

CONTENTS

1	Introduction	1
1.1	Definitions and nomenclature	1
1.2	Some historical perspectives	4
1.3	The synthetic polymers industry	6
1.4	General features of polymerization processes	11
	Exercises	15
2	Average molecular masses and polydispersity	18
2.1	Definitions and illustrations	18
2.2	Experimental determinations	21
2.3	Liquid-phase osmometry	32
	Exercises	34
3	Microscopic features of bulk polymers	36
3.1	General aspects	36
3.2	Microcrystallinity and drawing	39
3.3	Amorphous polymers	42
3.4	Glass transition temperatures (T_g)	45
3.5	Melting temperatures (T_m)	50
3.6	Measurement of T_g and T_m	55
3.7	Concluding remarks	57
	Exercises	57
4	Major techniques for analysis and structure determination	61
4.1	Infrared absorption spectroscopy	61
4.2	Nuclear magnetic resonance (NMR) spectroscopy	65
4.3	X-ray scattering	70
	Exercises	78
5	Step growth polymerizations	85
5.1	General features	85
5.2	Linear step-growth systems with two monomers	90
5.3	Some important linear step-growth polymers	93
5.4	Network polymers	96
	Exercises	102

6	Addition polymerization via free radicals	105
6.1	General features	105
6.2	Physical forms of synthesis media	107
6.3	Initiation processes	111
6.4	The growth and termination of chains	113
6.5	The control of chain growth	118
6.6	Generation of side chains	123
	Exercises	126
7	Addition polymerization via ionic and coordination mechanisms	128
7.1	General features of ionic polymerization	128
7.2	Cationic polymerization	130
7.3	Anionic polymerization	133
7.4	Coordination polymerization	136
	Exercises	142
8	Properties of common polymers in bulk	144
8.1	Crystallinity	144
8.2	Variation of glass transition temperature (T_g)	146
8.3	Drawn thermoplastics	151
8.4	Elastomers	153
8.5	Polymer degradation and recycling	160
	Exercises	164
9	Some speciality polymers	167
9.1	Graft copolymers and comb copolymers	167
9.2	Liquid crystal polymers	170
9.3	High-temperature polymers	175
9.4	Polycarbonate	179
9.5	Ionomers and polymeric solid electrolytes	180
	Exercises	185
10	Looking to the future	189
10.1	The synthesis of block copolymers	189
10.2	Side-chain liquid crystals	193
10.3	Synthetic metals	195
10.4	Polymers with active surfaces	197
10.5	Concluding remarks	201

Appendix Systematic names of common monomers	202
Further reading	203
Index	209