

CONTENTS

1. Simple Tool Skills	1
1.1. Unit Conversions	1
1.2. Estimating	5
1.3. Ideal Gas Law	9
1.4. Stoichiometry	14
1.5. Problem Set	16
2. Mass Balance and Kinetics	23
2.1. Steady-State Mass Balance	24
2.2. Non-Steady-State Mass Balance	41
2.3. Chemical Kinetics	59
2.4. Problem Set	69
3. Atmospheric Chemistry	77
3.1. Atmospheric Structure	77
3.2. Light and Photochemistry	80
3.3. Atmospheric Oxidants	86
3.4. Kinetics of Atmospheric Reactions	88
3.5. Stratospheric Ozone	91
3.6. Smog	105
3.7. Problem Set	112
4. Climate Change	123
4.1. Historical Perspective	123
4.2. Blackbody Radiation and Earth's Temperature	125
4.3. Absorption of Infrared Radiation	130
4.4. Greenhouse Effect	132
4.5. Earth's Radiative Balance	134
4.6. Aerosols and Clouds	138
4.7. Radiative Forcing	141

4.8. Global Warming Potentials	142
4.9. Concluding Remarks	144
4.10. Problem Set	146
5. Carbon Dioxide Equilibria	153
5.1. Pure Rain	155
5.2. Polluted Rain	160
5.3. Surface Water	169
5.4. Ocean Acidification	174
5.5. Problem Set	181
6. Pesticides, Mercury, and Lead	189
6.1. Pesticides	191
6.2. Mercury	210
6.3. Lead	213
6.4. Problem Set	217
7. Fates of Organic Compounds	223
7.1. Vapor Pressure	225
7.2. Water Solubility	226
7.3. Henry's Law Constant	227
7.4. Partition Coefficients	228
7.5. Lipophilicity	229
7.6. Bioaccumulation	231
7.7. Adsorption	232
7.8. Water–Air Transfer	235
7.9. Reactive Fates of Organics	240
7.10. Partitioning and Persistence	242
7.11. Problem Set	247
8. PCBs, Dioxins, and Flame Retardants	259
8.1. Polychlorinated Biphenyls (PCBs)	259
8.2. Polychlorinated Dibenzo- <i>p</i> -dioxins and Dibenzofurans	277
8.3. Brominated Flame Retardants	297
8.4. Lessons Learned	304

A. Primer on Organic Structures and Names	307
B. Answers to the Problem Sets	325
C. Periodic Table of the Elements	328
Index	331