Physical Chemistry: A Molecular Approach

Physical Chemistry is the study of macroscopic, and particulate phenomena in chemical systems in terms of the principles, practices, and concepts of physics such as motion, energy, force, time, thermodynamics, quantum chemistry, statistical mechanics, analytical dynamics and chemical equilibria. In contrast to chemical physics, physical chemistry is predominantly (but not always) a macroscopic or supra-molecular science, as the majority of the principles on which it was founded relate to the bulk rather than the molecular/atomic structure alone.

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• 1: The Dawn of the Quantum Theory

• 2: The Classical Wave Equation
3: The Schrödinger Equation and a Particle in a Box

4: Postulates and Principles of Quantum Mechanics

5: The Harmonic Oscillator and the Rigid Rotor

6: The Hydrogen Atom

\[
E_n^{(1)} = \langle \phi_n | H_1 | \phi_n \rangle \\
C_{nk}^{(1)} = \frac{\langle \phi_k | H_1 | \phi_n \rangle}{E_n^{(0)} - E_k^{(0)}} \\
E_n^{(2)} = \sum_{k \neq n} \frac{|\langle \phi_k | H_1 | \phi_n \rangle|^2}{E_n^{(0)} - E_k^{(0)}}
\]

7: Approximation Methods
8: Multielectron Atoms

9: Chemical Bonding in Diatomic Molecules

10: Bonding in Polyatomic Molecules

11: Computational Quantum Chemistry
12: Group Theory - The Exploitation of Symmetry

13: Molecular Spectroscopy

14: Nuclear Magnetic Resonance Spectroscopy

15: Lasers, Laser Spectroscopy, and Photochemistry
16: The Properties of Gases

17: Boltzmann Factor and Partition Functions

\[ Z = \sum_i e^{-\beta E_i} \]

18: Partition Functions and Ideal Gases

19: The First Law of Thermodynamics
20: Entropy and The Second Law of Thermodynamics

21: Entropy and the Third Law of Thermodynamics

22: Helmholtz and Gibbs Energies

23: Phase Equilibria
24: Solutions I - Liquid-Liquid Solutions

25: Solutions II - Solid-Liquid Solutions

26: Chemical Equilibrium

27: The Kinetic Theory of Gases
28: Chemical Kinetics I - Rate Laws

29: Chemical Kinetics II - Reaction Mechanisms

30: Gas-Phase Reaction Dynamics

31: Solids and Surface Chemistry
$e^{i\pi} + 1 = 0$

32: Math Chapters

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