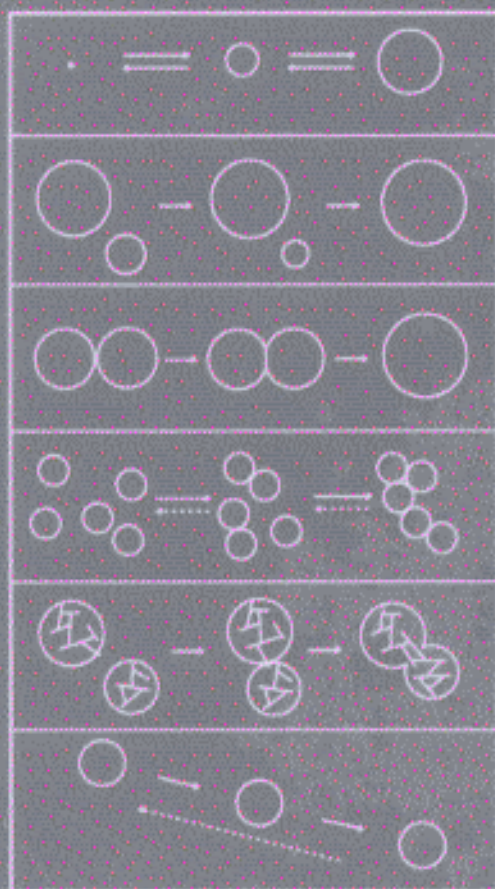


Physical Chemistry of Foods



Pieter Walstra

Contents

<i>Foreword</i>	<i>iii</i>
<i>Preface</i>	<i>v</i>
1 INTRODUCTION	1
1.1 Physical Chemistry in Food Science and Technology	2
1.2 About this Book	5
Bibliography	9
2 ASPECTS OF THERMODYNAMICS	10
2.1 Concepts	11
2.2 Solutions	15
2.3 Electrolyte Solutions	34
2.4 Recapitulation	44
Bibliography	45
3 BONDS AND INTERACTION FORCES	46
3.1 Types of Bonds	49
3.2 Solvation	53
3.3 Recapitulation	57
Bibliography	58

4	REACTION KINETICS	59
4.1	Reaction Order	60
4.2	Chemical Equilibrium	65
4.3	Rate Theories	67
4.4	Further Complications	79
4.5	Recapitulation	84
	Bibliography	85
5	TRANSPORT PHENOMENA	87
5.1	Flow and Viscosity	87
5.2	Diffusion	112
5.3	Transport in Composite Materials	121
5.4	Recapitulation	132
	Bibliography	135
6	POLYMERS	137
6.1	Introduction	137
6.2	Very Dilute Solutions	142
6.3	Polyelectrolytes	154
6.4	More Concentrated Solutions	168
6.5	Phase Separation	179
6.6	Starch	187
6.7	Recapitulation	199
	Bibliography	201
7	PROTEINS	203
7.1	Description	204
7.2	Conformational Stability and Denaturation	217
7.3	Solubility	237
7.4	Recapitulation	246
	Bibliography	248
8	WATER RELATIONS	250
8.1	Water Activity	250
8.2	Sorption Isotherms	256
8.3	"Water Binding"	265
8.4	Reaction Rates and Water Content	270
8.5	Recapitulation	279
	Bibliography	280
9	DISPERSED SYSTEMS	282
9.1	Structure	284

9.2	Importance of Scale	294
9.3	Particle Size Distributions	302
9.4	Recapitulation	312
	Bibliography	314
10	SURFACE PHENOMENA	316
10.1	Surface Tension	316
10.2	Adsorption	321
10.3	Surfactants	332
10.4	Time Effects	347
10.5	Curved Interfaces	354
10.6	Contact Angles and Wetting	363
10.7	Interfacial Tension Gradients	373
10.8	Interfacial Rheology	381
10.9	Recapitulation	392
	Bibliography	395
11	FORMATION OF EMULSIONS AND FOAMS	397
11.1	Introduction	398
11.2	Foam Formation and Properties	402
11.3	Breakup of Drops and Bubbles	411
11.4	Role of Surfactant	423
11.5	Recapitulation	434
	Bibliography	435
12	COLLOIDAL INTERACTIONS	437
12.1	General Introduction	437
12.2	DLVO Theory	440
12.3	Role of Polymers	454
12.4	Other Interactions	469
12.5	Recapitulation	471
	Bibliography	474
13	CHANGES IN DISPERSITY	476
13.1	Overview	476
13.2	Aggregation	480
13.3	Sedimentation	504
13.4	Coalescence	514
13.5	Partial Coalescence	529
13.6	Ostwald Ripening	535
13.7	Recapitulation	541
	Bibliography	546

14	NUCLEATION	548
	14.1 Phase Transitions	548
	14.2 Nucleation Theory	553
	14.3 Nucleation in a Finely Dispersed Material	571
	14.4 Formation of a Gas Phase	576
	14.5 Recapitulation	579
	Bibliography	581
15	CRYSTALLIZATION	583
	15.1 The Crystalline State	583
	15.2 Crystal Growth	592
	15.3 Crystallization from Aqueous Solutions	607
	15.4 Fat Crystallization	620
	15.5 Recapitulation	645
	Bibliography	648
16	GLASS TRANSITIONS AND FREEZING	650
	16.1 The Glassy State	650
	16.2 The Special Glass Transition	663
	16.3 Freezing of Foods	669
	16.4 Recapitulation	680
	Bibliography	682
17	SOFT SOLIDS	683
	17.1 Rheology and Fracture	684
	17.2 Gels	708
	17.3 Plastic Fats	739
	17.4 Closely Packed Systems	750
	17.5 Cellular Systems	757
	17.6 Recapitulation	763
	Bibliography	769
APPENDIX A: Frequently Used Symbols for Physical Quantities		772
APPENDIX B: Some Frequently Used Abbreviations		777
APPENDIX C: Some Mathematical Symbols		778
APPENDIX D: SI Rules for Notation		779
APPENDIX E: The SI Units System		781
APPENDIX F: Some Conversion Factors		784
APPENDIX G: Recalculation of Concentrations		785
APPENDIX H: Physical Properties of Water at 0–100°C		786

Contents**xiii****APPENDIX I: Thermodynamic and Physical Properties of
Water and Ice****787****APPENDIX J: Some Values of the Error Function****788***Index***789**