

# CONTENTS

<i>Preface</i> .....	(xiii)
<i>Acknowledgements</i> .....	(xv)
<b>1. Atomic Structure</b>	
1.1 Fundamental Particles of Atom.....	1
1.2 Rutherford's Model of the Atom.....	2
1.3 Bohr's Model of the Atom.....	2
1.4 Sommerfeld Model.....	3
1.5 Wave Nature of the Electron.....	4
1.6 Heisenberg Uncertainty Principle.....	4
1.7 Electronic Configuration.....	5
1.8 Quantum Numbers.....	6
1.9 Atomic Orbitals.....	7
<i>Practice Questions</i> .....	9
<b>2. Chemical Bonding and Hybridisation</b>	
2.1 Octet Rule.....	10
2.2 Chemical Bonds.....	10
2.3 Characteristic Features of Covalent Bond.....	12
2.4 Polar Molecules.....	14
2.5 Non-Polar Bonds.....	15
2.6 Applications of Polarity.....	15
2.7 Hydrogen Bond.....	16
2.8 Intermolecular Forces.....	20
2.9 Molecular Orbital Theory.....	21
2.10 Hybridisation.....	23
<i>Practice Questions</i> .....	26
<b>3. Purification and Characterisation of Organic Compounds</b>	
3.1 Introduction.....	28
3.2 Purification.....	28
3.3 Qualitative Analysis of Organic Compounds.....	35
3.4 Quantitative Analysis.....	37
3.5 Determination of Molecular Mass.....	40
3.6 Calculation of Empirical and Molecular Formulae.....	40
3.7 Modern Methods of Structure Elucidation.....	41
3.8 Physical Properties of Chemical Compounds.....	41
<i>Practice Questions</i> .....	45
<b>4. Electron Displacement Effects</b>	
4.1 Inductive Effect.....	47
4.2 Electromeric Effect.....	49
4.3 Resonance.....	50

(viii) **Contents**

4.4	Hyperconjugative Effect.....	54
4.5	Theories of Reaction Rates.....	56
	<i>Practice Questions</i> .....	59
<b>5.</b>	<b>Reactive Intermediates</b>	
5.1	Introduction.....	60
5.2	Free Radicals.....	60
5.3	Carbocations.....	63
5.4	Carbenes.....	65
5.5	Nitrenes.....	67
5.6	Carbanions.....	68
5.7	Organic Reagents.....	70
5.8	Acids and Bases.....	71
5.9	Chemical Reactions: An Overview.....	74
5.10	Solvents.....	77
	<i>Practice Questions</i> .....	80
<b>6.</b>	<b>Classification and Nomenclature of Organic Compounds</b>	
6.1	Classification of Organic Compounds.....	81
6.2	Functional Group.....	81
6.3	Homologous Series.....	82
6.4	Nomenclature of Organic Compounds.....	82
6.5	Rules to Write the Structure of a Compound.....	86
	<i>Practice Questions</i> .....	86
<b>7.</b>	<b>Principles of Isomerism</b>	
7.1	Structural Isomerism.....	88
7.2	Stereoisomerism.....	89
7.3	Geometrical Isomerism.....	90
7.4	Optical Isomerism.....	95
7.5	Conformational Isomerism.....	109
	<i>Practice Questions</i> .....	114
<b>8.</b>	<b>Chemistry of Alkanes</b>	
8.1	Nomenclature of Alkanes.....	117
8.2	Alkyl Groups.....	118
8.3	Natural Sources of Alkanes.....	119
8.4	General Methods of Preparation.....	119
8.5	Physical Properties.....	122
8.6	Chemical Properties.....	124
8.7	Pharmaceutical Compounds.....	127
	<i>Practice Questions</i> .....	128
<b>9.</b>	<b>Chemistry of Alkenes</b>	
9.1	Introduction.....	129
9.2	Nomenclature.....	129
9.3	General Methods of Preparation.....	129
9.4	Physical Properties.....	136

