

Do-Now (2/26):

1. As the temperature of a liquid increases, what happens to its vapor pressure? Explain.
2. What type(s) of intermolecular forces exist between molecules of ethanoic acid? (You may want to use Ref. Table H to answer)
3. What is the B.P. of propanone at .6 atm? (You may want to use Ref. Table H to answer)

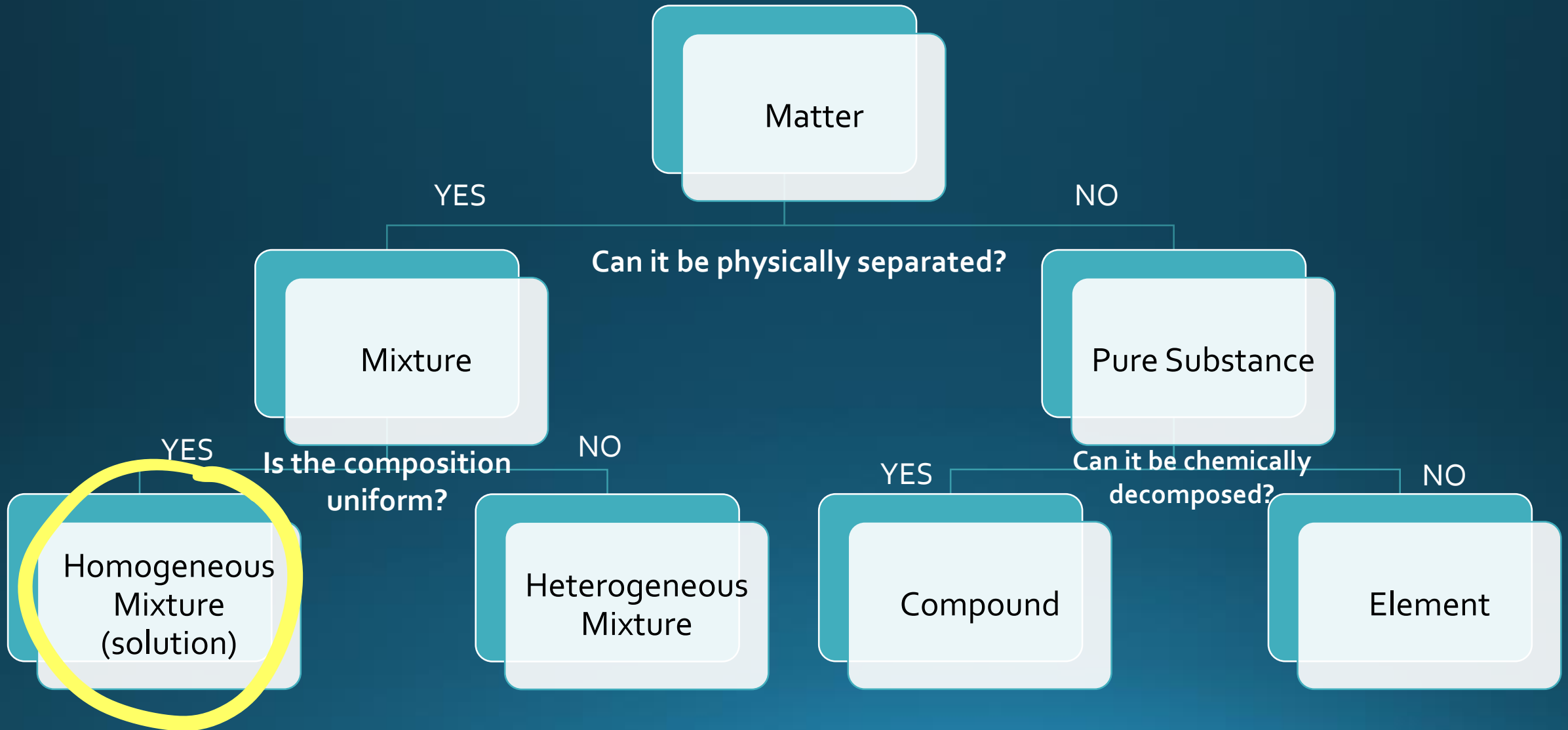
Before PPT: Answer the following questions.

1. What is a solution?
2. In a solution of salt water, identify the solute and the solvent.
3. What are some examples of solutions (aside from salt water) that you can think of from everyday life? Try and come up with 3 examples.

