

eEdition

UNIT 1

Matter and Energy

Unit Features

SCIENTIFIC AMERICAN FRONTIERS IN SCIENCE <i>Fuels of the Future</i>	2
TIMELINES IN SCIENCE <i>About Temperature and Heat</i>	96

1 Introduction to Matter 6

the BIG idea

Everything that has mass and takes up space is matter.

1 Matter has mass and volume.	9
CHAPTER INVESTIGATION <i>Mass and Volume</i>	14
2 Matter is made of atoms.	16
EXTREME SCIENCE <i>Particles Too Small to See</i>	20
3 Matter combines to form different substances.	21
MATH IN SCIENCE <i>Making a Circle Graph</i>	26
4 Matter exists in different physical states.	27

2 Properties of Matter 38

the BIG idea

Matter has properties that can be changed by physical and chemical processes.

1 Matter has observable properties.	41
MATH IN SCIENCE <i>Solving Proportions</i>	49
2 Changes of state are physical changes.	50
CHAPTER INVESTIGATION <i>Freezing Point</i>	56
3 Properties are used to identify substances.	58
CONNECTING SCIENCES <i>Separating Minerals</i>	63



What properties could help you identify this sculpture as sugar?
page 38



What different forms of energy are shown in this photograph? page 68

3 Energy

68

the BIG idea

Energy has different forms, but it is always conserved.

- | | | |
|----------|--|----|
| 1 | Energy exists in different forms. | 71 |
| | THINK SCIENCE <i>Gasoline or Electric?</i> | 77 |
| 2 | Energy can change forms but is never lost. | 78 |
| | CHAPTER INVESTIGATION <i>Energy Conversions</i> | 84 |
| 3 | Technology improves the ways people use energy. | 86 |
| | MATH IN SCIENCE <i>Using Formulas</i> | 91 |

4 Temperature and Heat

100

the BIG idea

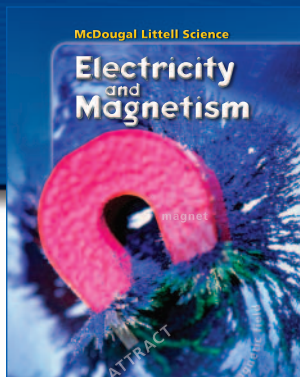
Heat is a flow of energy due to temperature differences.

- | | | |
|----------|--|-----|
| 1 | Temperature depends on particle movement. | 103 |
| | MATH IN SCIENCE <i>Metric Conversions</i> | 109 |
| 2 | Energy flows from warmer to cooler objects. | 110 |
| | SCIENCE ON THE JOB <i>Cooking with Heat</i> | 115 |
| 3 | The transfer of energy as heat can be controlled. | 116 |
| | CHAPTER INVESTIGATION <i>Insulators</i> | 122 |

Visual Highlights

- | | |
|-------------------|-----|
| States of Matter | 29 |
| Physical Changes | 45 |
| Converting Energy | 81 |
| Insulation | 120 |





UNIT 2 Electricity and Magnetism

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Unit Features

SCIENTIFIC AMERICAN FRONTIERS IN SCIENCE *Electronics in Music* 130

TIMELINES IN SCIENCE *The Story of Electronics* 200

5 Electricity 134

the BIG idea

Moving electric charges transfer energy.

- 1 Materials can become electrically charged. 137
CONNECTING SCIENCES *Electric Eels* 145
- 2 Charges can move from one place to another. 146
CHAPTER INVESTIGATION *Lightning* 154
- 3 Electric current is a flow of charge. 156
MATH IN SCIENCE *Using Variables* 163

6 Circuits and Electronics 168

the BIG idea

Circuits control the flow of electric charge.

- 1 Charge needs a continuous path to flow. 171
SCIENCE ON THE JOB *The Science of Electrical Work* 178
- 2 Circuits make electric current useful. 179
MATH IN SCIENCE *Solving Percent Problems* 184
- 3 Electronic technology is based on circuits. 185
CHAPTER INVESTIGATION *Design an Electronic Communication Device* 194

How can circuits control the flow of charge? page 168



What force is acting on this compass needle?
page 204

7 Magnetism

204

the BIG idea

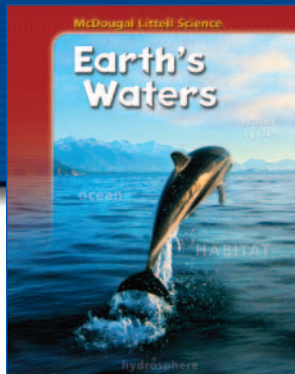
Current can produce magnetism, and magnetism can produce current.

