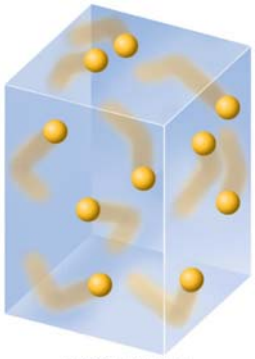
Gases

- Things you've already observed
  - What happens when you take a filled balloon outside in the winter?
  - What happens when you take a filled balloon and squeeze it?

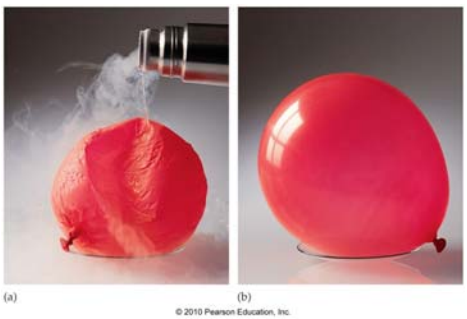
- Kinetic-Molecular Theory of Gases helps to rationalize these observations
  - Particles in constant motion
  - Lots of empty space between particles
  - Particles aren't attracted to one another
  - When particles collide, they undergo *elastic* collisions
  - Temperature is a measure of kinetic energy of the gas ($KE = mv^2/2$)

- How does this fit with the observations above?



Quantifying Observations with Gas Laws

- Boyle's Law - volume inversely related to pressure ($V_1P_1 = V_2P_2$)
- Charles' Law - volume directly related to temperature ($V_1/T_1 = V_2/T_2$)
- Ideal gas law – PV = nRT (T in Kelvin)
  - R = 0.0821 (L atm)/(mol K)
  - 1 mole of gas occupies 22.4 L at STP (STP= 0°C, 1 atm)
    - "Standard Molar Volume"



Solutions and Concentrations

- Solutions consist of a **solute** dissolved in a **solvent**.
  - Why/how do solutions form? Intermolecular Forces!!
    - What forces must be disrupted and what new forces formed?
    - Must be energetically favorable

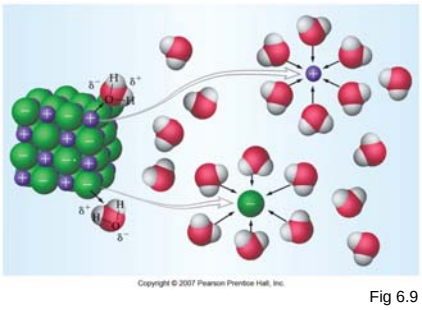
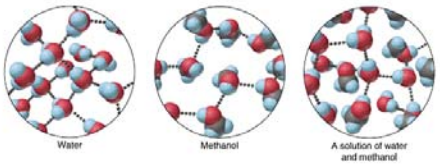


Fig 6.9



http://www.chem.ufl.edu/~itl/2045/change/C12F3.GIF

- Solutions can be **electrolytic** or **nonelectrolytic**
  - Strong vs. weak

Solution Concentrations

- Describes the amount of solute relative to the entire solution.
- Concentration units
  - % w/w, %w/v
  - ppm and ppb as mg/L and μg/L
  - molarity
- Molarity is very useful in studying chemical reactions involving solutions: (moles/L) x L = moles!