Introduction to Solutions and Solubility

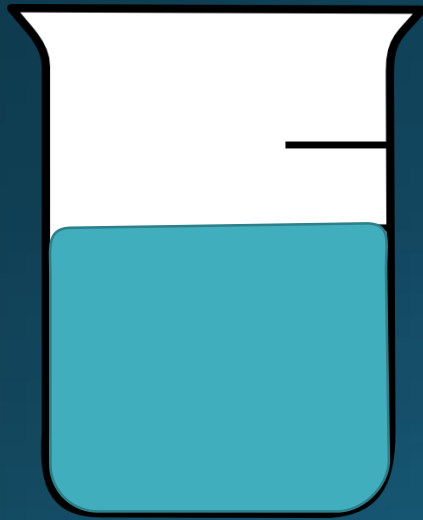


Matter Flowchart (Review)



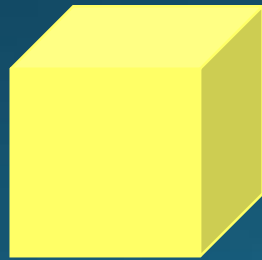
What is a solution?

- A **solution** is a homogeneous (uniform) mixture of a **solute** and a **solvent**
 - The dissolved substances in a solution are mixed so well that the individual substances are no longer distinguishable



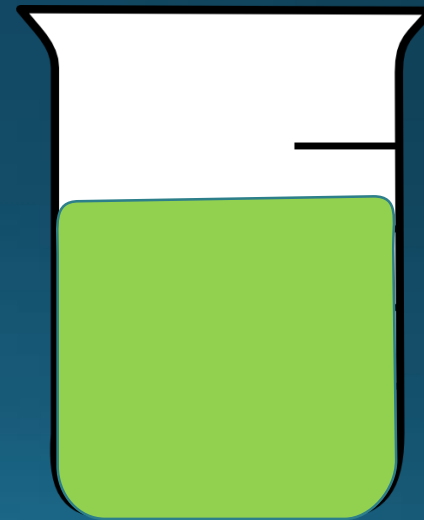
Solvent-Substance that does the dissolving

