

CONTENTS

Abbreviations
Preface

vii

ix

Section A – The nature and scope of analytical chemistry	1
A1 Analytical chemistry, its functions and applications	1
A2 Analytical problems and procedures	3
A3 Analytical techniques and methods	5
A4 Sampling and sample handling	10
A5 Calibration and standards	15
A6 Quality in analytical laboratories	18
Section B – Assessment of data	21
B1 Errors in analytical measurements	21
B2 Assessment of accuracy and precision	26
B3 Significance testing	34
B4 Calibration and linear regression	41
B5 Quality control and chemometrics	49
Section C – Analytical reactions in solution	55
C1 Solution equilibria	55
C2 Electrochemical reactions	61
C3 Potentiometry	66
C4 pH and its control	74
C5 Titrimetry I: acid–base titrations	80
C6 Complexation, solubility and redox equilibria	85
C7 Titrimetry II: complexation, precipitation and redox titrations	90
C8 Gravimetry	95
C9 Voltammetry and amperometry	98
C10 Conductimetry	104
Section D – Separation techniques	109
D1 Solvent and solid-phase extraction	109
D2 Principles of chromatography	119
D3 Thin-layer chromatography	131
D4 Gas chromatography: principles and instrumentation	137
D5 Gas chromatography: procedures and applications	149
D6 High-performance liquid chromatography: principles and instrumentation	155
D7 High-performance liquid chromatography: modes, procedures and applications	166
D8 Electrophoresis and electrochromatography: principles and instrumentation	174
D9 Electrophoresis and electrochromatography: modes, procedures and applications	182

Section E – Spectrometric techniques	189
E1 Electromagnetic radiation and energy levels	189
E2 Atomic and molecular spectrometry	195
E3 Spectrometric instrumentation	201
E4 Flame atomic emission spectrometry	206
E5 Inductively coupled plasma spectrometry	209
E6 X-ray emission spectrometry	214
E7 Atomic absorption and atomic fluorescence spectrometry	218
E8 Ultraviolet and visible molecular spectrometry: principles and instrumentation	223
E9 Ultraviolet and visible molecular spectrometry: applications	228
E10 Infrared and Raman spectrometry: principles and instrumentation	233
E11 Infrared and Raman spectrometry: applications	242
E12 Nuclear magnetic resonance spectrometry: principles and instrumentation	248
E13 Nuclear magnetic resonance spectrometry: interpretation of proton and carbon-13 spectra	261
E14 Mass spectrometry	270
Section F – Combined techniques	283
F1 Advantages of combined techniques	283
F2 Sample identification using multiple spectrometric techniques data	285
F3 Gas chromatography–mass spectrometry	294
F4 Gas chromatography–infrared spectrometry	298
F5 Liquid chromatography–mass spectrometry	302
Section G – Thermal methods	305
G1 Thermogravimetry	305
G2 Differential thermal analysis and differential scanning calorimetry	311
G3 Thermomechanical analysis	316
G4 Evolved gas analysis	320
Section H – Sensors, automation and computing	323
H1 Chemical sensors and biosensors	323
H2 Automated procedures	328
H3 Computer control and data collection	331
H4 Data enhancement and databases	333
Further reading	337
Index	339