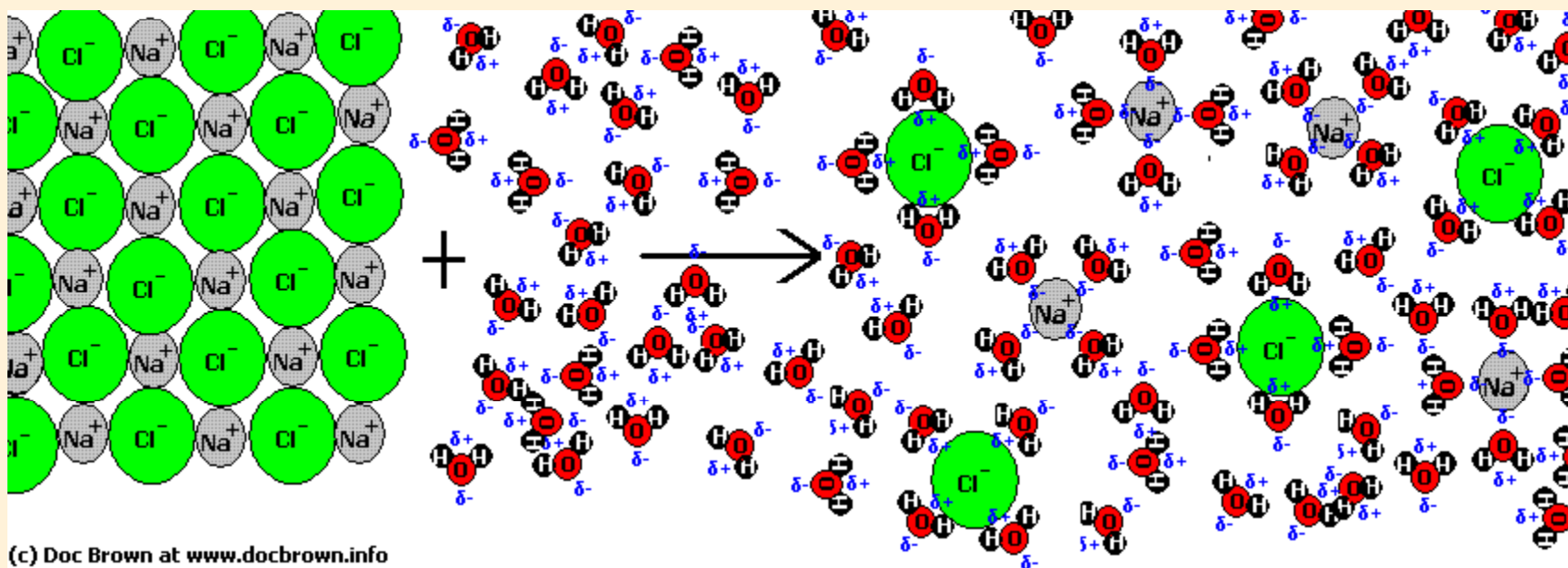


## Notes 9 - The Solvation Process

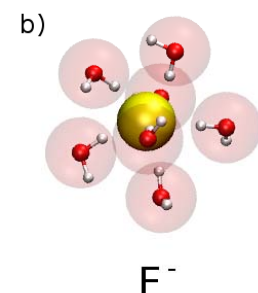
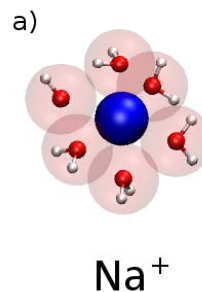
**MAIN** Idea

Factors such as temperature, pressure, and polarity affect the formation of solutions.