9.5 Chemical Properties.....	137
<i>Practice Questions</i> .....	149
<b>10. Chemistry of Alkynes</b>	
10.1 Introduction .....	151
10.2 IUPAC Nomenclature .....	151
10.3 Preparation of Alkynes.....	152
10.4 Physical Properties of Alkynes.....	154
10.5 Chemical Properties.....	154
<i>Practice Questions</i> .....	159
<b>11. Chemistry of Dienes</b>	
11.1 Classification of Dienes.....	160
11.2 Preparation of Dienes .....	161
11.3 Properties of Dienes .....	161
<i>Practice Questions</i> .....	165
<b>12. Chemistry of Cycloalkanes</b>	
12.1 Nomenclature .....	167
12.2 Preparation of Cycloalkanes.....	167
12.3 Physical Properties of Cycloalkanes.....	168
12.4 Chemical Properties of Cycloalkanes.....	168
12.5 Baeyer Strain Theory.....	170
12.6 Sachse-Mohr Theory of Strainless Rings .....	171
<i>Practice Questions</i> .....	171
<b>13. Chemistry of Alkyl Halides</b>	
13.1 Introduction .....	172
13.2 Classification .....	172
13.3 Nomenclature of Alkyl Halides.....	173
13.4 Isomerism in Alkyl Halides.....	174
13.5 Methods to Prepare Alkyl Halides.....	174
13.6 Physical Properties of Alkyl Halides.....	176
13.7 Chemical Properties of Alkyl Halides .....	176
13.8 S <sub>N</sub> <sup>1</sup> vs S <sub>N</sub> <sup>2</sup> Reaction: A Summary .....	193
13.9 E1 vs E2 Reaction: A Summary .....	194
13.10 Important Pharmaceutical Compounds.....	194
<i>Practice Questions</i> .....	196
<b>14. Alcohols</b>	
14.1 Classification of Alcohols .....	198
14.2 Nomenclature of Alcohols.....	199
14.3 Isomerism in Alcohols.....	199
14.4 Preparation of Alcohols.....	200
14.5 Industrial Manufacture of Ethyl Alcohol.....	205
14.6 Industrial Manufacture of Methyl Alcohol.....	206
14.7 Physical Properties of Alcohols.....	206
14.8 Chemical Properties of Alcohols.....	207

(x) **Contents**

14.9	Chemical Distinction among Primary, Secondary and Tertiary Alcohols.....	210
14.10	Pharmaceutical Compounds .....	212
	<i>Practice Questions</i> .....	218
<b>15.</b>	<b>Chemistry of Ethers and Epoxides</b>	
15.1	Introduction .....	220
15.2	Nomenclature of Ethers.....	220
15.3	Functional Isomerism .....	221
15.4	General Methods of Preparation .....	221
15.5	Physical Properties of Ethers.....	223
15.6	Chemical Properties of Ethers .....	223
15.7	Epoxides .....	224
15.8	Pharmaceutical Compounds .....	225
	<i>Practice Questions</i> .....	226
<b>16.</b>	<b>Chemistry of Benzene and Aromaticity</b>	
16.1	Introduction .....	227
16.2	Structure .....	227
16.3	Preparation.....	231
16.4	Physical Properties .....	232
16.5	Chemical Reactions .....	232
16.6	Electrophilic Aromatic Substitution Reactions of Substituted Benzenes.....	237
16.7	Aromaticity.....	242
16.8	Anti-Aromaticity .....	243
	<i>Practice Questions</i> .....	243
<b>17.</b>	<b>Chemistry of Aryl Halides</b>	
17.1	Introduction .....	245
17.2	Synthesis of Aryl Halides .....	245
17.3	Physical Properties .....	246
17.4	Chemical Properties.....	246
	<i>Practice Questions</i> .....	249
<b>18.</b>	<b>Aromatic Sulphonic Acids</b>	
18.1	Introduction .....	251
18.2	Synthesis of Aromatic Sulphonic Acids.....	251
18.3	Physical Properties .....	252
18.4	Chemical Properties.....	252
18.5	Uses of Arylsulphonic Acids.....	254
18.6	Pharmaceutical Compounds .....	254
	<i>Practice Questions</i> .....	256
<b>19.</b>	<b>Chemistry of Aldehydes and Ketones</b>	
19.1	Nomenclature .....	257
19.2	Isomerism.....	258
19.3	Preparation of Carbonyl Compounds .....	258
19.4	Physical Properties of Carbonyl Compounds .....	263