- | | | |
|----------|--|-----|
| 1 | Magnetism is a force that acts at a distance. | 207 |
| | THINK SCIENCE <i>Can Magnets Heal People?</i> | 215 |
| 2 | Current can produce magnetism. | 216 |
| 3 | Magnetism can produce current. | 223 |
| | CHAPTER INVESTIGATION <i>Build a Speaker</i> | 228 |
| 4 | Generators supply electrical energy. | 230 |
| | MATH IN SCIENCE <i>Using Significant Figures</i> | 235 |



Visual Highlights

- | | |
|---|-----|
| How a Photocopier Works | 143 |
| How Lightning Forms | 149 |
| Batteries | 161 |
| How a PC Works | 190 |
| How Magnets Differ from Other Materials | 211 |
| How a Motor Works | 221 |



UNIT 3

Earth's Waters

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Unit Features

SCIENTIFIC AMERICAN FRONTIERS IN SCIENCE *Exploring the Water Planet* 242

TIMELINES IN SCIENCE *Exploring the Ocean* 346



The Water Planet

246

the BIG idea

Water moves through Earth's atmosphere, oceans, and land in a cycle.

- 1 Water continually cycles.** 249
THINK SCIENCE *Does Mars Have a Water Cycle?* 255
- 2 Fresh water flows and freezes on Earth.** 256
MATH IN SCIENCE *Multiplying Fractions and Whole Numbers* 263
- 3 Fresh water flows underground.** 264
CHAPTER INVESTIGATION *Water Moving Underground* 272



Freshwater Resources

278

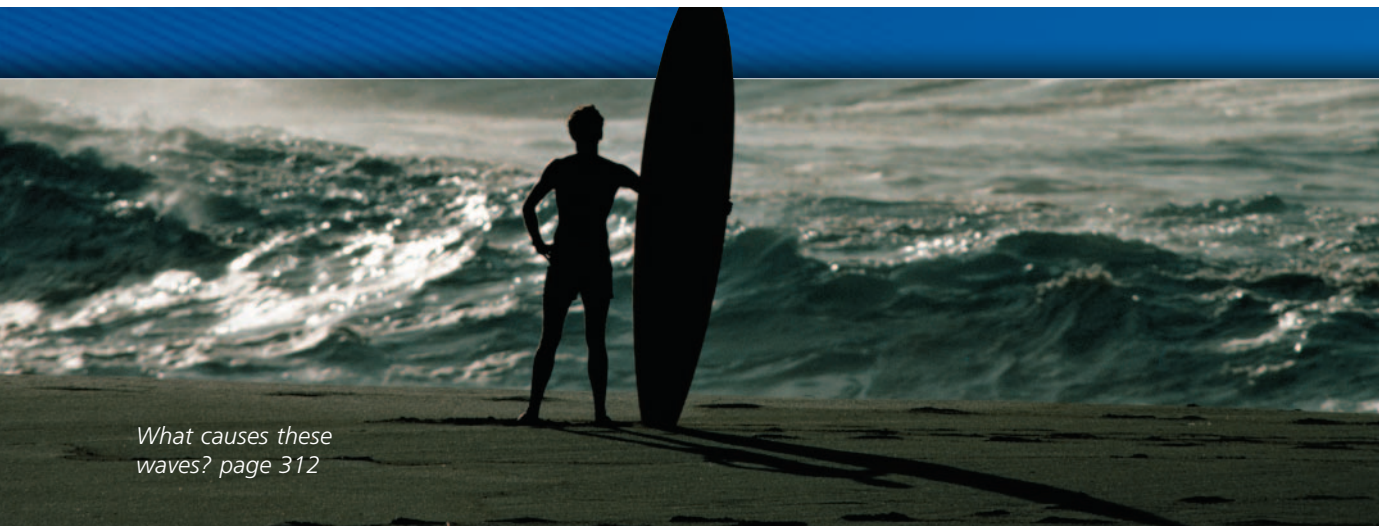
the BIG idea

Fresh water is a limited resource and is essential for human society.

- 1 Fresh water is an essential resource.** 281
MATH IN SCIENCE *Volume of Rectangular Prisms* 289
- 2 Society depends on clean and safe water.** 290
CHAPTER INVESTIGATION *Monitoring Water Quality* 298
- 3 Water shortages threaten society.** 300
SCIENCE ON THE JOB *Water and Farming* 307

In what ways do you depend on water?
page 278





What causes these waves? page 312

10 Ocean Systems

312

the BIG idea

The oceans are a connected system of water in motion.

