

Contents

1. The Beginnings (E.H.)	1
1.1. Greek Chemistry	1
1.2. Chinese Chemistry and Alchemy	4
2. Alchemy, the Chemistry of the Middle Ages (F.A.M.)	11
2.1. Overview	11
2.2. A Brief History of Alchemy	12
2.3. Our Alchemical Inheritance	16
2.4. Alchemists in Literature and Art	16
2.5. Named Alchemists on Stamps	17
3. Inorganic Chemistry and the Discovery of the Elements (F.A.M.)	27
3.1. The Development of Inorganic Chemistry	27
3.1.1. Introductory Remarks	
3.1.2. Pneumatic Chemistry	
3.1.3. <i>Antoine Lavoisier</i>	
3.1.4. <i>Jöns Jakob Berzelius</i>	
3.1.5. Isomerism	
3.1.6. Inorganic Chemistry in the Mid-1800s	
3.1.7. <i>Werner's</i> Coordination Theory	
3.1.8. Modern Inorganic Chemistry	
3.2. The Discovery and Naming of the Elements: Filling the Periodic Table	36
3.2.1. Introductory Comments	
3.2.2. Elements Known to the Ancients	
3.2.3. Other Elements Known before 1600 A.D.	
3.2.4. Elements Discovered 1600–1800	
3.2.5. Elements Discovered <i>via</i> Electrolysis	
3.2.6. The Contributions of Spectroscopy	
3.2.7. The Lanthanides or Rare Earth Elements	
3.2.8. The Discovery of the Noble Gases	
3.2.9. Natural Radioactivity	
3.2.10. Artificial Radioactivity	
3.2.11. Other Elements, 1920–1940	
3.2.12. Man-made Elements	

4. Organic Chemistry (E.H.)	57
4.1. Introductory Remarks	57
4.2. The Emergence of 'Organic Chemistry'	59
4.3. Benzene and the Aromatic Compounds	65
4.4. Chirality	74
4.5. Organic Chemistry after 1880	80
4.5.1. Two Preliminary Remarks	
4.5.2. Synthetic Chemistry	
4.5.3. Natural-Product Chemistry	
4.6. Polymer Chemistry	93
4.7. Biochemistry	98
4.7.1. Enzymes	
4.7.2. Insulin	
4.7.3. Miscellaneous Research	
5. Physical and Theoretical Chemistry (E.H.)	107
5.1. Introductory Remarks	107
5.2. Early Thermochemistry: Temperature and Heat Capacities	108
5.3. Chemical Equilibria and Chemical Kinetics	112
5.4. Thermodynamics	116
5.5. Properties of Gases	121
5.6. Electrochemistry	126
5.7. Theoretical Chemistry: A Comment	134
6. Spectroscopy (F.A.M.)	143
6.1. The Experimental Techniques	143
6.1.1. Early Observations	
6.1.2. Contributions of <i>Bunsen and Kirchhoff</i>	
6.1.3. New Light Sources and Detectors	
6.1.4. Other Experimental Advances	
6.1.5. Some Uses of Optical Spectroscopy	
6.2. Understanding the Electromagnetic Spectrum and Its Interaction with Matter	154
6.3. Other Types of Optical Spectroscopy	159
6.4. Mass Spectrometry	159
7. X-Ray Structure Analysis (E.H.)	161
7.1. Crystals	161
7.2. X-Rays and Their Diffraction by Crystals	166
7.3. X-Ray Structure Analysis	169
7.4. Examples of X-Ray Structure Determinations	171
7.5. Electron Diffraction	172

8. Technical Chemistry (E.H.)	175
8.1 Some Preliminary Comments	175
8.2. Beer	176
8.3. Sugar	178
8.4. Cosmetics and Pharmaceuticals	181
8.5. Polymers	184
8.6. Paper	185
8.7. Minerals	186
8.8. Petroleum	188
8.9. Metals	192
8.10. Glass	199
8.11. Photography	202
9. Miscellaneous Topics (E.H. and F.A.M.)	207
9.1. Chemical Education	207
9.2. The Anonymous Chemist	209
9.3. Tools of the Chemist	210
9.3.1. Chemical Glassware	
9.3.2. Scales and Balances	
9.3.3. Other Instruments	
9.4. Elemental Symbols and Chemical Formulae	212
9.5. Chemical Societies and Meetings	214
9.6. Chomical Errors on Chemical Stamps	219
9.6.1. Preliminary Remarks	
9.6.2. Faulty Chemical Formulae	
9.6.3. Faulty Stereochemistry	
9.6.4. Wrong Reactions	
9.6.5. Wrong Names, Dates, and Other Information	
9.6.6. Assorted Nonsense	
Stamp Identification List	231
Name Index	253
Subject Index	261