

Brandon University

Department of Chemistry

18:260 Physical Chemistry I: Thermodynamics and Kinetics Fall Term, 2012

Instructor: Dr. Adrian Weber (Office: 4-12 Brodie, webera@brandonu.ca, (204) 571-7899)

Text: P. W. Atkins and J. de Paula "Physical Chemistry", 9th edition, W. H. Freeman & Co., New York (2010)

Course Outline

1. The properties of gases (Chapter 1)
States of gases, the gas laws, molecular interaction, the van der Waals equation.
2. The First Law (Chapter 2)
Work, heat, energy, internal energy, heat transactions, enthalpy, adiabatic passages, exact differential and state functions, the partial derivative, changes in internal energy, the Joule-Thomson effect.
3. The Second Law (Chapter 3)
The dispersal of energy, entropy, entropy changes, Maxwell's relations, the third law of thermodynamics, the Helmholtz and Gibbs energies, refrigeration, the fundamental equation, properties of the internal energy, properties of the Gibbs energy.
4. Physical transformations of pure substances (Chapter 4)
Stability of phases, phase boundaries, three representative phase diagrams, supercritical fluids, the dependence of stability of conditions, location of phase boundaries, The Ehrenfest classification of phase transitions.
5. Simple mixtures (Chapter 5)
Partial molar quantities, thermodynamics of mixing, chemical potentials of liquids, liquid mixtures, colligative properties, Osmosis, vapour pressure diagrams, temperature-composition diagrams, liquid-liquid phase diagrams, liquid-solid phase diagrams, liquid crystals, activities.
6. Chemical equilibrium (Chapter 6)
The Gibbs energy minimum, electrochemistry.
7. Kinetic Molecular Theory of Gases and Liquids (Chapter 20)
Boltzmann distribution. Velocity distribution in one dimension. Maxwell Boltzmann distribution. Root mean square velocity. Most probable and median velocities. Collisional and transport properties of gases. Molecular effusion. Mean free path. Collision number and collision frequency. Conductivities of electrolyte solutions. The mobilities of ions. The diffusion equation and probabilities.
8. Rates of Chemical Reactions (Chapter 21)
The rates of reactions. Integrated rate laws. Reactions approaching equilibrium. The temperature dependence of reactions rates. Elementary reactions. Consecutive

elementary reaction. Consecutive elementary reactions. Unimolecular reactions.
Polymerization kinetics. Photochemistry.

9. Reaction Dynamics (Chapter 22)
Collision theory. Diffusion-controlled reactions. The material balance equation. The Eyring equation and thermodynamic aspects.
10. Enzyme Kinetics (Chapter 23)
The Michaelis-Menten mechanism. Catalytic efficiency of enzymes. Mechanisms of enzyme inhibition.

Evaluation:	Term tests (2)	25%
	Problem sets (3)	10%
	Labs	20%
	Final exam	45%

Grading:	A+	90-100
	A	85-89
	A-	80-84
	B+	76-79
	B	72-75
	B-	68-71
	C+	62-67
	C	59-61
	C-	55-58
	D	50-54
	F	0-49