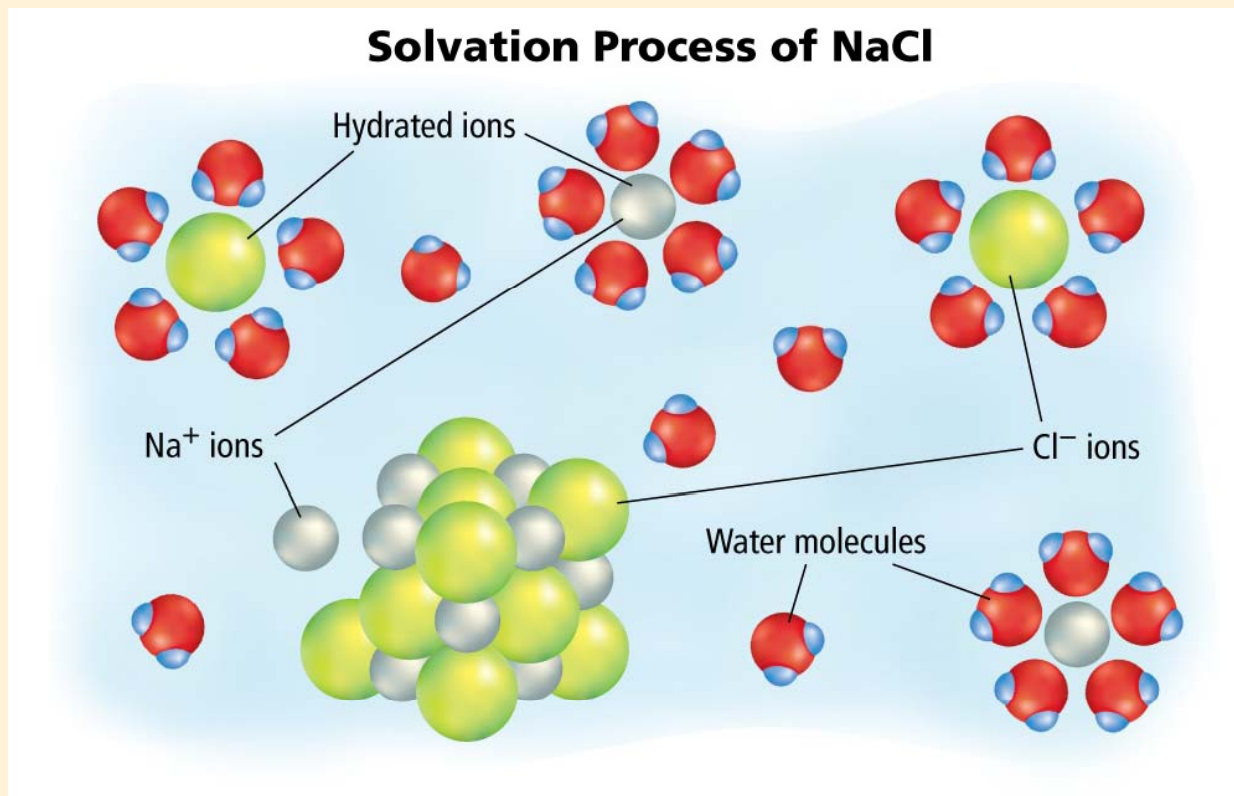


## The Solvation Process

- **Solvation** is the process of surrounding solute particles with solvent particles to form a solution.
- Solvation in water is called hydration.
- The attraction between dipoles of a water molecule and the ions of a crystal are greater than the attraction among ions of a crystal.



