CHEM 116 Lecture 7 Notes (kl)
September 23, 2008

Today's Agenda:

- Exam changed to next Thursday

Clicker Question:

- Answer: B
  - Draw Lewis Structures→ Figure out shapes
  - Strength of Dipole=Strength of Bond
  - More Attracted to Oxygen because Oxygen has a higher electronegativity
  - More electron density on oxygen than on carbon or hydrogen atoms
  - OH bond is very polar
  - CO dipole is a lot weaker than the OH dipole

Explaining Macroscopic (lab level) behavior by particle level interactions:

- When Matter Changes, requires energy
- Dipole-dipole attractions predominate
  - Small Molecules with Large Dipoles
    - Water and Ammonia are good examples
- London Dispersion attractions predominate
  - Small Molecules with nearly zero dipoles
    - Chloroform (CCl_4)
    - Between one CCl_4 molecule and another CCl_4 molecule
  - Large molecules, whether they have dipoles or no
    - Usually the strongest forces in large molecules

Particle level: materials composed of molecules:

- Molecules vibrate faster and faster as raise temperature
- At certain point, Energy gets high so all molecules go out at the same time→ looks like it all melts instantly

Reminder: What is a dipole?

- Electron distribution is not even

Particle Level: Materials composed of Ions:

- Ions melt by individual ion
- Have to get to high temperature to melt
- Solid State
  - Ions arranged in lattice, with individual ions occupying lattice points (either positive or negative ion)
- Gas State
  - Mostly a theoretical construct→ We will never see in real life

Some examples of ionic solids (particle level illustrations):

- Ions are at the lattices

- Ammonium ions and chloride ions

Forces that hold units together in condensed states of matter: The Basic Idea:

- Liquid and Solid= Condensed states (any state that is close enough so can interact together)
- Several Factors matter in determining the strength of the attractive force:
  - Separation:
    - Ions→ worry about individual ions
    - Molecules→ Worry about size of molecules
    - Has to do w/ size
  - Strengths:
    - Non-polar molecules depends on size of molecules

Ion-Ion attractions:

- Everything rests on Coulomb's Law in Chemistry
- Every atom has a positively and negatively charged ions→ don't have to be evenly distributed
- Example: NaCl, MgCl, and KCl
  - The distance between Mg and Cl is similar to the distance between Na and Cl. Therefore, the r for MgCl and the r for NaCl are similar.
  - Na has a +1 charge, Cl has a -1 Charge, Mg has a 2+ charge, and K has a +1 charge
  - The force of attraction between MgCl is stronger than NaCl because Q+ changes from a +1 to a +2
  - The force of attraction is weaker between KCl than NaCl because K and Cl are further apart than Na and Cl. Therefore, the r for KCl is bigger.

Explaining macroscopic behavior by reasoning based on ion-ion attractions:

- As *r* (distance between the two charge centers = radius of positive ion + radius of negative ion) is increased, the forces become weaker, and the melting point decreases

Polar molecule-polar molecule attractions:

- Have dipoles in it
- Positive→ lack of electrons
- Negative→ Excess of electrons

Explaining macroscopic behavior by reasoning based on dipole-dipole interactions:

- Attractions between HF and the other HF molecule is stronger

Compare HCl and HF:

- Answer: HF

Some dipole-dipole interactions are very strong;

- Hydrogen bonding is important in biology
- Dipole-Dipole interactions that are not hydrogen bonding (why not?)
  - CH_3OCH_3→ cause H not bonded to N, O, F, or Cl