Chem 116, Lecture 9
Sept. 30, 2008
Class Notes [HT]

Intermolecular Force Practice:
What kinds of intermolecular forces hold the following condensed phases together?

1. H_2O (l)	*London dispersion, Hydrogen bonding*
2. CO_2 (s)	*London dispersion*
3. NH_3 (l)	*London dispersion, Hydrogen bonding*
4. $CaCl_2$ (s)	*Ionic and London dispersion*
5. C_8H_{18} (l) Octane	*London dispersion*
6. $C_4H_{10}O$	*London dispersion, Hydrogen bonding*
7. HCl (*l*)	*Hydrogen bonding, Dipole-dipole*

Key concepts:

- London dispersion forces are weak but present in all polar and non-polar molecules. **Molecular size is important in determining the strength of the London dispersion force.**
- Dipole-dipole forces are the degrees of attraction between the **positive end of a polar molecule** to the **negative end of another polar molecule**. Visualize the Lewis structure of these molecules.
- Hydrogen bonding are forces that require Hydrogen atoms to be present and bond strongest to Chlorine, Nitrogen, Oxygen, and Fluorine due to their high **electronegativity**.
- Ion-ion attractions depend on the **cations (+) and anions (-) charges** of the molecules. NaCl (s) is an example of this attraction because of the Na^+ and Cl^- charges.

Chapter 13 (Solutions)

The following content is not on Exam 1

- Solutions are mixtures. When solids disappear this is evidence of mixing taking place, aka dissolving.
- Mixture are evenly dispersed throughout the solution.

Saturation

<u>Below saturation</u> – when the solvent (liquid that dissolves a solid, becomes a solution = mixture) such as water, can CONTINUE to dissolve. Sugar crystals added to water at first will dissolve.

<u>Saturation point</u> – Solvent is holding the maximum concentration and can not further dissolve the solid at that temperature. Sugar crystals will not dissolve and sink to the bottom. Consider a cup of delicious Hazelnut Dunkin Donuts ICE coffee (Medium, 2 creams, 2 sugars) ordered 10 minutes before Chemistry lecture begins (15 minutes before

iClicker problem/attendance points tally) – at that cold temperature, only so much of the sugar crystals will actually dissolve and the rest will sink to the bottom because saturation point has been reached. Shake it all you want, it'll only sink back to the bottom.

Beyond saturation – Solvent is holding more solute (example, sugar crystals) than it is able to at that temperature. Hard candy is an example of this saturation stage. **If you add anything to the solution, the excess will crystallize out.**

Solubility

Positive slope = endothermic reactions
Negative slope = exothermic reactions

Breaking apart intermolecular forces requires an input of energy and, as a result, $\Delta H > 0$ so this is a positive slope, which means it is an endothermic reaction. Separation of molecules can be thought of as dissolving the solute in a solvent = mixture = solution.

In the formation of some precipitates from a solute-solvent interaction, the end enthalpy state is $\Delta H < 0$, and requires the release of energy so this is a negative slope and a exothermic reaction.