## The Solvation Process (cont.)

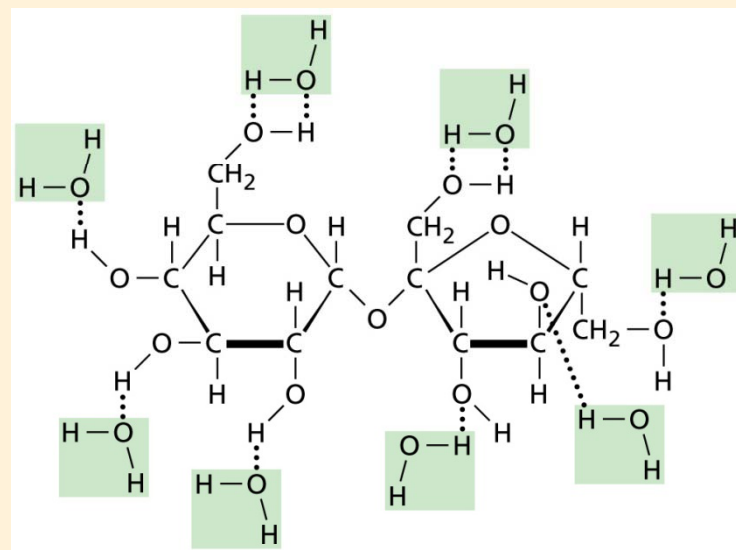


Concepts In Motion 



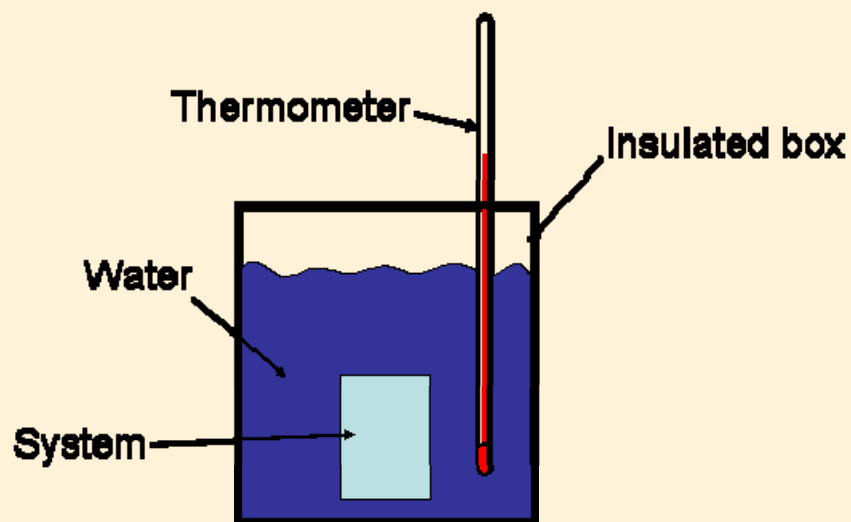
## The Solvation Process (cont.)

- Sucrose molecules have several O–H bonds, which become sites for hydrogen bonding with water molecules.
- Oil does not form a solution with water because there is little attraction between polar water molecules and nonpolar oil molecules.



## The Solvation Process (cont.)

- During solvation, the solute must separate into particles and move apart, which requires energy.
- The overall energy change that occurs during solution formation is called the heat of solution.



## Factors That Affect Solvation

- Stirring or shaking moves dissolved particles away from the contact surfaces more quickly and allows new collisions to occur thereby increasing the rate of solvation.





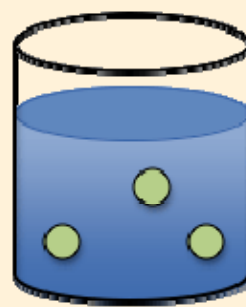
## Factors That Affect Solvation

- Breaking the solute into small pieces increases surface area and allows more collisions to occur thereby increasing the rate of solvation.
- As temperature increases, rate of solvation increases.

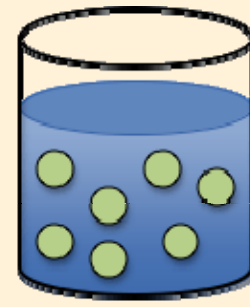


## Solubility

- Solubility depends on the nature of the solute and solvent.
- **Unsaturated solutions** are solutions that contain less dissolved solute for a given temperature and pressure than a saturated solution.



