Unit 9 – SOLUTIONS – GLUE INS

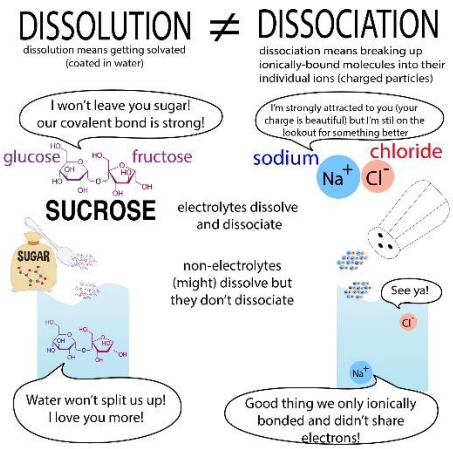
N35 – Ksp

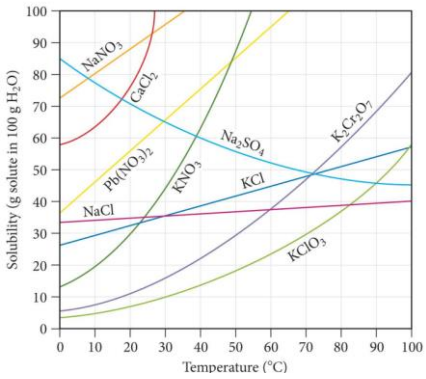
Will Something Precipitate?

$Q < K_{sp}$	**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





N32 – Heat of Solution

Energetics of Solution Formation: The Enthalpy of Solution

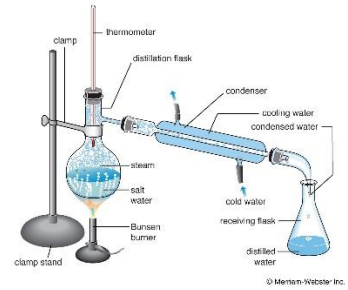
To make a solution you must

1. **Overcome all attractions between the solute particles;** therefore, ΔH_{solute} is endothermic. ΔH_1

2. **Overcome some attractions between solvent molecules;** therefore, $\Delta H_{solvent}$ 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



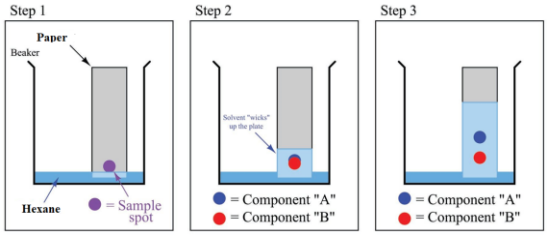


TABLE 12.5 Solution Concentration Terms

Unit	Definition	Units
Molarity (M)	$\frac{\text{amount solute (in mol)}}{\text{volume solution (in L)}}$	$\frac{\text{mol}}{\text{L}}$
Molality (m)	$\frac{\text{amount solute (in mol)}}{\text{mass solvent (in kg)}}$	$\frac{\text{mol}}{\text{kg}}$
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	$\frac{\text{mass solute}}{\text{mass solution}} \times$ 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)	$\frac{\text{volume solute}}{\text{volume solution}} \times$ multiplication factor *	

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

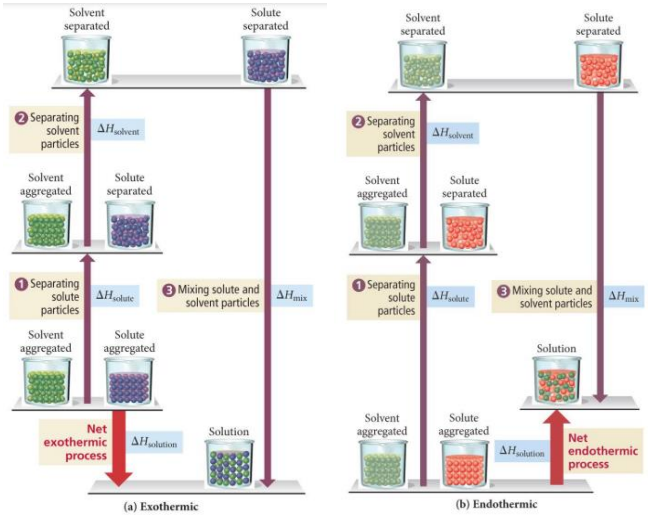


TABLE 12.2 Relative Interactions and Solution Formation

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