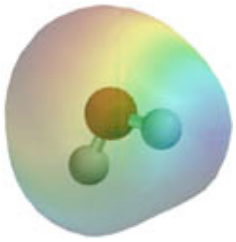
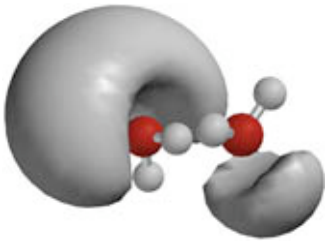
Chemistry 366 **Spring 2008**



Concepts of Chemistry
Advanced Section

From "Physical Chemistry" by T. Engel and P. Reid, Pearson:San Francisco, 2007.



FUNDAMENTAL CONCEPTS

Why Thermodynamics?
Basic definitions
Thermometry
Equation of state and the ideal gas

HEAT, WORK, INTERNAL ENERGY AND ENTHALPY

Work and heat
Reversibility
Irreversible work
Calculations of q, w, DU and DH.

STATE FUNCTIONS

Mathematical properties of state functions
Variation of Enthalpy with temperature and constant pressure
C_V and C_P
Joule-Thompson effect

THERMOCHEMISTRY

Internal energy and enthalpy changes and chemical reactions
Hess's Law
Temperature dependence of reaction enthalpy
Experimental determination of DU and DH
Differential Scanning Calorimetry

ENTROPY

Heat engines and the second law of thermodynamics
Calculating entropy changes
Clausius inequalities
Third law of thermodynamics
Entropy changes in chemical reactions

CHEMICAL EQUILIBRIUM

Gibbs and Helmholtz energies
Differential forms of U, H, G, and A
Gibbs energy of a reaction mixture
Gibbs energy of a gas mixture
DG_{rxn} and the equilibrium constant
Variations of K with temperature

REAL GASES

Real gases
Equations of states
Compression factor
Law of corresponding states
Fugacity

PHASE DIAGRAMS

Pressure-temperature phase diagram
Pressure-volume phase diagram
Clapeyron equation and vapor pressure

IDEAL AND REAL SOLUTIONS

Ideal solutions
Binary solutions
Temperature-composition diagram
Gibbs-Duhem equation
Colligative properties
Activities and real solutions
Henry's and Raoult's laes

BOLTZMAN DISTRIBUTION

Microstates and configuration
Derivation of the Boltzmann distribution
Physical meaning of the Boltzmann distribution

ENSEMBLE AND PARTITION FUNCTION

Canonical ensemble
Translational partition function
Rotational partition function
Vibrational partition function
Equipartition theorem
Electronic partition function

STATISTICAL MECHANICS

Energy and molecular degrees of freedom
Heat capacity
Entropy
Other thermodynamic functions
Chemical equilibrium