Lecture 9/23/2008 (LL)

TEST: Moved to Thursday 2nd

i-clicker question

B) CH_3OH- Has the strongest dipole moment

Dipole moment has to do with where the electrons prefer to spend most of their time (on which atom). The electrons prefer to spend time on the most electronegative atom or bond.
-Strength of the dipole moment depends on the strength of the bonds between atoms in a molecule

Non polar molecule- Dipole moments cancel each other ex: CCl_4. Electrons are evenly distributed around the molecule

Polar molecule- Electrons are not evenly distributed around molecule, there is a non zero dipole moment.

-When figuring out dipole moment it is helpful to write out the Lewis structure

Explaining macroscopic behavior by particle level interactions

-Matter changes because of energy being added or removed

H_2O is a small molecule with large dipoles
Dipole- Dipole attractions are predominately polar

London Dispersion Forces
CCl_4 -small molecule with nearly zero dipoles

Liquid particles slide past each other, random
Solid particles vibrate together, repeating patterns

Long range order- Long distance away from molecule you are looking at
Solids are long range order

Particle level: Materials composed of Molecules

Molecules of a liquid occupy similar amount of space as in a solid except are a little more spread out

Melting- Molecules overcome attractions in the solid state

Molecules vibrate faster as you raise the temperature slowly

If you raise the temperature slowly have even energy distribution molecules will break off all together instead of one at a time

Particle level: Materials composed of Ions

To change an ion to a solid: have to overcome intermolecular attractions

In a lattice structure: Ions occupy lattice sites ex: NH_4+

Particle level: Materials composed of metal atoms

-Metal core structure occupy each lattice site

-Core structure: Nucleus and electrons not in the valence shell. (valence shell=outer shell of electrons)

Force that hold units together in condensed states of matter: The basic idea

Condensed State (solid/liquid): Particles close enough together and they can interact with each other

- Gases are never in the condensed state

<u>Strength</u>

Ion- The greater the charge the more strength between ions

Molecule- In a polar molecule the strength is due to the strength of the dipole moment

In a non polar molecule the strength is due to the size of the molecule: larger molecule more strength

Ion-Ion attractions

Further apart the radius between ions: Weaker attractions

Ex: $MgCl_2$ has weaker attractions that NaCl

The radius increases because shells are being added to the atom

Explaining macroscopic behavior by reasoning based on ion-ion attractions

Larger lattice energy: Larger melting point

Lattice energy: Amount of energy to break apart a lattice solid and turn it into a liquid

LiF: Lattice energy 1037, Melting point 848

LiI: Lattice energy 761, Melting point 459

Explaining macroscopic behavior by reasoning based on dipole-dipole attractions

- The stronger the dipole moment: Stronger boiling point

HF attractions are stronger than HCl because F is more electronegative than Cl

When looking for the strength of the bond polarity: Look at the difference in electronegativity (N, O, F, Cl- elements with the strongest electronegativity)

Some dipole-dipole interactions are very strong

Hydrogen Bonding: DNA, RNA, Proteins

H_2O – has a high boiling point because of its two O-H polar bonds
O-H bond is a form of hydrogen bonding

More about non-polar – non-polar attractions

London Dispersion forces are greater when electrons are more polarizable
Larger molecules- larger London Dispersion forces

Explaining macroscopic behavior by reasoning about intermolecular forces

	Melting Points
$C_{11}H_{23}COOH$	44 C
$C_{13}H_{27}COOH$	58 C
$C_{15}H_{31}COOH$	63 C
$C_{17}H_{35}COOH$	70 C

In molecules with similar molecular weights: Melting points increase due to London Dispersion forces

London Dispersion forces
Weak: Small molecules
Strong: Large molecules