

Unit 9 – SOLUTIONS – GLUE INS

N35 – K_{sp}

Will Something Precipitate?

$Q < K_{sp}$	No precipitate yet! The solution is unsaturated. All ions are still dissociated.
$Q = K_{sp}$	No precipitate yet! The solution is saturated. The maximum amount of ions are dissociated.
$Q > K_{sp}$	A precipitate will form! The maximum amount of ions are already dissociated, so the extra will “crash out” as a solid precipitate.

Note Supersaturated solutions have $Q > K_{sp}$ but a ppt hasn't crashed out yet because it was made at a higher temperature and slowly cooled down. It is unstable and the ppt will crash out once the sol'n is disturbed.

N33 - Solubility Trends

DISSOLUTION ≠ DISSOCIATION

dissolution means getting solvated (coated in water)

dissociation means breaking up ionically-bound molecules into their individual ions (charged particles)

I won't leave you sugar! our covalent bond is strong!

glucose fructose

SUCROSE

SUGAR

Water won't split us up! I love you more!

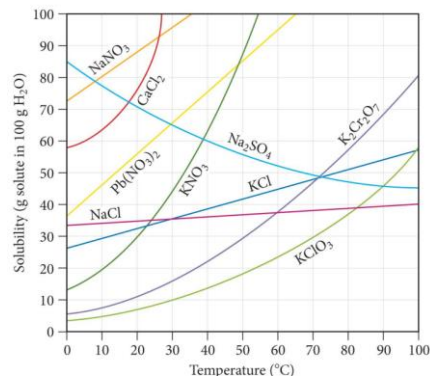
I'm strongly attracted to you (your charge is beautiful) but I'm still on the lookout for something better

electrolytes dissolve and dissociate

non-electrolytes (might) dissolve but they don't dissociate

See ya!

Good thing we only ionically bonded and didn't share electrons!



N32 – Heat of Solution

Energetics of Solution Formation: The Enthalpy of Solution

To make a solution you must

1. **Overcome all attractions between the solute particles;** therefore, ΔH_{solute} is endothermic. ΔH_1
2. **Overcome some attractions between solvent molecules;** therefore, $\Delta H_{\text{solvent}}$ is endothermic. ΔH_2
3. **Form new attractions between solute particles and solvent molecules;** therefore, ΔH_{mix} is exothermic. ΔH_3

N31 – Separation Techniques and Concentration Calcs

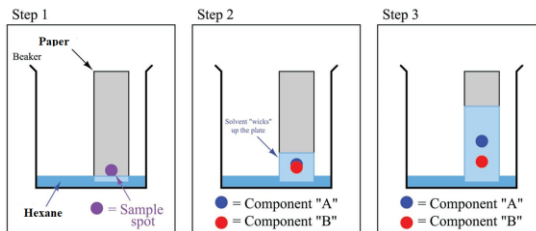
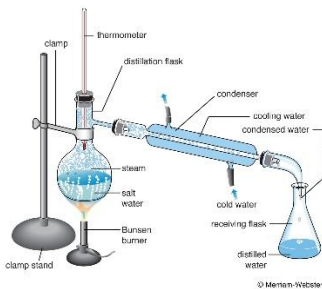


TABLE 12.5 Solution Concentration Terms

Unit	Definition	Units
Molarity (M)	$\frac{\text{amount solute (in mol)}}{\text{volume solution (in L)}}$	mol/L
Molality (m)	$\frac{\text{amount solute (in mol)}}{\text{mass solvent (in kg)}}$	mol/kg
Mole fraction (χ)	$\frac{\text{amount solute (in mol)}}{\text{total amount of solute and solvent (in mol)}}$	None
Mole percent (mol %)	$\frac{\text{amount solute (in mol)}}{\text{total amount of solute and solvent (in mol)}} \times 100\%$	%
Parts by mass	$\frac{\text{mass solute}}{\text{mass solution}} \times \text{multiplication factor}$	
Percent by mass (%)	Multiplication factor = 100	%
Parts per million by mass (ppm)	Multiplication factor = 10^6	ppm
Parts per billion by mass (ppb)	Multiplication factor = 10^9	ppb
Parts by volume (% , ppm, ppb)	$\frac{\text{volume solute}}{\text{volume solution}} \times \text{multiplication factor}^*$	

*Multiplication factors for parts by volume are identical to those for parts by mass.

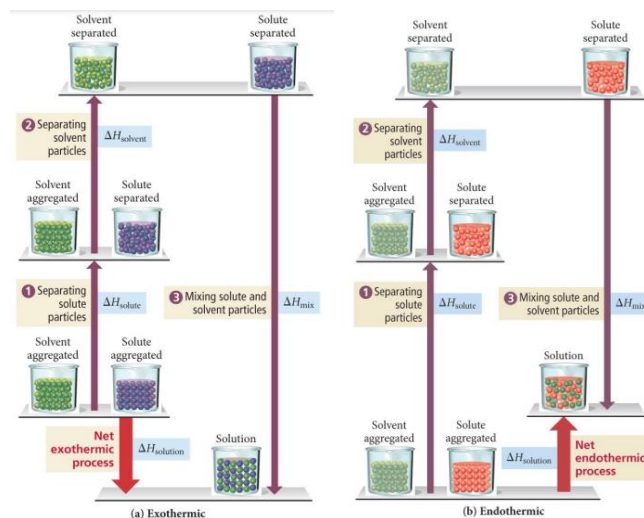


TABLE 12.2 Relative Interactions and Solution Formation

Solute-solute interactions	Relative to Solvent-solvent and solute-solute interactions	Solution Formation
>	Solvent-solvent and solute-solute interactions	Solution forms
=	Solvent-solvent and solute-solute interactions	Solution forms
<	Solvent-solvent and solute-solute interactions	Solution may or may not form, depending on relative disparity