

Table of contents provided by Syndetics

- **Society of Dyers and Colourists** (p. xiii)
- **Preface** (p. xv)
- **1 General Chemistry Related to Textiles** (p. 1)
- **1.1 Introduction** (p. 1)
- **1.2 Atomic Structure** (p. 1)
- **1.3 Periodic Table of the Elements** (p. 4)
- **1.4 Valency and Bonding** (p. 6)
- **1.4.1 Giving or Receiving of Electrons: Formation of Ionic Bonds** (p. 6)
- **1.4.2 Sharing of Electrons: Formation of Covalent Bonds** (p. 8)
- **1.4.3 Secondary Forces of Attraction** (p. 10)
- **1.5 Chemical Reactions** (p. 13)
- **1.5.1 Types of Chemical Reaction** (p. 13)
- **1.5.2 Rates of Chemical Reactions and Chemical Equilibria** (p. 14)
- **1.5.3 Effect of Temperature on Rate of Reaction** (p. 16)
- **1.5.4 Catalysts** (p. 17)
- **1.5.5 Thermodynamics of Reactions** (p. 19)
- **1.5.5.1 The First Law of Thermodynamics** (p. 19)
- **1.5.5.2 The Second Law of Thermodynamics** (p. 20)
- **1.5.5.3 The Third Law of Thermodynamics** (p. 21)
- **1.5.5.4 Free Energy** (p. 21)
- **1.5.5.5 Interpreting Thermodynamic Data** (p. 22)
- **1.6 Acids, Bases and Salts** (p. 23)
- **1.6.1 Acids and Bases** (p. 23)
- **1.6.2 The pH Scale** (p. 23)
- **1.6.3 Sides and Salt Hydrolysis** (p. 24)
- **1.6.4 Buffer Solutions** (p. 25)
- **1.7 Redox Reactions** (p. 26)
- **1.8 Organic Chemistry** (p. 27)
- **1.8.1 The Hydrocarbons** (p. 27)
- **1.8.1.1 Aliphatic Hydrocarbons** (p. 28)
- **1.8.1.2 Aromatic Hydrocarbons** (p. 30)
- **1.8.2 Functional Groups** (p. 32)
- **1.8.3 Important Functional Groups of Aliphatic Compounds** (p. 32)
- **1.8.3.1 Halides** (p. 32)
- **1.8.3.2 Alcohols** (p. 33)
- **1.8.3.3 Carboxylic Acids** (p. 34)
- **1.8.3.4 Esters** (p. 35)
- **1.8.3.5 Aldehydes and Ketones** (p. 36)
- **1.8.3.6 Ethers** (p. 36)
- **1.8.3.7 Amines** (p. 36)
- **1.8.3.8 Cyano and Nitro Groups** (p. 38)
- **1.8.4 Important Functional Groups of Aromatic Compounds** (p. 38)
- **1.8.5 Important Compounds in Textile Dyeing** (p. 40)
- **1.8.5.1 Sequestering Agents** (p. 40)

- **1.8.5.2 Surface-Active Agents (Surfactants)** (p. 41)
- **1.8.5.3 Carriers** (p. 42)
- **1.9 The Use of Chemicals by Industry** (p. 43)
- **1.9.1 REACH** (p. 43)
- **1.9.2 Effluent Disposal** (p. 44)
- **2 Textile Fibres** (p. 47)
- **2.1 Introduction** (p. 47)
- **2.2 Nature of Fibre-Forming Polymers** (p. 51)
- **2.3 Properties of Textile Fibres** (p. 54)
- **2.4 Mechanical Properties of Textile Fibres** (p. 54)
- **2.4.1 Fibre Length** (p. 54)
- **2.4.2 Fibre Fineness** (p. 54)
- **2.4.3 Fibre Strength** (p. 55)
- **2.5 Chemistry of the Main Fibre Types** (p. 57)
- **2.5.1 Cellulosic Fibres** (p. 57)
- **2.5.1.1 Cotton** (p. 57)
- **2.5.1.2 Chemistry of Cotton** (p. 58)
- **2.5.1.3 Morphology of Cotton** (p. 60)
- **2.5.1.4 Properties of Cotton** (p. 62)
- **2.5.1.5 Organic Cotton** (p. 64)
- **2.5.2 Other Cellulosic Fibres** (p. 65)
- **2.6 Protein Fibres** (p. 65)
- **2.6.1 Wool** (p. 66)
- **2.6.1.1 Chemistry of Wool** (p. 66)
- **2.6.1.2 Morphology of Wool** (p. 70)
- **2.6.1.3 Properties of Wool Fibres** (p. 72)
- **2.6.1.4 Ecological Aspects** (p. 74)
- **2.6.2 Hair Fibres** (p. 74)
- **2.6.3 Silk** (p. 74)
- **2.7 Regenerated Fibres** (p. 75)
- **2.7.1 Early Developments** (p. 75)
- **2.7.2 Viscose** (p. 75)
- **2.7.3 Lyocell Fibres** (p. 77)
- **2.7.4 Cellulose Acetate Fibres** (p. 79)
- **2.7.5 Polylactic Acid Fibres** (p. 80)
- **2.8 Synthetic Fibres** (p. 81)
- **2.8.1 Condensation Polymers** (p. 82)
- **2.8.1.1 Polyamide (Nylon) Fibres** (p. 82)
- **2.8.1.2 Aramid Fibres** (p. 84)
- **2.8.1.3 Polyester Fibres** (p. 85)
- **2.8.1.4 Elastomeric Fibres** (p. 87)
- **2.8.2 Addition Polymers** (p. 87)
- **2.8.2.1 Polyolefin Fibres** (p. 87)
- **2.8.2.2 Acrylic Fibres** (p. 89)
- **2.9 Conversion of Synthetic Polymers into Fibre Filaments** (p. 90)
- **2.10 Fibre Cross-Sectional Shapes** (p. 92)

