H<sup>+</sup> & OH<sup>-</sup> ions

NaOH



**Weak Acids/Bases:**

produce only a few H<sup>+</sup> & OH<sup>-</sup> ions



**Indicators:** substances that can be used to determine whether a solution is acidic or basic. Most indicators undergo a color change when they react with the  $H^+$  and  $OH^-$  ions in the solutions.

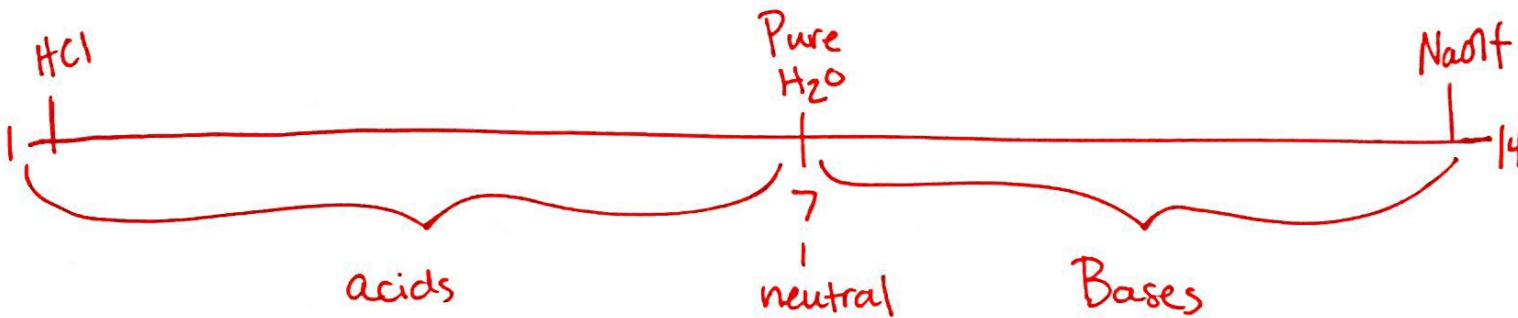
Acids:

red

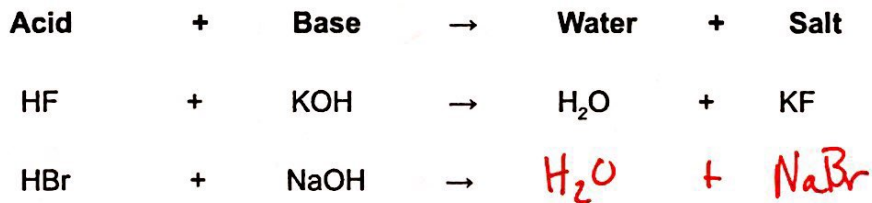
Bases:

blue

**PH Scale:** a way to measure the concentration of  $H^+$  ions in a solution



**Acid/Base Neutralization reactions:** When acids and bases react, water and a salt are formed. The reaction is called a neutralization.



Acids		Bases
Sour	Taste	Bitter
Squeaky	Touch	Slippery
Yes	Reaction with Metals	No
YES	Electrical Conductivity	YES
Red	Litmus Paper Test	Blue
1-7	pH	7-14
$H^+$	Type of ion formed in water	$OH^-$
$HCl + KOH \rightarrow H_2O + KCl$ <span style="margin-left: 200px;">(salt)</span>		