BROOKS/COLE LABORATORY SERIES for General Chemistry

# Chemical Principles

In The Laboratory

EIGHTH EDITION

Emil J. Slowinski Wayne C. Wolsey William L. Masterson

#### **Experiment 1**

The Densities of Liquids and Solids 1

#### **Experiment 2**

Resolution of Matter into Pure Substances, I. Paper Chromatography 7

#### **Experiment 3**

Resolution of Matter into Pure Substances, II. Fractional Crystallization 15

#### **Experiment 4**

Determination of a Chemical Formula 23

#### **Experiment 5**

Identification of a Compound by Mass Relationships 29

#### **Experiment 6**

Properties of Hydrates 35

#### **Experiment 7**

Analysis of an Unknown Chloride 41

#### **Experiment 8**

Verifying the Absolute Zero of Temperature—Determination of the Barometric Pressure 47

#### **Experiment 9**

Molar Mass of a Volatile Liquid 55

#### **Experiment 10**

Analysis of an Aluminum-Zinc Alloy 61

#### **Experiment 11**

The Atomic Spectrum of Hydrogen 69

#### **Experiment 12**

The Alkaline Earths and the Halogens—Two Families in the Periodic Table 79

#### **Experiment 13**

The Geometrical Structure of Molecules—An Experiment Using Molecular Models 87

# **Experiment 14**

Heat Effects and Calorimetry 97

#### **Experiment 15**

The Vapor Pressure and Heat of Vaporization of a Liquid 105

#### **Experiment 16**

The Structure of Crystals—An Experiment Using Models 113

# **Experiment 17**

Classification of Chemical Substances 125

#### **Experiment 18**

Some Nonmetals and Their Compounds—Preparations and Properties 133

# **Experiment 19**

Molar Mass Determination by Depression of the Freezing Point 141

#### Experiment 20

Rates of Chemical Reactions, I. The Iodination of Acetone 149

#### **Experiment 21**

Rates of Chemical Reactions, II. A Clock Reaction 159

# **Experiment 22**

Properties of Systems in Chemical Equilibrium—Le Châtelier's Principle 169

#### **Experiment 23**

Determination of the Equilibrium Constant for a Chemical Reaction 181

#### **Experiment 24**

The Standardization of a Basic Solution and the Determination of the Molar Mass of an Acid 191

#### **Experiment 25**

pH Measurements—Buffers and Their Properties 199

#### **Experiment 26**

Determination of the Solubility Product of PbI, 209

#### **Experiment 27**

Relative Stabilities of Complex Ions and Precipitates Prepared from Solutions of Copper(II) 215

#### **Experiment 28**

Determination of the Hardness of Water 223

lx

# **Experiment 29**

Synthesis and Analysis of a Coordination Compound 229

# **Experiment 30**

Determination of Iron by Reaction with Permanganate—A Redox Titration 239

# **Experiment 31**

Determination of an Equivalent Mass by Electrolysis 245

#### **Experiment 32**

Voltaic Cell Measurements 253

# **Experiment 33**

Preparation of Copper(I) Chloride 263

#### **Experiment 34**

Development of a Scheme for Qualitative Analysis 269

# Experiment 35

Spot Tests for Some Common Anions 275

#### **Experiment 36**

Qualitative Analysis of Group I Cations 283

#### **Experiment 37**

Qualitative Analysis of Group II Cations 291

# **Experiment 38**

Qualitative Analysis of Group III Cations 299

#### **Experiment 39**

Identification of a Pure Ionic Solid 307

#### **Experiment 40**

The Ten Test Tube Mystery 315

#### **Experiment 41**

Preparation of Aspirin 323

#### **Experiment 42**

Rate Studies on the Decomposition of Aspirin 331

#### **Experiment 43**

Analysis for Vitamin C 339

#### Contents

# Appendix I

Vapor Pressure of Water 345

# **Appendix II**

Summary of Solubility Properties of Ions and Solids 347

# **Appendix IIA**

Some Properties of the Cations in Groups I, II, and III 349

# Appendix III

Table of Atomic Masses (Based on Carbon-12) 353

# Appendix IV

Making Measurements—Laboratory Techniques 355

# Appendix V

Mathematical Considerations—Making Graphs 365

# **Appendix Vi**

Suggested Locker Equipment 371

# **Appendix VII**

Suggestions for Extension of the Experiments to "Real World Problems" 373