- **2.11 Microfibres** (p. 93)
- **2.12 Absorbent Fibres** (p. 94)
- **2.13 Drawing of Synthetic Fibre Filaments** (p. 94)
- **2.14 Conversion of Man-Made Fibre Filaments to Staple** (p. 96)
- **2.15 Imparting Texture to Synthetic Fibres** (p. 96)
- **2.16 Fibre Blends** (p. 97)
- **2.17 Textile Manufacturing** (p. 99)
 - **2.17.1 Yarns** (p. 99)
 - **2.17.2 Fabrics** (p. 99)
 - **2.17.2.1 Woven Fabrics** (p. 100)
 - **2.17.2.2 Knitted Fabrics** (p. 103)
 - **Suggested Further Reading** (p. 105)
- **3 Chemistry of Dyes and Pigments** (p. 107)
 - **3.1 Introduction** (p. 107)
 - **3.2 Classification of Colorants** (p. 107)
 - **3.3 Colour in Organic Molecules** (p. 110)
 - **3.4 Classification of Dyes According to Chemical Structure** (p. 113)
 - **3.4.1 Azo Dyes** (p. 113)
 - **3.4.2 Anthraquinone Dyes** (p. 115)
 - **3.4.3 Methine and Polymethine Dyes** (p. 116)
 - **3.4.4 Nitro Dyes** (p. 116)
 - **3.4.5 Triarylmethane Dyes** (p. 117)
 - **3.5 Classification of Dyes According to Application Class** (p. 117)
 - **3.5.1 Dyes for Protein Fibres** (p. 117)
 - **3.5.1.1 Acid Dyes** (p. 117)
 - **3.5.1.2 Mordant Dyes** (p. 120)
 - **3.5.1.3 Pre-metallised (or Metal-Complex) Dyes** (p. 121)
 - **3.5.1.4 Reactive Dyes** (p. 123)
 - **3.5.1.5 Summary** (p. 126)
 - **3.5.2 Dyes for Cellulosic Fibres** (p. 127)
 - **3.5.2.1 Direct Dyes** (p. 127)
 - **3.5.2.2 Vat Dyes** (p. 128)
 - **3.5.2.3 Solubilised Vat Dyes** (p. 129)
 - **3.5.2.4 Reactive Dyes** (p. 130)
 - **3.5.2.5 Sulphur Dyes** (p. 134)
 - **3.5.2.6 Azoic Dyes** (p. 136)
 - **3.5.3 Dyes for Synthetic Fibres** (p. 137)
 - **3.5.3.1 Disperse Dyes** (p. 137)
 - **3.5.3.2 Basic Dyes** (p. 138)
 - **3.5.4 Pigments** (p. 139)
 - **3.6 Commercial Naming of Dyes and Pigments** (p. 141)
 - **3.7 Strength and Physical Form of Colorants** (p. 141)
 - **References** (p. 142)
- **4 Industrial Coloration Methods** (p. 143)
 - **4.1 Introduction** (p. 143)
 - **4.2 Dye Application Processes** (p. 143)

