Contents

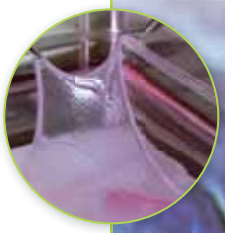
Exploring *ON Science 10* xii
Safety in your Science Classroom xiv

Unit 1 Tissues, Organs, and Systems of Living Things xviii

Get Ready for Unit 1 2

Chapter 1 Cells and More Cells 4
1.1 Studying the Structure of Cells 7
1.2 Genes: Answers and Questions 16
1.3 Cells from Cells 29
1.4 The Cell Cycle 40
Chapter 1 Summary 51
Chapter 1 Review 52

Chapter 2 Plants: From Cells to Systems 54
2.1 Plant Cells, Tissues, and Organs 57
2.2 Plant Organ Systems 70
Chapter 2 Summary 79
Chapter 2 Review 80



Chapter 3 Animals: From Cells to Systems 82
3.1 Cells and Tissues 85
3.2 Organs and Systems 93
3.3 Maintaining Healthy Systems 108
Chapter 3 Summary 121
Chapter 3 Review 122

Unit 1 Science at Work 124
Unit 1 Projects 126
Unit 1 Review 128

Unit 2 Chemical Reactions 132

Get Ready for Unit 2 134

Chapter 4 Developing Chemical Equations 136

4.1 Representing Ionic Compounds 139

4.2 Representing Molecular Compounds 152

4.3 Conservation of Mass and Chemical Equations 159

Chapter 4 Summary 173

Chapter 4 Review 174

Chapter 5 Classifying Chemical Reactions 176

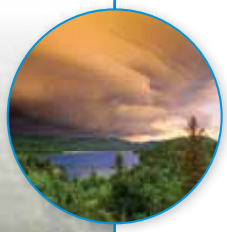
5.1 Synthesis and Decomposition Reactions 179