+



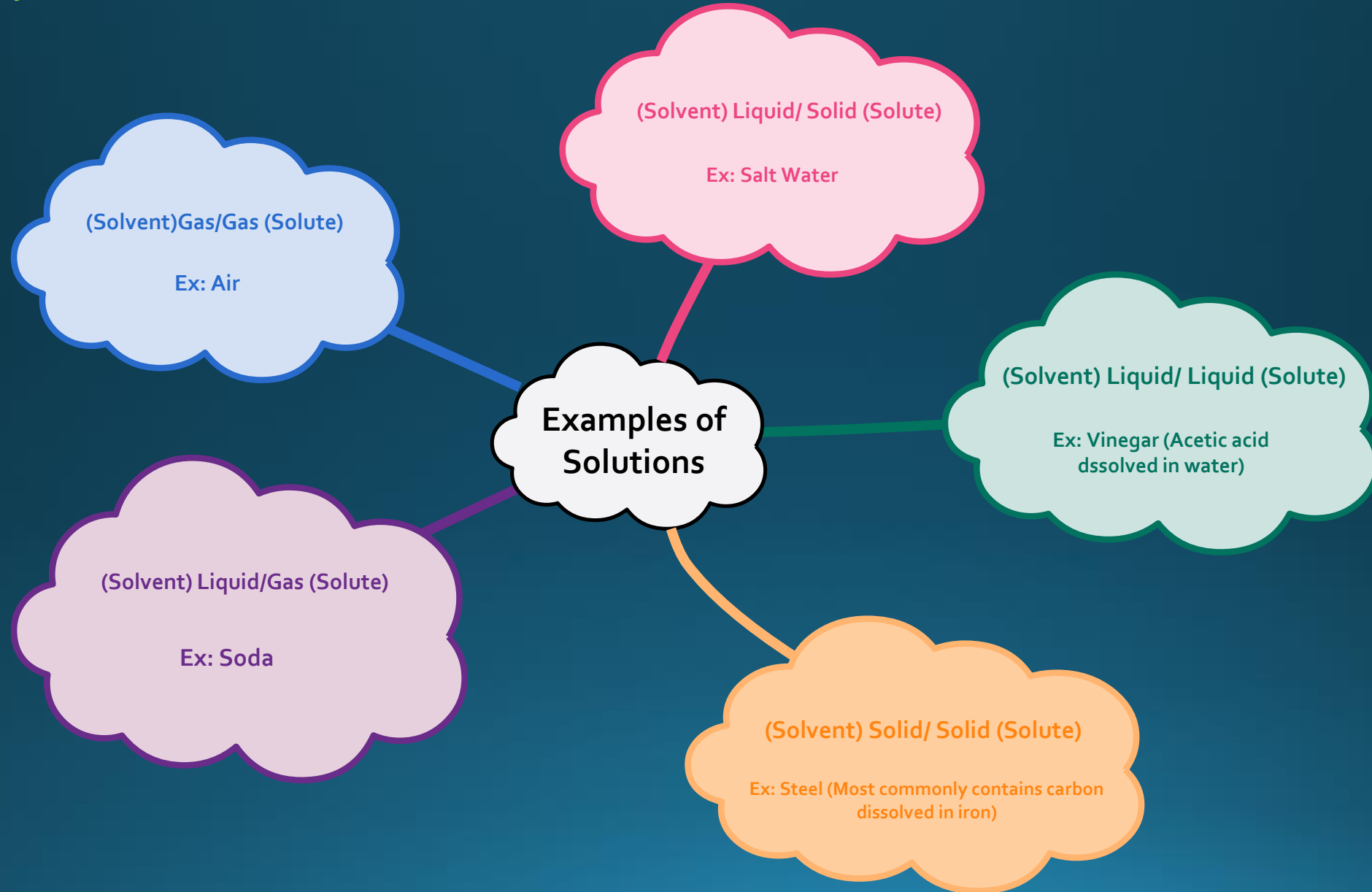
Solute-Substance that is dissolved

=



Solution-A homogeneous mixture of a solute and a solvent

Examples of Solutions



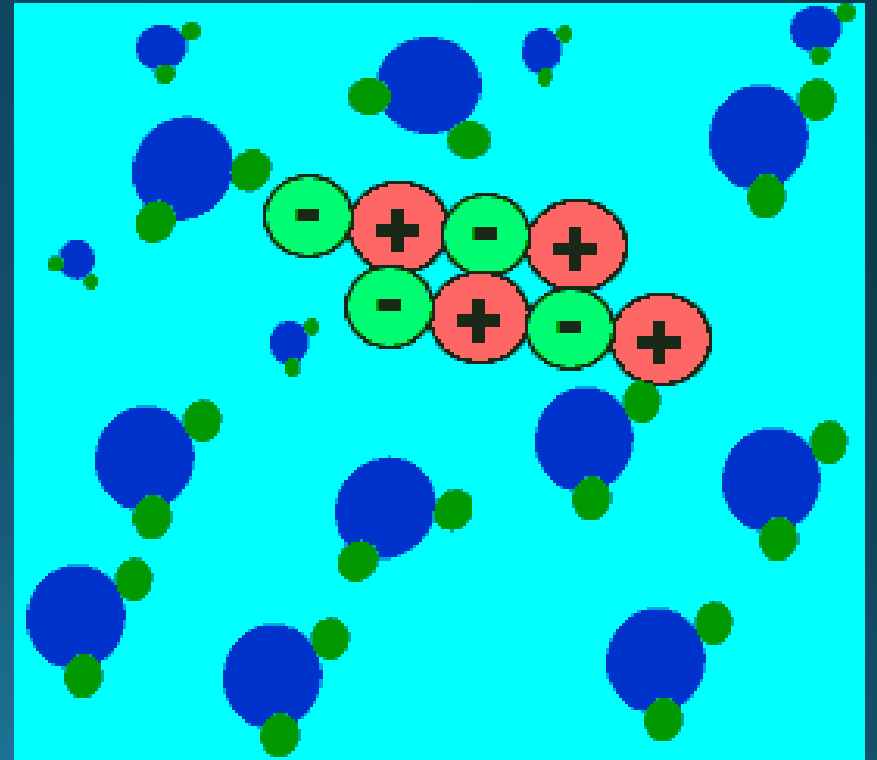
Solution Formation *"Like Dissolves Like"*

