Laboratory Manual for Principles of **General Chemistry**

Sixth Edition

J. A. Beran Texas A & M University—Kingsville

Bibliothek Chemie / Materialwissenschaft Technische Universität Darmstadt



New York

Chichester

Weinheim

Brisbane

SIngapore

John Wiley & Sons, Inc.

Toronto

Inventar Nr. <u>PC / R</u>096

Contents

PREFACE V

LABORATORY SAFETY AND GUIDELINES f 1

- A. Self-Protection 1
- B. In Case of an Accident 2
- C. Laboratory Rules 2
- D. Working in the Laboratory 3

LABORATORY DATA 5

- A. Recording Data 5
- B. Reporting Data 6
- C. Accessing Supplementary Data 6
- D. Laboratory Notebook 7

COMMON LABORATORY DESK EQUIPMENT 9

SPECIAL LABORATORY EQUIPMENT 10

LABORATORY TECHNIQUES 11

EXPERIMENTS

- A. Introduction
 Dry Lab 1 The Laboratory and SI, 37
 Experiment 1 Basic Laboratory Operations, 45
- B. Chemical and Physical Properties
 Experiment 2 Identification of a Compound: Physical Properties, 53
 Experiment 3 Identification of a Compound: Chemical Properties, 61
 Experiment 4 Paper Chromatography, 69
 Experiment 5 Chemistry of Copper, 79
- C. Mole Concept
 - Experiment 6 Formula of a Hydrate, 87
 - Experiment 7 Empirical Formulas, 93
 - Experiment 8 Limiting Reactant, 101
 - Experiment 9 A Volumetric Analysis, 109
 - Experiment 10 Vinegar Analysis, 119
 - Dry Lab 2A Inorganic Nomenclature I. Oxidation Numbers, 125
 - Dry Lab 2B Inorganic Nomenclature II. Binary Compounds, 128
 - Dry Lab 2C Inorganic Nomenclature III. Ternary Compounds, 133

D. Atomic and Molecular Structure Experiment 11 Periodic Table and Periodic Law, 139 Dry Lab 3 Atomic and Molecular Structure, 151 E. Chemical Reactions in Solution Experiment 12 Inorganic Compounds and Metathesis Reactions, 165 Experiment 13 Acids and Bases; pH, 173 Dry Lab 4 Oxidation–Reduction Equations, 187 Experiment 14 Oxidation-Reduction Reactions, 193 Experiment 15 Bleach Analysis, 201 Experiment 16 Stoichiometric Analysis of a Redox Reaction, 211 Experiment 17 Synthesis of an Alum, 219 F. Gases Experiment 18 Molar Mass of a Volatile Liquid, 229 Experiment 19 Calcium Carbonate Analysis; Molar Volume of Carbon Dioxide, 237 Experiment 20 Aluminum Analysis, 245 G. Solutions Experiment 21 Molar Mass of a Solid, 253 Experiment 22 Calorimetry, 263 H. Kinetics Experiment 23 Factors Affecting Reaction Rates, 275 Experiment 24 Determination of a Rate Law, 285 I. Chemical Equilibria and Thermodynamics Experiment 25 LeChâtelier's Principle; Buffers, 295 Experiment 26 An Equilibrium Constant, 307 Experiment 27 Antacid Analysis, 319 Experiment 28 Potentiometric Analyses, 327 Experiment 29 Aspirin Synthesis and Analysis, 337 Experiment 30 Molar Solubility; Common-Ion Effect, 345 Experiment 31 The Thermodynamics of the Dissolution of Borax, 353 J. Electrochemistry Experiment 32 Galvanic Cells; the Nernst Equation, 363 Experiment 33 Electrolytic Cells; Avogadro's Number, 375 K. Qualitative Analysis Dry Lab 5 Preface to Qualitative Analysis, 383 Experiment 34 Common Anions, 389 Experiment 35 Quali I. Na⁺, K⁺, NH₄⁺, Ag⁺, Cu²⁺, Bi³⁺, 399 Experiment 36 Qual II. Mn²⁺, Ni²⁺, Fe³⁺(Fe²⁺), Al³⁺, Zn²⁺, 411 Experiment 37 Qual III. Mg²⁺, Ca²⁺, Ba²⁺; General Unknown Examination, 421 Experiment 38 Transition Metal Chemistry, 429

APPENDICES

Appendix A Glassworking, 441

Appendix B Treatment of Data, 443

Appendix C Graphing Data, 447

Appendix D Familiar Names of Common Chemicals, 450

Appendix E Vapor Pressure of Water, 452

Appendix F Concentrations of Acids and Bases, 453

Appendix G Water Solubility of Inorganic Salts, 454

Appendix H Conversion Factors, 456

PHOTO CREDITS 459

XII Laboratory Manual for Principles of General Chemistry