5.2 Displacement Reactions 190

5.3 Reactions and Environmental Issues 199

Chapter 5 Summary 213

Chapter 5 Review 214



Chapter 6 Acids and Bases 216

6.1 Identifying Acids and Bases 219

6.2 The pH Scale and Indicators 229

6.3 Reactions of Acids and Bases 236

Chapter 6 Summary 251

Chapter 6 Review 252

Unit 2 Science at Work 254

Unit 2 Projects 256

Unit 2 Review 258

Unit 3 Climate Change 262

Get Ready for Unit 3 264

Chapter 7 Earth's Climate System 266

7.1 Factors That Affect Climate Change 269

7.2 Describing Climates 279

7.3 Indicators and Effects of Climate Change 290

Chapter 7 Summary 305

Chapter 7 Review 306

Chapter 8 Dynamics of Climate Change 308

8.1 Energy Transfer in the Climate System 311

8.2 Greenhouse Gases and Human Activities 323

8.3 Cycling of Matter and the Climate System 333

Chapter 8 Summary 345

Chapter 8 Review 346

Chapter 9 Addressing Climate Change 348

9.1 Discovering Past Climates 351

9.2 Monitoring and Modelling Climate Change 360

9.3 Taking Action to Slow Climate Change 370

Chapter 9 Summary 385

Chapter 9 Review 386

Unit 3 Science at Work 388

Unit 3 Projects 390

Unit 3 Review 392

Unit 4 Light and Geometric Optics 396

Get Ready for Unit 4 398

Chapter 10 Light and Reflection 400

10.1 Sources and Nature of Light 403

10.2 Properties of Light and Reflection 411

10.3 Images in Concave Mirrors 419

10.4 Images in Convex Mirrors 431

Chapter 10 Summary 443

Chapter 10 Review 444

Chapter 11 Refraction 446

11.1 Refraction of Light 449

11.2 Partial Refraction and Total Internal Reflection 457

11.3 Optical Phenomena in Nature 468

Chapter 11 Summary 481

Chapter 11 Review 482

Chapter 12 Lenses and Lens Technologies 484

12.1 Characteristics of Lenses 487

12.2 Images Formed by Lenses 494

12.3 Lens Technologies and the Human Eye 502

Chapter 12 Summary 517

Chapter 12 Review 518

Unit 4 Science at Work 520

Unit 4 Projects 522

Unit 4 Review 524

Guide to the Toolkits and Appendices 528

Science Skills Toolkits 529

Math Skills Toolkits 552

Study Toolkits 560

Appendix A: Chemistry References 567

Appendix B: Properties of Common Substances 568

Appendix C: Numerical Answers and Answers to Practice Problems 570

Glossary 572

Index 579

Credits 586

Periodic Table 590

Activities, Investigations, and Features

Activities

1-1 Did You Get the Message? 5
1-2 To Test or Not to Test? 21
1-3 Modelling Mitosis 36
2-1 Observing Plant Growth 55
2-2 Inside a Leaf 62
2-3 The Flow of Phloem 71
3-1 More Than a Covering 83
3-2 Tissue Sleuth 89
3-3 Changing Your Pulse Rate 101
4-1 Making a Reaction Happen 137
4-2 Take My Electron–Please! 143
4-3 Electron, Anyone? 154
5-1 Foiled Again! 177
5-2 Building Up and Breaking Down 188
5-3 How Active Are the Non-Metals? 194
5-4 "Taking Care" of Toxic Materials 200
6-1 Cabbage Detector 217
6-2 Chemical Card Games 225
6-3 A Universal Rainbow 232
6-4 Air Pollution and Ontario's Lakes 244
7-1 Views on Climate Change 267
7-2 Modelling the Effects of Volcanoes on Climate 276
7-3 How to Make a Climatograph 281
7-4 Acidity and Coral Reefs 293
8-1 Modelling Balance in Systems 309
8-2 What Heats the Atmosphere? 315
8-3 Graphing Changes in Carbon Dioxide 329
8-4 Modelling Carbon Reservoirs 336
9-1 Who Is Responsible for Responding to Climate Change? 349
9-2 Analyzing Tree Rings 352
9-3 Pennies from Heaven 365
9-4 Talking the Talk, Walking the Walk 375
10-1 Glowing Slime 401
10-2 A Reflection Obstacle Course 414
10-3 Reflection from the Concave Surface of a Spoon 421
10-4 Reflection from the Convex Surface of a Spoon 434
11-1 The Re-appearing Coin 447
11-2 Investigating Properties of Light 459
11-3 The Fountain of Light 463
11-4 Apparent Depth 471
12-1 The Disappearing Finger 485
12-2 Hocus Focus 491

Investigations

1-A Examining Cell Structures 46
1-B Mitosis in Plant and Animal Cells 48
1-C Does the Patient Have Cancer? 50
2-A Transpiration in Different Plant Types 77
2-B Modelling Water Transport in Plants 78
3-A Heart Disease: Making the Public Aware 116
3-B Frog Dissection 117
3-C Who's Stubbing Out? 119
4-A Monitoring Paper Recycling 169
4-B Keep That Toothy Grin 170
4-C Comparing the Masses of Reactants and Products 172
5-A Evidence of Chemical Change 207
5-B Synthesis and Decomposition Reactions 208
5-C Displacement Reactions 210
5-D Can Metals Be "Active"? 212
6-A What Is Your Exposure to Acids and Bases? 247
6-B The pH of Lakes Near Sudbury 248
6-C Neutralizing an Acid with a Base 250
7-A Specific Heat Capacity of Earth Materials 300
7-B Comparing Ecoregions of Canada 302

7-C Comparing the Effects of Climate Change on Vegetation in Canada **304**

8-A Recognizing the Effects of El Niño and La Niña on Southern Canada **341**

8-B Comparing Heat Absorption of Water and Soil **343**

8-C Modelling the Greenhouse Effect **344**

9-A Understanding Ice-Core Data **382**

9-B Evaluating the "Food Miles" Initiative **384**

10-A Applying the Laws of Reflection **439**

10-B Studying the Laws of Reflection **440**

10-C Testing for Real and Virtual Images **442**

11-A Investigating Refraction, from Air to Water **476**

11-B Analyzing the Index of Refraction **477**

11-C Saving Time **478**

11-D Investing Total Internal Reflection in Water **480**

12-A Image Characteristics of a Converging Lens **512**

12-B I "Speye" **514**

12-C Make a Simple Telescope **516**

Case Studies

Clones in the Kitchen **24**

Eliminating Wheat Rust with Transgenic Therapy **66**

Childhood Vaccinations: Weighing the Risks **110**

Green Chemistry **166**

Hydrogen: Fuel of the Future? **182**

Update on Acid Precipitation **240**

This Weather Is Making Me Sick! **294**

Overheating the Ocean's Forests **312**

Reduce, Re-use, Recycle, and Upgrade **378**

Saved by the Sun **428**

Protecting Your Eyes from UV Radiation **472**

Laser Eye Surgery: Shaping Vision **508**

Making a Difference

Ted Paranjothy **44**

Isdin Oke **68**

Jerri Clout **113**

Adrienne Duimering **166**

Nikhita Singh **205**

Simon Bild-Enkin **242**

BJ Bodnar **292**

P.J. Partington **328**

Jasmeet Sidhu **380**

Pénélope Robinson and Maude Briand-Lemay **415**

Michael Furdyk **463**

Kienan Marion **500**

National Geographic Features

Visualizing Microscopes **8**

Visualizing Acids in Nature **221**

Visualizing El Niño and La Niña **318**

Visualizing Bioluminescence **408**