- Many ionic compounds and polar covalent compounds dissolve by a process called **solvation**

Solvation

The process of surrounding solute particles with solvent particles to form a solution

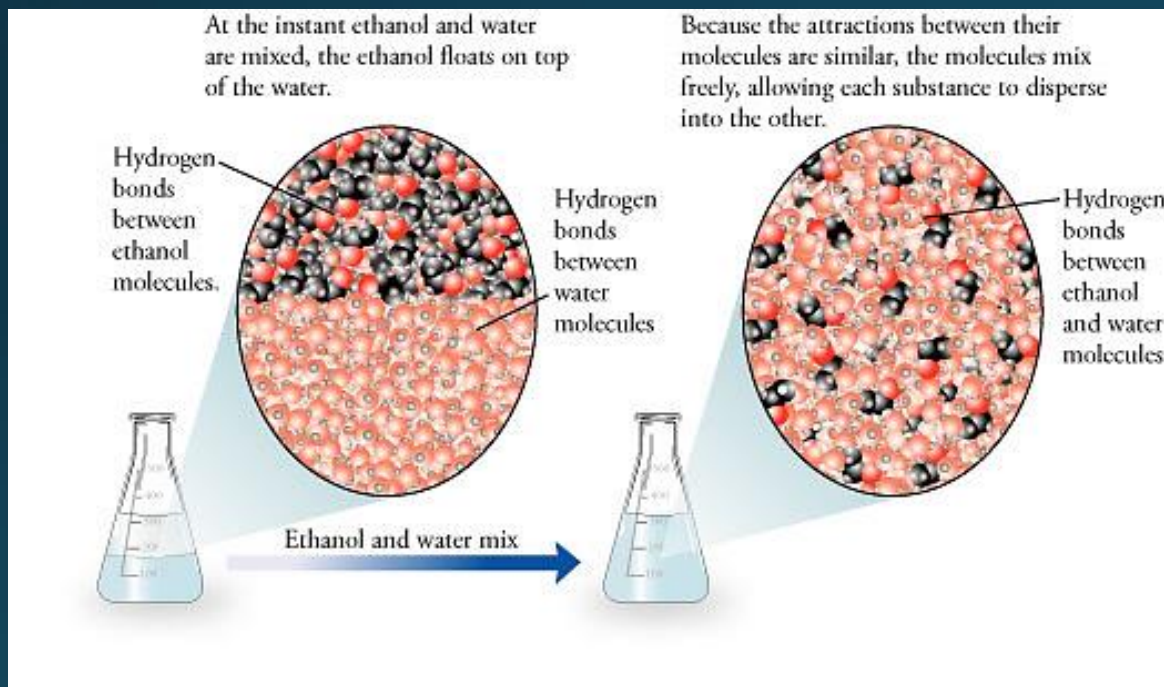
The solvated solute particles are held by the solvent particles as a result of the ion-dipole or dipole-dipole intermolecular forces between the two substances



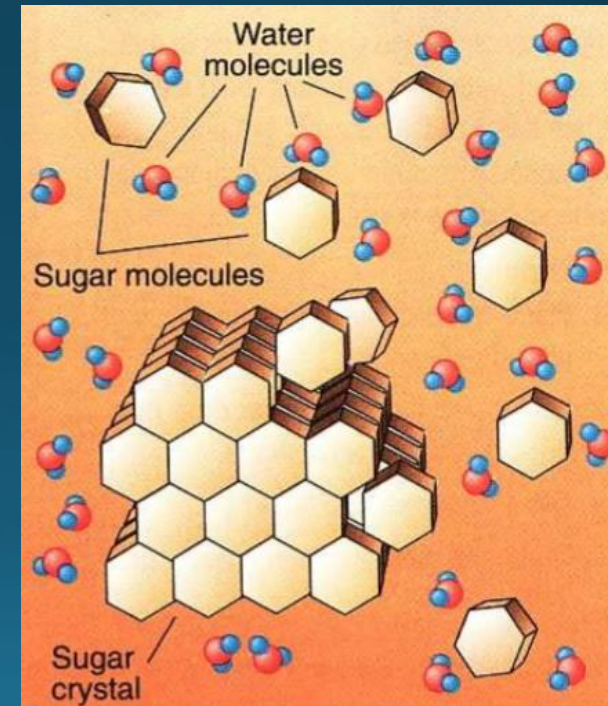
Solution Formation

"Like Dissolves Like"