- **4.2.1 Wool Dyeing** (p. 143)
- **4.2.1.1 Acid Dyes** (p. 143)
- **4.2.1.2 Chrome Dyes** (p. 145)
- **4.2.1.3 Pre-metallised Dyes** (p. 147)
- **4.2.1.4 Reactive Dyes** (p. 149)
- **4.2.1.5 Summary** (p. 150)
- **4.2.2 Cellulosic Fibre Dyeing** (p. 151)
- **4.2.2.1 Introduction** (p. 151)
- **4.2.2.2 Direct Dyes** (p. 152)
- **4.2.2.3 Vat Dyes** (p. 154)
- **4.2.2.4 Reactive Dyes** (p. 157)
- **4.2.2.5 Sulphur Dyes** (p. 161)
- **4.2.2.6 Azoic Dyes** (p. 162)
- **4.2.3 Polyester Fibre Dyeing** (p. 162)
- **4.2.4 Nylon Fibre Dyeing** (p. 167)
- **4.2.4.1 Disperse Dyes** (p. 167)
- **4.2.4.2 Acid Dyes** (p. 167)
- **4.2.4.3 Reactive Dyes** (p. 170)
- **4.2.5 Acrylic Fibre Dyeing** (p. 171)
- **4.2.5.1 Basic (Cationic) Dyes** (p. 171)
- **4.2.5.2 Disperse Dyes** (p. 172)
- **4.2.6 Polypropylene Fibre Dyeing** (p. 172)
- **4.2.7 Dyeing Fibre Blends** (p. 172)
- **4.2.7.1 Wool Fibre Blends** (p. 172)
- **4.2.7.2 Cotton Fibre Blends** (p. 174)
- **4.3 Dyeing Machinery** (p. 176)
- **4.3.1 Introduction** (p. 176)
- **4.3.2 Dyeing Loose Fibre** (p. 178)
- **4.3.3 Top Dyeing** (p. 179)
- **4.3.4 Yam Dyeing** (p. 180)
- **4.3.4.1 Package Dyeing** (p. 180)
- **4.3.4.2 Beam Dyeing for Yarns** (p. 183)
- **4.3.4.3 Hank Dyeing** (p. 185)
- **4.3.5 Fabric Dyeing** (p. 187)
- **4.3.5.1 Winch Dyeing** (p. 187)
- **4.3.5.2 Jig Dyeing** (p. 188)
- **4.3.5.3 Beam Dyeing of Fabric** (p. 191)
- **4.3.5.4 Jet Dyeing** (p. 192)
- **4.3.6 Garment Dyeing** (p. 194)
- **4.3.6.1 Side-Paddle Machines** (p. 195)
- **4.3.6.2 Rotating Drum Machines** (p. 196)
- **4.3.7 Continuous Dyeing** (p. 197)
- **4.4 Supercritical Fluid Dyeing** (p. 199)
- **References** (p. 201)
- **Suggested Further Reading** (p. 202)
- **5 Textile Printing** (p. 203)

- **5.1 Introduction** (p. 203)
- **5.2 Print Paste Formulation** (p. 204)
- **5.3 Thickeners** (p. 205)
 - **5.3.1 Natural Products** (p. 205)
 - **5.3.1.1 Starch-Based Thickeners** (p. 206)
 - **5.3.1.2 Alginates** (p. 206)
 - **5.3.1.3 Xanthans** (p. 206)
 - **5.3.2 Modified Natural Products** (p. 208)
 - **5.3.2.1 Carboxymethyl Cellulose** (p. 208)
 - **5.3.3 Synthetic Products** (p. 208)
 - **5.3.3.1 Emulsions** (p. 208)
- **5.4 Binders** (p. 209)
- **5.5 Pigments and Dyes** (p. 209)
 - **5.5.1 Pigments** (p. 210)
 - **5.5.2 Dyes** (p. 211)
- **5.6 Printing Screens** (p. 212)
 - **5.6.1 Flat Screens** (p. 212)
 - **5.6.2 Rotary Screens** (p. 213)
 - **5.6.3 Engraved Rollers** (p. 214)
- **5.7 Stages of Printing** (p. 215)
 - **5.7.1 Transport** (p. 215)
 - **5.7.2 Fixation (Dye-Based Prints)** (p. 216)
 - **5.7.3 Wash-Off (Dye-Based Prints)** (p. 217)
 - **5.7.4 Pigment Prints** (p. 217)
- **5.8 Printing Styles** (p. 217)
 - **5.8.1 Direct Printing** (p. 218)
 - **5.8.2 Discharge Printing** (p. 218)
 - **5.8.3 Resist Printing** (p. 220)
- **5.9 Printing Methods** (p. 221)
 - **5.9.1 Flat Screen Printing** (p. 221)
 - **5.9.2 Rotary Screen Printing** (p. 221)
 - **5.9.3 Copper Roller Printing** (p. 223)
 - **5.9.4 Heat Transfer Printing** (p. 224)
 - **5.9.5 Ink Jet Printing** (p. 225)
 - **5.9.5.1 Continuous Ink Jet Technology** (p. 226)
 - **5.9.5.2 Thermal Ink Jet Printing** (p. 226)
 - **5.9.5.3 Piezo Ink Jet Printing** (p. 227)
 - **5.9.6 Comparisons between Ink Jet Printing and Screen Printing** (p. 228)
- **Suggested Further Reading** (p. 229)
- **6 Theoretical Aspects of Dyeing** (p. 231)
 - **6.1 Introduction** (p. 231)
 - **6.2 Kinetic Aspects of Dyeing** (p. 232)
 - **6.3 Dye Aggregation** (p. 235)
 - **6.4 Diffusion** (p. 243)
 - **6.4.1 Measurement of the Diffusion Coefficient of Dyes** (p. 244)
 - **6.4.2 Activation Energy of Diffusion** (p. 246)

