

# Contents

<b>1. Introduction</b>	<b>1</b>
The Scope and Purpose of Physical Chemistry	1
Fundamental Concepts, Measurable Properties, and Fundamental Units	3
<b>2. Gases</b>	<b>8</b>
The Gaseous State of Matter	8
The Gas Laws	9
The Kinetic Theory of Gases	19
Deviations from The Ideal Gas Law	22
<b>3. Liquids</b>	<b>31</b>
The Liquid State of Matter	31
The Vapor Pressure of Liquids	32
The Surface Tension of Liquids	41
The Viscosity of Liquids	49
<b>4. Basic Thermodynamics</b>	<b>57</b>
Heat, Work, and Energy	57
The First and Second Laws of Thermodynamics	59
Enthalpy, Heat Capacity, and Heats of Transition	61
Reversible Processes	67
<b>5. Thermochemistry</b>	<b>77</b>
Definitions and Conventions	77
The Determination of Heats of Reaction	79
Variation of Heat of Reaction with Temperature	84
<b>6. Solutions I: Nonelectrolytes</b>	<b>89</b>
Fundamental Concepts	89
Solutions of Gases in Liquids	92

**7. Solutions II: Osmotic Pressure**

The Cause of Osmotic Pressure and The Mechanism of Osmosis 122

The Calculation of Osmotic Pressure 125

The Experimental Determination of Osmotic Pressure 126

Some Biological Aspects of Osmosis and Osmotic Pressure 128

**8. Solutions III: Solutions of Electrolytes**

The Role of the Arrhenius Theory in The Study of Electrolytic Solutions 134

The Development of the Modern Ionic Theory 137

The Proton-Transfer Theory of Acids and Bases 146

**9. Chemical Equilibrium**

Derivation of the Expression for the Equilibrium Constant 150

Applications of the Equilibrium Expression 154

Factors Influencing Equilibrium Concentrations 161

**10. Entropy and Free Energy**

Entropy 171

Free Energy 176

**11. Ionic Equilibrium and Buffer Action**

The Ion-Product Constant of Water and the pH Scale 188

Equilibria in Solutions of Acids, Bases, and Salts 192

The Hydrolysis of Salts 207

**12. Conductivity**

Mechanism of Conductance 231

The Measurement of Conductance 242

**13. Electromotive Force**

The Galvanic Cell 251

The Measurement of Cell Potentials 264

The Thermodynamics of Galvanic Cells 267

The Potentiometric Determination of pH	278	
Acid-Base Indicators	285	
The Determination of pH by Colorimetric Methods	290	
Use of Indicators in Neutralization Reactions	295	
<b>15. Oxidation-Reduction Potentials</b>		<b>307</b>
Oxidation-Reduction Systems	307	
The Determination of Redox Potentials	311	
<b>16. Reaction Kinetics. Catalysis</b>		<b>317</b>
Reaction Kinetics	317	
Catalysis	330	
<b>17. Adsorption</b>		
The Process of Adsorption	338	
Applications of Adsorption	344	
<b>18. Colloidal Systems</b>		
Introduction of Colloidal Systems	348	
Sols. Their Preparation and Purification	356	
Sols. Their Electrical Properties	360	
Emulsions	367	
Gels	369	
<b>19. Nuclear Chemistry</b>		<b>373</b>
Natural Radioactivity	373	
Artificial Radioactivity	381	
Nuclear Fission	385	
Uses of Radioisotopes	389	