Ethanol and Water

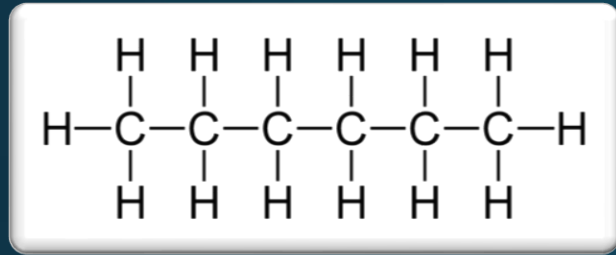


Sugar and Water

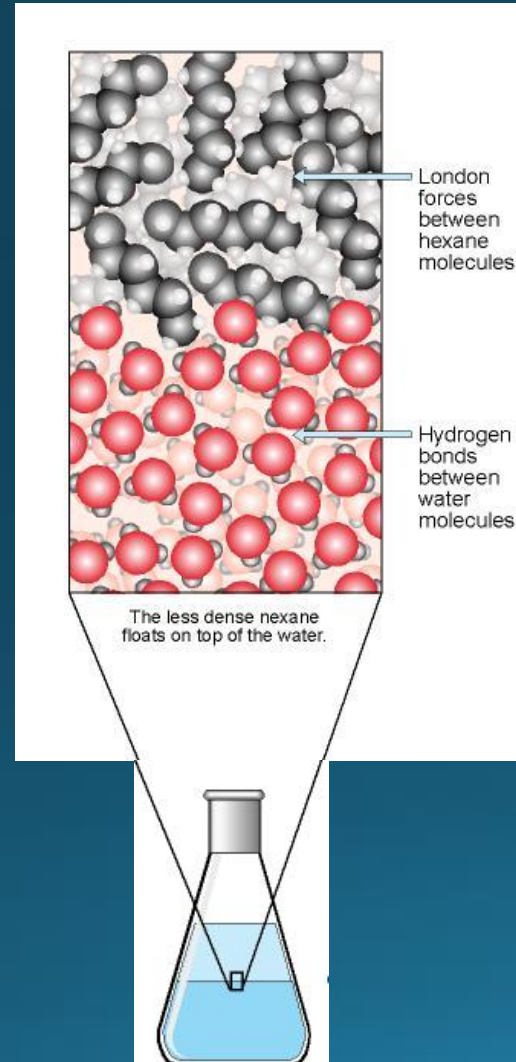


Solution Formation

"Like Dissolves Like"



Hexane looks like Methane
(Both are Nonpolar)

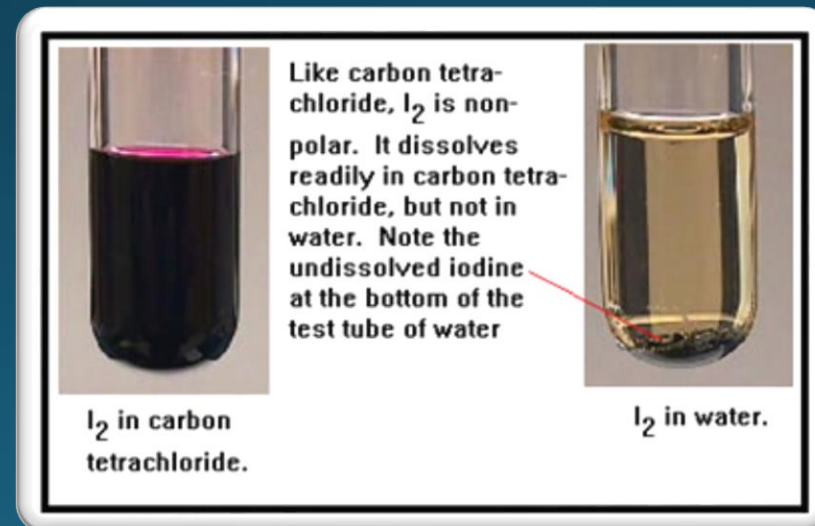


Nonpolar solvents do NOT dissolve polar and ionic substances (and vice versa) because there is no attraction between them. For example, hexane and water do NOT mix.

