Physical chemistry encompasses a wide variety of ideas that are intimately linked. For the most part, we cannot understand one without having some understanding of many others. We overcome this problem by looking at the same idea from a series of slightly different and increasingly sophisticated perspectives. This book focuses on the theories of physical chemistry that describe and make predictions about chemical equilibrium. We omit many topics that are usually understood to be included in the subject of physical chemistry. In particular, we treat quantum mechanics only briefly and spectroscopy not at all.

As an organizing principle, the text introduces physical chemistry by developing the principles of chemical equilibrium from the perspectives of chemical kinetics, classical thermodynamics, and statistical thermodynamics. The central objective was to develop the ideas that are necessary to produce the equilibrium constant expression for a chemical reaction from each of these perspectives. Since these ideas comprise the core of each of these subjects, this device necessarily selects subject matter that goes to the heart of these subjects.
3: Distributions, Probability, and Expected Values

4: The Distribution of Gas Velocities

5: Chemical Kinetics, Reaction Mechanisms, and Chemical Equilibrium

6: Equilibrium States and Reversible Processes
7: State Functions and The First Law

8: Enthalpy and Thermochemical Cycles

9: The Second Law - Entropy and Spontaneous Change

10: Some Mathematical Consequences of the Fundamental Equation

11: The Third Law, Absolute Entropy, and the Gibbs Free Energy of Formation
12: Applications of the Thermodynamic Criteria for Change

13: Equilibria in Reactions of Ideal Gases

14: Chemical Potential - Extending the Scope of the Fundamental Equation

15: Chemical Potential, Fugacity, Activity, and Equilibrium

16: The Chemical Activity of the Components of a Solution

17: Electrochemistry
18: Quantum Mechanics and Molecular Energy Levels

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19: The Distribution of Outcomes for Multiple Trials

• 20: Boltzmann Statistics

• 21: The Boltzmann Distribution Function

• 22: Some Basic Applications of Statistical Thermodynamics

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23: The Ensemble Treatment

• No image available

24: Indistinguishable Molecules - Statistical Thermodynamics of Ideal Gases

• No image available
25: Bose-Einstein and Fermi-Dirac Statistics

- No image available

26: Appendices

- Back Matter