Unsaturated



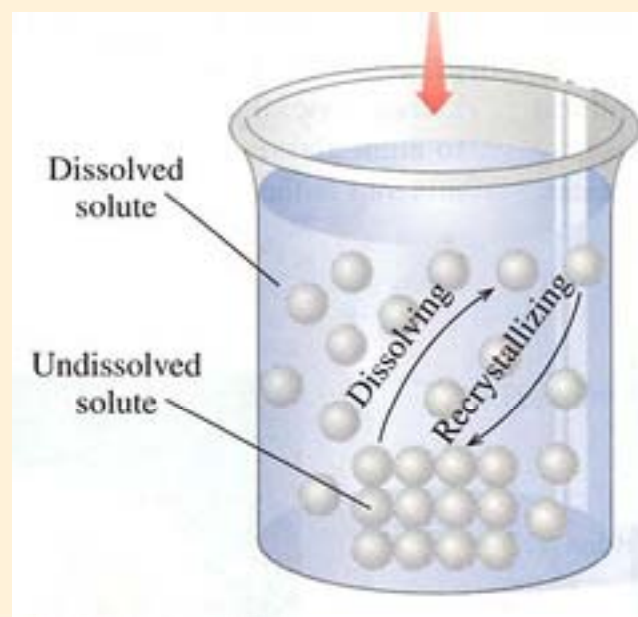
Saturated



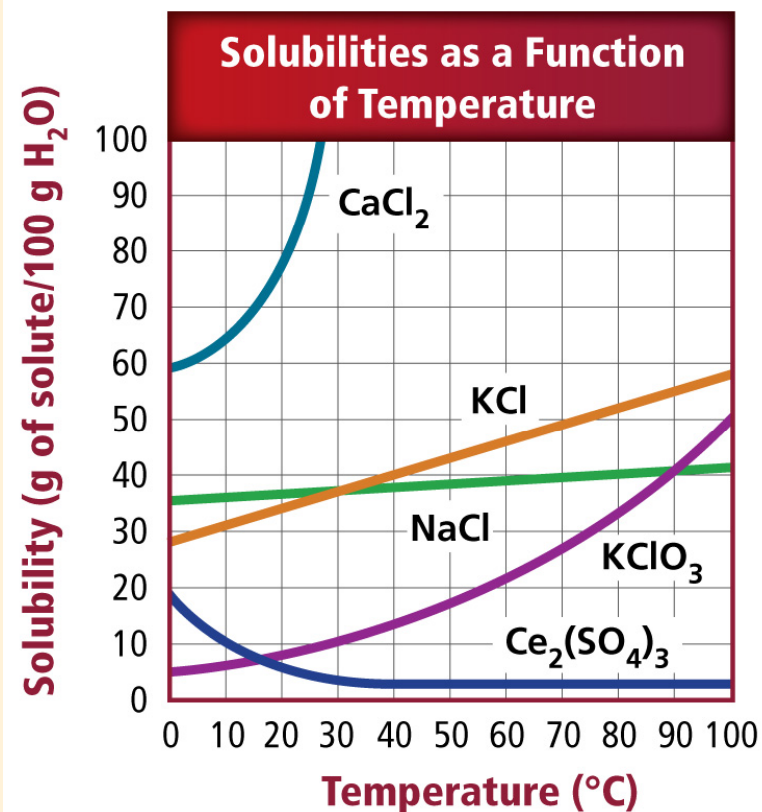


## Solubility (cont.)

- **Saturated solutions** contain the maximum amount of dissolved solute for a given amount of solution at a specific temperature and pressure.
- Solubility is affected by increasing the temperature of the solvent because the kinetic energy of the particles increases.

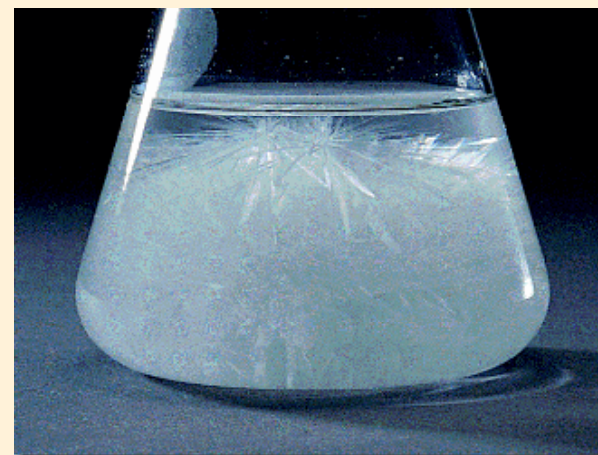


## Solubility (cont.)



## Solubility (cont.)

- A supersaturated solution contains more dissolved solute than a saturated solution at the same temperature.
- To form a supersaturated solution, a saturated solution is formed at high temperature and then slowly cooled.
- Supersaturated solutions are unstable.