Solution Formation

"Like Dissolves Like"

Nonpolar substances such as iodine (I_2) dissolve in nonpolar solvents such as carbon tetrachloride (CCl_4) because the forces of attraction are too weak to prevent the particles from freely intermingling. (One type of molecule is not more attracted to itself than the other type of molecule)



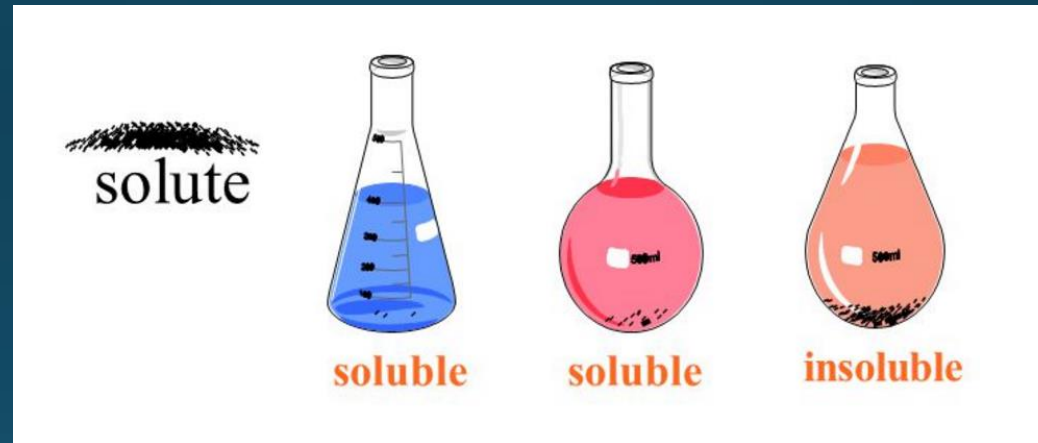
Solubility - How do we know the amount of solute that will dissolve in a particular solvent?

- If you add spoonful after spoonful of sugar to tea, eventually no more sugar will dissolve.
- This illustrates the fact that for every combination of solvent with a solid solute at a given temperature, there is a limit to the amount of solid that can be dissolved.
- The point at which this limit is reached (solubility) for any solute-solvent combination depends on the **nature of the solute, the nature of the solvent, and the temperature of the solvent.**



- **Solubility** is defined as the quantity of a solute that may be added to a given quantity of solvent at a given temperature and pressure

@ STP

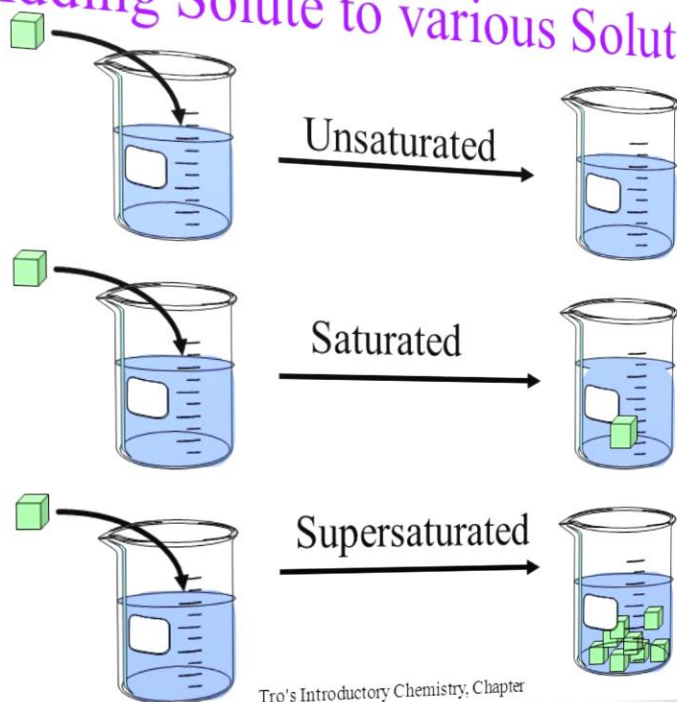


Solute has greater solubility in blue solvent than red and is insoluble in orange solvent.

