

TABLE OF CONTENTS

Licensing

1: The Basics

- 1.1: The System and the Surroundings
- 1.2: Pressure and Molar Volume
- 1.3: Temperature
- 1.4: The Zeroth Law of Thermodynamics
- 1.5: Work and Energy
- 1.E: The Basics (Exercises)
- 1.S: The Basics (Summary)

2: Gases

- 2.1: The Empirical Gas Laws
- 2.2: The Ideal Gas Law
- 2.3: The Kinetic Molecular Theory of Gases
- 2.4: Kinetic Energy
- 2.5: Graham's Law of Effusion
- 2.6: Collisions with Other Molecules
- 2.7: Real Gases
- 2.E: Gases (Exercises)
- 2.S: Gases (Summary)

3: First Law of Thermodynamics

- 3.1: Prelude to Thermodynamics
- 3.2: Work and Heat
- 3.3: Reversible and Irreversible Pathways
- 3.4: Calorimetry
- 3.5: Temperature Dependence of Enthalpy
- 3.6: Reaction Enthalpies
- 3.7: Lattice Energy and the Born-Haber Cycle
- 3.E: First Law of Thermodynamics (Exercises)
- 3.S: First Law of Thermodynamics (Summary)

4: Putting the First Law to Work

- 4.1: Prelude to Putting the First Law to Work
- 4.2: Total and Exact Differentials
- 4.3: Compressibility and Expansivity
- 4.4: The Joule Experiment
- 4.5: The Joule-Thomson Effect
- 4.6: Useful Definitions and Relationships
- 4.E: Putting the First Law to Work (Exercises)
- 4.S: Putting the First Law to Work (Summary)

5: The Second Law

- 5.1: Introduction to the Second Law
- 5.2: Heat Engines and the Carnot Cycle
- 5.3: Entropy
- 5.4: Calculating Entropy Changes
- 5.5: Comparing the System and the Surroundings
- 5.6: Entropy and Disorder
- 5.7: The Third Law of Thermodynamics
- 5.8: Adiabatic Compressibility
- 5.E: The Second Law (Exercises)
- 5.S: The Second Law (Summary)

6: Putting the Second Law to Work

- 6.1: Free Energy Functions
- 6.2: Combining the First and Second Laws - Maxwell's Relations
- 6.3: ΔA , ΔG , and Maximum Work
- 6.4: Volume Dependence of Helmholtz Energy
- 6.5: Pressure Dependence of Gibbs Energy
- 6.6: Temperature Dependence of A and G
- 6.7: When Two Variables Change at Once
- 6.8: The Difference between C_p and C_v
- 6.E: Putting the Second Law to Work (Exercises)
- 6.S: Putting the Second Law to Work (Summary)

7: Mixtures and Solutions

- 7.1: Thermodynamics of Mixing
- 7.2: Partial Molar Volume
- 7.3: Chemical Potential
- 7.4: The Gibbs-Duhem Equation
- 7.5: Non-ideality in Gases - Fugacity
- 7.6: Colligative Properties
- 7.7: Solubility
- 7.8: Non-ideality in Solutions - Activity
- 7.E: Mixtures and Solutions (Exercises)
- 7.S: Mixtures and Solutions (Summary)

8: Phase Equilibrium

- 8.1: Prelude to Phase Equilibrium
- 8.2: Single Component Phase Diagrams
- 8.3: Criterion for Phase Equilibrium
- 8.4: The Clapeyron Equation
- 8.5: The Clausius-Clapeyron Equation
- 8.6: Phase Diagrams for Binary Mixtures
- 8.7: Liquid-Vapor Systems - Raoult's Law
- 8.8: Non-ideality - Henry's Law and Azeotropes
- 8.9: Solid-Liquid Systems - Eutectic Points
- 8.10: Cooling Curves
- 8.E: Phase Equilibrium (Exercises)
- 8.S: Phase Equilibrium (Summary)

9: Chemical Equilibria

- 9.1: Prelude to Chemical Equilibria
- 9.2: Chemical Potential
- 9.3: Activities and Fugacities
- 9.4: Pressure Dependence of K_p - Le Châtelier's Principle
- 9.5: Degree of Dissociation
- 9.6: Temperature Dependence of Equilibrium Constants - the van 't Hoff Equation
- 9.7: The Dumas Bulb Method for Measuring Decomposition Equilibrium
- 9.8: Acid-Base Equilibria
- 9.9: Buffers
- 9.10: Solubility of Ionic Compounds
- 9.E: Chemical Equilibria (Exercises)
- 9.S: Chemical Equilibria (Summary)

10: Electrochemistry

- 10.1: Electricity
- 10.2: The connection to ΔG
- 10.3: Half Cells and Standard Reduction Potentials
- 10.4: Entropy of Electrochemical Cells
- 10.5: Concentration Cells
- 10.E: Electrochemistry (Exercises)
- 10.S: Electrochemistry (Summary)

11: Chemical Kinetics I

- 11.1: Reaction Rate
- 11.2: Measuring Reaction Rates
- 11.3: Rate Laws
- 11.4: 0th order Rate Law
- 11.5: 1st order rate law
- 11.6: 2nd order Rate Laws
- 11.7: The Method of Initial Rates
- 11.8: The Method of Half-Lives
- 11.9: Temperature Dependence
- 11.10: Collision Theory
- 11.11: Transition State Theory
- 11.E: Chemical Kinetics I (Exercises)
- 11.S: Chemical Kinetics I (Summary)

12: Chemical Kinetics II

- 12.1: Reaction Mechanisms
- 12.2: Concentration Profiles for Some Simple Mechanisms
- 12.3: The Connection between Reaction Mechanisms and Reaction Rate Laws
- 12.4: The Rate Determining Step Approximation
- 12.5: The Steady-State Approximation
- 12.6: The Equilibrium Approximation
- 12.7: The Lindemann Mechanism
- 12.8: The Michaelis-Menten Mechanism
- 12.9: Chain Reactions
- 12.10: Catalysis
- 12.11: Oscillating Reactions

- [12.E: Chemical Kinetics II \(Exercises\)](#)
- [12.S: Chemical Kinetics II \(Summary\)](#)

[Index](#)

[Glossary](#)

[Detailed Licensing](#)