Phases Changes and Phase Diagrams
Lecture 4
9/11/2008 (LL)

The iclicker question: pg.2

- When you have two gases in two tubes and the valves open the gases move between the tubes.
- The speed at which the molecules move depend on the Molecular Weight of the gas.
- The lighter the gas the faster it moves. Slower gas moves slower.
- A cloud of gas is formed closer to HCl than NH_3 because HCl has a larger mass and therefore the particles move slower than the NH_3 particles

Gas Mixtures

- Pressure is related to the number of times the particles in the gas hit the walls of the container
- Total Pressure= The sum of each partial pressure from each component in the gas

What use are partial pressures

- In the experiment the water bath contains gas from the reaction and gas from water with vapor pressure
- In a warmer room there is more energy and more water vaporizes
- As the reaction occurs gas is produced and bubbles in the open tube, then gas is captured inside the jar

Collecting Water

T= 25C=298K
P= 755mmHg
V= 125mL=.125L
$P_{total}= P_{H2} + P_{water}$

(23.76 mmHg is the vapor pressure of water, P_{water} , which can be found in Appendix B p.1122 in the book)

755mmHg= P H2 + 23.76 mmHg
P H2= 755mmHg- 23.76 mmHg= 731 mmHg
P H2= 731 mmHg

Finding the mols of H_2
n=PV / RT
(731mmHg/760mmHg)(.125L) / (.08206 L atm/ mol K) (298 K)= 0.0049166 mols H_2

Finding the mass of Zn
0.0049166 mol H_2(1mol Zn/ 1mol H_2) (65.39g Zn/ 1 mol Zn)= 0.321496 g Zn
= 0.321 g Zn (3 sig. figs)

What happened when the KMT assumptions break down?

Same ways of talking about characteristics of gas particles

1) No attractive forces between gas particles

4) Particles travel in straight lines and change velocities only when they collide, either with other particles or with walls of a container- all collision are elastic (no loss of kinetic energy)

Two ways in which gases deviate from ideal

1) Low temperature- Not ideal because the particles can stick together when they collide

2) High pressure- Not ideal because when particles are close together the can have attractions between them (Ideal gas has no attractive forces btw particles)

Which Ways gases are more likely to deviate from ideal gas behavior? Why?

H_2-2
O_2-4
H_2O- 7 (very polar molecule)
Xe-5
C_4H_{10}-6
He-1
Ne-3

1-most unlikely to deviate
7-most likely to deviate

- Polar molecules deviate more from ideal behavior than nonpolar molecules do
- When molecules have bonds (H_2, C_4H_{10}, H_20, O_2) they are more likely to deviate from an ideal gas because there are not perfectly elastic collisions due to vibrations in the bonds (energy gets lost in the vibrations)
- When looking for deviations from ideal gas behavior, you can also look at boiling points:
    - As boiling points increase deviations from ideal gas behavior increase
- There are three things to look for when comparing two different gases under the same T and P conditions, or the same gas under different conditions of T or P:
    - If the molecules are more massive, then they'll deviate more from ideal gas behavior [breakdown of the assumption about gases having negligible volume]
    - If the molecules are floppier (more bonds) then they'll deviate more [breakdown of the assumption about elastic collisions]
    - If it is high pressure, then the gas behavior will deviate more from ideal behavior [the molecules are squished closer together, so both assumptions break down - not negligible volume, and molecules closer together so they have more attractions expressed]
    - If it is low temperature, the gas behavior will deviate more from ideal behavior [molecules moving more slowly so more time for attractions thus less elastic collisions]