*When we say a substance is more soluble in a particular solvent, it means we can dissolve more of it in a given amount of solvent

Types of Solutions

Adding Solute to various Solutions



Tro's Introductory Chemistry, Chapter

16

- Unsaturated Solutions - Solutions that can still dissolve more solute.
- Saturated Solutions - Solutions that have dissolved as much as they possibly can. Any more solute added would settle at the bottom and not dissolve.
- Supersaturated Solutions - Solutions that contain even more dissolved solute than saturated solutions.
 - Can happen when some solvent evaporates from a saturated solution or a hot saturated solution is cooled to a lower temperature. It will form crystals when the solution is disturbed because the solution is holding more solute than it is able to at that temperature.

Supersaturated Solutions

- This is a supersaturated solution of sodium acetate being spontaneously crystallized by the introduction of a small flake of crystallized sodium acetate

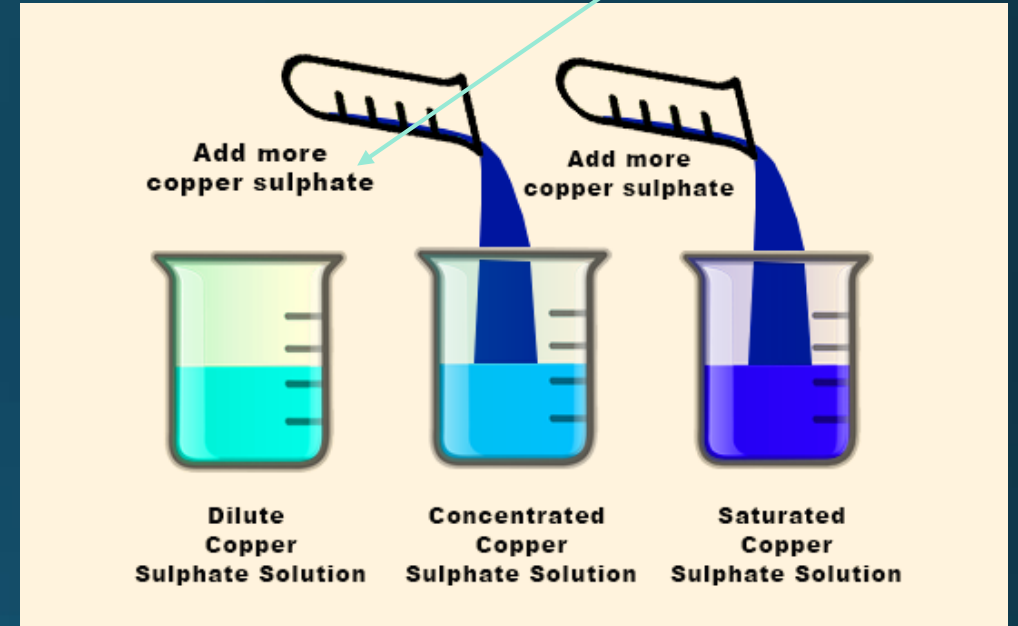


Solution Concentration

Concentration

- the amount of solute dissolved in a given amount of solvent
- Dilute - less solute
- Concentrated - more solute

British for "sulfate"



*These terms are unrelated to the degree to which a solution is saturated: a saturated solution of a solute that is not very soluble might be very dilute.

How can we make solids dissolve faster?

Rate of Dissolving

Solids Dissolve Faster-

- More stirring (agitation)



Rate of Dissolving

Solids Dissolve Faster-

- stirring
- more surface area
(small particle size)



Rate of Dissolving

Solids Dissolve Faster-

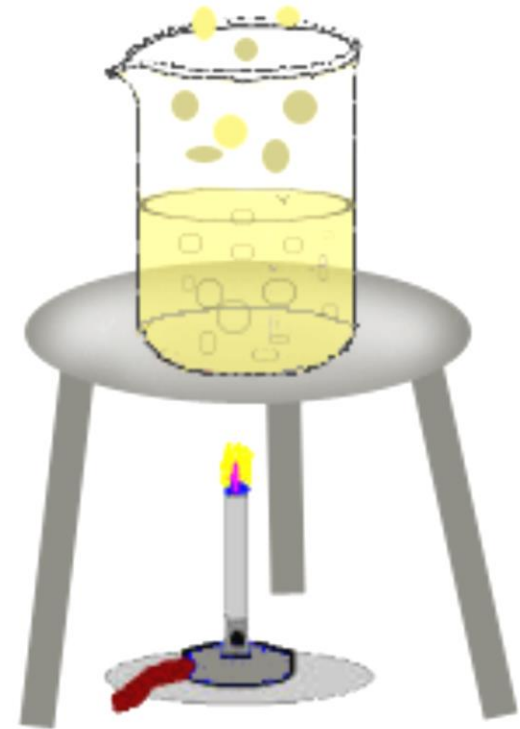
- More stirring
- more surface area (small particle size)
- high temp.