- **6.5 Rate of Dyeing** (p. 247)
- **6.6 Adsorption** (p. 250)
 - **6.6.1 Physical Adsorption** (p. 250)
 - **6.6.2 Chemical Adsorption (Chemisorption)** (p. 252)
 - **6.6.3 Adsorption Isotherms** (p. 252)
- **6.7 Thermodynamic Information Derived from Equilibrium Studies of Dyeing Systems** (p. 256)
 - **6.7.1 Standard Affinity, Standard Enthalpy and Standard Entropy of Dyeing** (p. 256)
 - **6.7.2 Determination of Thermodynamic Values for the Three Dye/Fibre System Types** (p. 258)
- **References** (p. 276)
- **Suggested Further Reading** (p. 276)
- **7 The Measurement of Colour** (p. 277)
 - **7.1 Introduction** (p. 277)
 - **7.2 Describing Colour** (p. 277)
 - **7.3 Additive and Subtractive Colour Mixing** (p. 278)
 - **7.3.1 Additive Colour Mixing** (p. 278)
 - **7.3.2 Subtractive Colour Mixing** (p. 279)
 - **7.4 The Colour Solid** (p. 280)
 - **7.5 Factors Affecting Colour Appearance** (p. 284)
 - **7.5.1 Light Sources** (p. 285)
 - **7.5.1.1 Colour Temperature of Light Sources** (p. 288)
 - **7.5.1.2 Standard Illuminants** (p. 288)
 - **7.5.2 Reflection** (p. 290)
 - **7.5.3 The Eye** (p. 295)
 - **7.6 The CIE System of Colour Specification** (p. 297)
 - **7.6.1 The Standard Observer** (p. 297)
 - **7.6.2 Specification of Surface Colours in the CIE XYZ System** (p. 299)
 - **7.6.3 Interpretation of Tristimulus Values** (p. 302)
 - **7.7 Applications of the CIE System** (p. 304)
 - **7.7.1 Colorant Formulation** (p. 304)
 - **7.7.2 Colour-Difference Formulae** (p. 310)
 - **7.7.3 Assessment of Metamerism** (p. 316)
 - **7.7.4 Assessment of Colour Constancy** (p. 317)
 - **7.7.5 Colour Sorting** (p. 319)
 - **7.7.6 Measurement of Whiteness** (p. 321)
 - **7.8 Solution Colour Measurement** (p. 322)
 - **Suggested Further Reading** (p. 326)
- **8 Fastness Testing** (p. 327)
 - **8.1 Introduction** (p. 327)
 - **8.2 Standards Related to Coloration** (p. 328)
 - **8.3 Resistance of Coloured Fabric to Harmful Agencies** (p. 330)
 - **8.4 Principles of Colour Fastness Testing** (p. 331)
 - **8.4.1 The ISO Standards Outlining the General Principles** (p. 331)
 - **8.4.2 Grey Scales** (p. 331)

- **8.4.3 Standard Depths** (p. 334)
- **8.5 Fastness Tests** (p. 336)
- **8.5.1 Light Fastness Tests** (p. 336)
- **8.5.2 Washing Fastness Tests** (p. 338)
- **8.5.3 Rubbing Fastness** (p. 340)
- **8.5.4 Other Fastness Tests** (p. 341)
- **8.5.4.1 Fastness to Water** (p. 341)
- **8.5.4.2 Fastness to Seawater** (p. 341)
- **8.5.4.3 Fastness to Chlorinated Water (Swimming Pool Water)** (p. 341)
- **8.5.4.4 Fastness to Perspiration** (p. 342)
- **8.5.4.5 Fastness to Dry Cleaning Using Perchloroethylene Solvent** (p. 342)
- **8.5.5 Miscellaneous Fastness Tests** (p. 342)
- **8.6 Test Organisations for Sustainable Textile Manufacture** (p. 343)
- **References** (p. 343)
- **Appendix Some Textile Terms and Definitions** (p. 345)
- **Index** (p. 347)