19.5	Chemical Properties of Carbonyl Compounds .....	263
19.6	Pharmaceutical Compounds .....	278
	<i>Practice Questions</i> .....	281
<b>20.</b>	<b>Carboxylic Acids</b>	
20.1	Introduction .....	283
20.2	Classification .....	283
20.3	IUPAC Nomenclature .....	284
20.4	Synthesis of Carboxylic Acids .....	286
20.5	Physical Properties of Carboxylic Acids .....	288
20.6	Chemical Properties of Carboxylic Acids .....	288
20.7	Dicarboxylic Acids.....	295
20.8	Aldehydic and Keto Acids.....	298
20.9	Hydroxy Acids .....	299
20.10	Pharmaceutical Compounds .....	302
	<i>Practice Questions</i> .....	311
<b>21.</b>	<b>Chemistry of Carboxylic Acid Derivatives</b>	
21.1	Acid Chlorides.....	313
21.2	Acid Anhydrides.....	316
21.3	Acid Amides.....	317
21.4	Esters .....	321
21.5	Relative Reactivity of Acid Derivatives .....	327
21.6	Acetoacetic Ester.....	328
21.7	Malonic Ester .....	331
21.8	Pharmaceutical Compounds .....	334
	<i>Practice Questions</i> .....	336
<b>22.</b>	<b>Chemistry of <math>\alpha,\beta</math>-Unsaturated Carbonyl Compounds</b>	
22.1	Introduction .....	338
22.2	Preparation.....	338
22.3	Chemical Reactions.....	339
	<i>Practice Questions</i> .....	342
<b>23.</b>	<b>Chemistry of Phenols</b>	
23.1	Introduction .....	343
23.2	General Methods of Preparation.....	343
23.3	Physical Properties .....	345
23.4	Chemical Properties.....	345
23.5	Pharmaceutical Compounds .....	352
	<i>Practice Questions</i> .....	356
<b>24.</b>	<b>Chemistry of Amines</b>	
24.1	Introduction .....	358
24.2	Bonding in Amines.....	358
24.3	Classification of Amines .....	359
24.4	Nomenclature of Amines.....	359

(xii) **Contents**

24.5	Preparation of Amines .....	360
24.6	Physical Properties of Amines.....	364
24.7	Chemical Properties of Amines.....	364
24.8	Quaternary Ammonium Salts .....	372
24.9	Aromatic Diazonium Salts .....	373
24.10	Pharmaceutical Compounds .....	377
	<i>Practice Questions</i> .....	381
<b>25.</b>	<b>Aromatic Heterocyclic Compounds</b>	
25.1	Introduction .....	383
25.2	Classification .....	383
25.3	Nomenclature .....	384
25.4	Chemistry of Furan.....	384
25.5	Chemistry of Pyrrole .....	389
25.6	Thiophene.....	392
25.7	Pyridine .....	394
	<i>Practice Questions</i> .....	397
<b>26.</b>	<b>Carbohydrates</b>	
26.1	Introduction .....	399
26.2	Classification of Carbohydrates.....	399
26.3	Glucose.....	401
26.4	Sucrose or Saccharose (Table Sugar, Cane Sugar).....	403
26.5	Lactose .....	403
26.6	Starch.....	404
26.7	Cellulose.....	405
	<i>Practice Questions</i> .....	406
<b>27.</b>	<b>Phase-Transfer Catalysis</b>	
27.1	Catalysis .....	407
27.2	Phase-Transfer Catalysis (PTC) .....	407
27.3	Phase-Transfer Catalysts .....	407
27.4	Methodology of Phase-Transfer Catalysis.....	409
27.5	Advantages of Phase-Transfer Catalysis .....	410
27.6	Factors Influencing Phase-Transfer Catalysis .....	410
27.7	Applications of Phase-Transfer Catalysis.....	410
	<i>Suggested Readings</i> .....	413
	<i>Index</i> .....	417