Rate of Dissolving

- Gases dissolve better...

- low temp... Why?



Adding heat decreases the solubility of gases

Adding heat decreases the solubility of gases

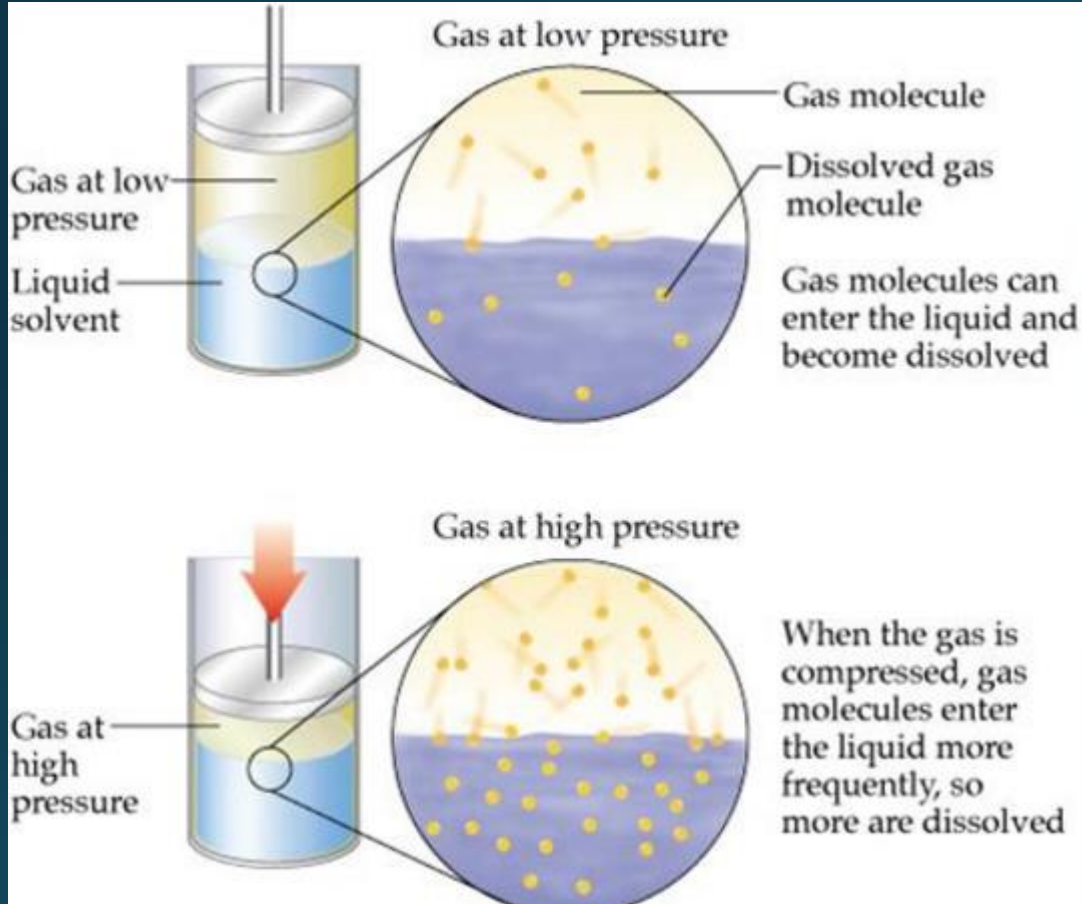
Rate of Dissolving

- Gases dissolve better...
- **no stirring (agitation)**

Shaking a soda can causes it to explode because the gas particles all rush out of the solution at once.



Rate of Dissolving



Gases dissolve better...

- **High external pressure**

Greater External Pressure = Greater Gas solubility. This is known as Henry's Law.

Changes in pressure have no effect on the solubility of **liquids or solids**.