Solutions Notes – part 1

Solutions have 2 parts...

- solute - substance being dissolved
- solvent - substance doing the dissolving - the solvent is substance of largest quantity

Factors Affecting The Rate of Solution (- how fast the solute dissolves.)

- collisions per second between solute and solvent particles
  - stirring, shaking, etc.
  - heating (also increases spacing)
- surface area exposure (particle size)
- chemical nature of the solute and solvent

Concentration

- **dilute** solution
- **concentrated** solution

} These terms are not precise. They are useless when applied to consumer products like laundry detergents, etc.

- **saturated** solution

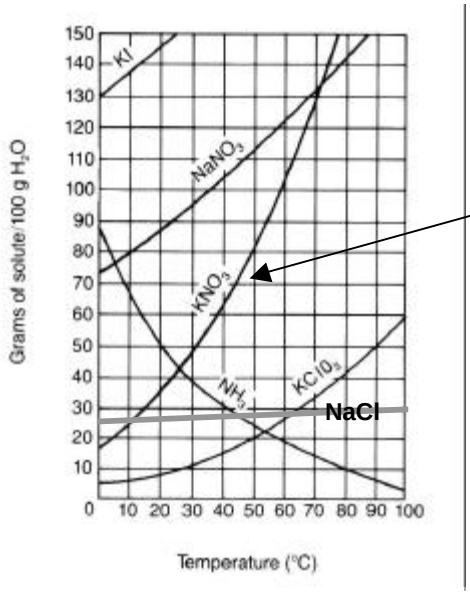
When describing a saturated solution we must specify...

- the name or chemical formula of the solute
- the name or chemical formula of the solvent
- the temperature of the solution
- the gas pressure on the surface of the solution (gas solutes in liquid solvents mostly)

- **supersaturated** solution

(same specifications as for saturated solutions)

Solubility – the quantity of a particular kind of solute that can dissolve in specified quantity of a particular kind of solvent at a specific temperature.



Example: Looking at the chart on the left you can see that about 82 g of KNO_3 will dissolve in 100 g of water at a temperature of 50°C.

A Solution...

⇒ is a **homogeneous** mixture
⇒ particles will not "settle out" if mixture is left undisturbed.
⇒ particles are too small to see
⇒ does not diffuse light
⇒ particles cannot be filtered out

A Colloid...

⇒ is a **homogeneous** mixture
⇒ particles cannot be filtered out
⇒ particles will not "settle out" if mixture is left undisturbed.
⇒ particles too small to be seen (even with a visible light microscope)
⇒ particles large enough to scatter light so the light appears as a beam(Tyndall Effect).

A Suspension...

⇒ becomes a **heterogeneous** mixture
⇒ particles "settle out" if mixture left undisturbed.
⇒ particles can be filtered out
⇒ particles are large enough to be seen

Dissociation - The separation of ions when an ionic compound dissolves.

Conductive Solutions - contain free ions formed by…

- dissociation of ions that form ionic compounds
- ionization of covalent compounds

Ionic solutions contain charged particles that can be made to "flow" like electrons. These particles are much larger and have much more mass than electrons, so they do not move as freely as electrons. Compared to most metals, ionic solutions (like saltwater) do not conduct electricity as well.

Water - The "Universal Solvent"

Water dissolves more substances than any other solvent and is often referred to as the "universal solvent".

If it was really a "universal" solvent, what would we store it in?

Solutions Notes – part 2

Gas solutes – The solubility of a gas being dissolved in a liquid decreases as the temperature increases. (e.g., The water in warmer streams has less dissolved oxygen than the water in colder streams; A glass of cold water from a home faucet will lose some of its dissolved gasses as it warms up causing bubbles to collect on the side of the glass;

Super saturated solutions – Slowly lowering the temperature or slowly evaporating the solvent of solid solute/liquid solvent solutions can cause solutions to become "super saturated" if the solute(s) and solvent(s) are pure.

Freezing point depression – The addition of a solid solute to a liquid solvent will usually lower the freezing point of the solution to a value below that of the pure solvent.

Boiling point elevation - The addition of a solid solute to a liquid solvent will usually raise the boiling point of the solution to a value above that of the pure solvent.

Brownian motion – The jiggling motion of visible particles in a fluid that is due to collisions with the much smaller, invisible particles that make up the fluid.

Tyndall Effect – The scattering of light by the particles of a colloid causes the beam of light to become visible. The particles in a true solution are small enough that light is not deflected and the beam cannot be seen.

Ions – Particles that have either a positive (shortage of electrons) or negative (excess electrons) charge are called ions.

Ionization – Any process that produces ions.

Dissociation – The separation of existing ions from the crystalline structure of an ionic compound during the dissolving process.

Solution Precipitate – Solute that comes out of solution because of a change in temperature or evaporation of solvent. (Chemical reactions can produce precipitates also, but they are new substances that were not originally present.)

Gaseous Evolution – A gas or gasses escaping from solutions as a result of a change in temperature or a chemical reaction.