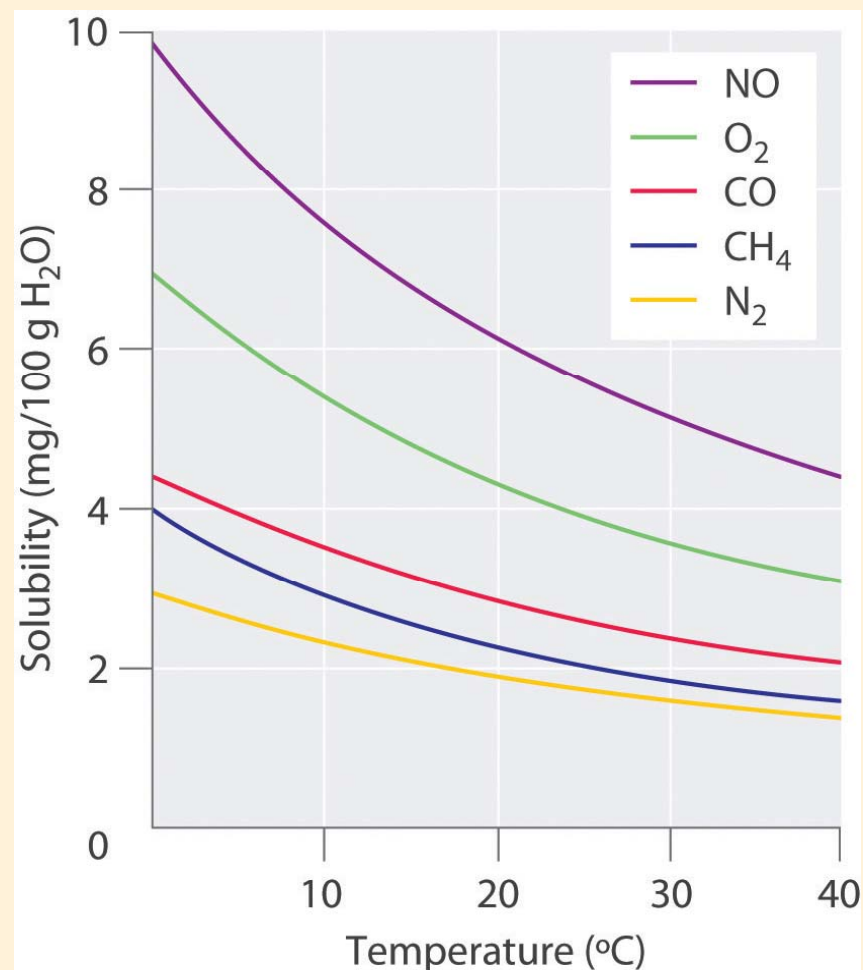
## Solubility (cont.)

Substance	Formula	Solubility (g/100 g H <sub>2</sub> O)*			
		0°C	20°C	60°C	100°C
Aluminum sulfate	Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	31.2	36.4	59.2	89.0
Barium hydroxide	Ba(OH) <sub>2</sub>	1.67	3.89	20.94	--
Calcium hydroxide	Ca(OH) <sub>2</sub>	0.189	0.173	0.121	0.076
Lithium sulfate	Li <sub>2</sub> SO <sub>4</sub>	36.1	34.8	32.6	--
Potassium chloride	KCl	28.0	34.2	45.8	56.3
Sodium chloride	NaCl	35.7	35.9	37.1	39.2
Silver nitrate	AgNO <sub>3</sub>	122	216	440	733
Sucrose	C <sub>12</sub> H <sub>22</sub> O <sub>11</sub>	179.2	203.9	287.3	487.2
Ammonia*	NH <sub>3</sub>	1130	680	200	--
Carbon dioxide*	CO <sub>2</sub>	1.713	0.878	0.359	--
Oxygen*	O <sub>2</sub>	0.048	0.031	0.019	--

\* L/1 L H<sub>2</sub>O of gas at standard pressure (101 kPa)

## Solubility (cont.)

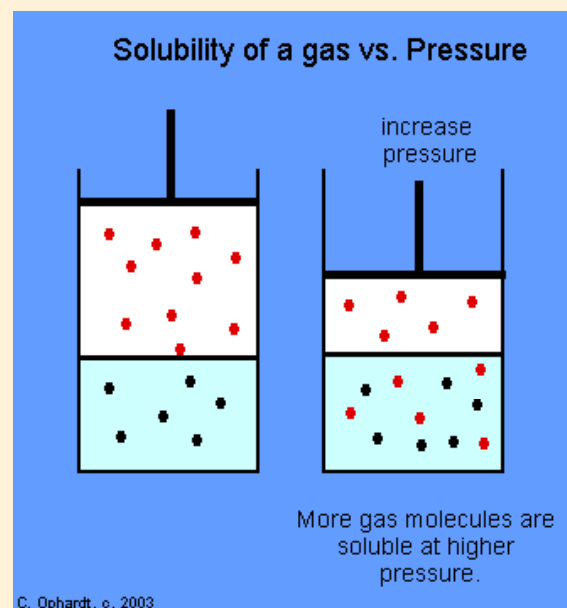
- Gases are less soluble in liquid solvents at high temperatures.
- Solubility of gases increases as its external pressure is increased.



## Solubility (cont.)

- **Henry's law** states that at a given temperature, the solubility ( $S$ ) of a gas in a liquid is directly proportional to the pressure ( $P$ ).

$$\frac{S_1}{P_1} = \frac{S_2}{P_2}$$





For a given amount, which type of solution contains the **LEAST** amount of solute?

- A. solvated
- B. saturated
- C. supersaturated
- D. unsaturated



At a given temperature, the solubility of a gas is directly proportional to what?

A. volume

B. mass

C. molarity

D. pressure