- | | | |
|----------|---|-----|
| 1 | The oceans are a connected system. | 315 |
| | MATH IN SCIENCE <i>Plotting Coordinates</i> | 323 |
| 2 | Ocean water moves in currents. | 324 |
| 3 | Waves move through oceans. | 329 |
| | CHAPTER INVESTIGATION <i>Wave Movement</i> | 334 |
| 4 | Waters rise and fall in tides. | 336 |
| | CONNECTING SCIENCES <i>Tidal Energy</i> | 341 |

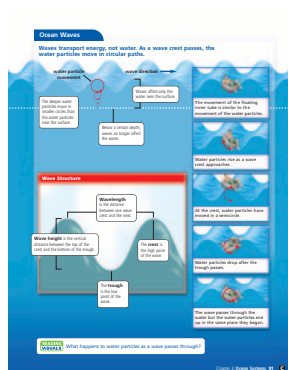
11 Ocean Environments

350

the BIG idea

The ocean supports life and contains natural resources.

- | | | |
|----------|--|-----|
| 1 | Ocean coasts support plant and animal life. | 353 |
| | MATH IN SCIENCE <i>Making a Double Bar Graph</i> | 360 |
| 2 | Conditions differ away from shore. | 361 |
| | EXTREME SCIENCE <i>Undersea Hot Spots</i> | 369 |
| 3 | The ocean contains natural resources. | 370 |
| | CHAPTER INVESTIGATION <i>Population Sampling</i> | 378 |



Visual Highlights

- | | |
|----------------------------|-----|
| Springs and Wells | 269 |
| Sources of Water Pollution | 295 |
| The Ocean Floor | 320 |
| Ocean Waves | 331 |
| Intertidal Zone | 355 |
| Coral Reefs | 363 |
| Life in the Open Ocean | 367 |



UNIT 4 Ecology

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Unit Features

SCIENTIFIC AMERICAN FRONTIERS IN SCIENCE <i>Ecosystems on Fire</i>	386
TIMELINES IN SCIENCE <i>Wilderness Conservation</i>	458

12 Ecosystems and Biomes 390

the **BIG** idea

Matter and energy together support life within an environment.

1 Ecosystems support life.	393
CHAPTER INVESTIGATION <i>Soil Samples</i>	398
2 Matter cycles through ecosystems.	400
MATH IN SCIENCE <i>Adding Integers</i>	405
3 Energy flows through ecosystems.	406
CONNECTING SCIENCES <i>Biomagnification</i>	413
4 Biomes contain many ecosystems.	414



How many living and nonliving things can you identify in this photograph? page 390



How do living things interact? page 426

13 Interactions Within Ecosystems 426

the BIG idea

Living things within an ecosystem interact with each other and the environment.

- 1 **Groups of living things interact within ecosystems.** 429
CHAPTER INVESTIGATION *Estimating Populations* 436
- 2 **Organisms can interact in different ways.** 438
THINK SCIENCE *Where Are the Salamanders?* 446
- 3 **Ecosystems are always changing.** 447
MATH IN SCIENCE *Multiplying a Fraction by a Whole Number* 453

14 Human Impact on Ecosystems 462

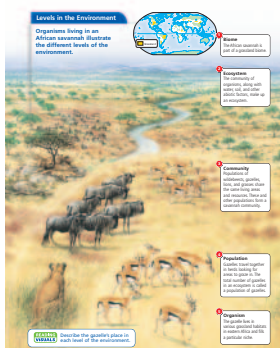
the BIG idea

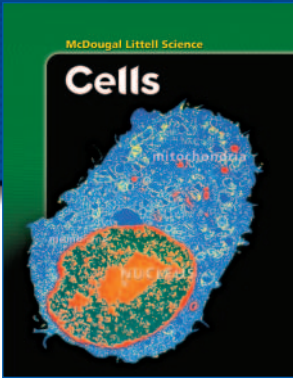
Humans and human population growth affect the environment.

- 1 **Human population growth presents challenges.** 465
SCIENCE ON THE JOB *Ecology in Urban Planning* 472
- 2 **Human activities affect the environment.** 473
MATH IN SCIENCE *Finding Volumes* 481
- 3 **People are working to protect ecosystems.** 482
CHAPTER INVESTIGATION *Cleaning Oil Spills* 490

Visual Highlights

Energy Flows Through Ecosystems	411
Aquatic Biomes	420
Levels in the Environment	433
Symbiotic Relationships	444
Ecosystem Recovery	485





UNIT 5 Cells

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15 The Cell

498

the BIG idea

All living things are made up of cells.

- 1 **The cell is the basic unit of living things.** 501
CHAPTER INVESTIGATION Using a Microscope 508
- 2 **Microscopes allow us to see inside the cell.** 510
MATH IN SCIENCE Using Scientific Notation 517
- 3 **Different cells perform various functions.** 518
THINK SCIENCE Cells and Spacesuits 525

16 How Cells Function

530

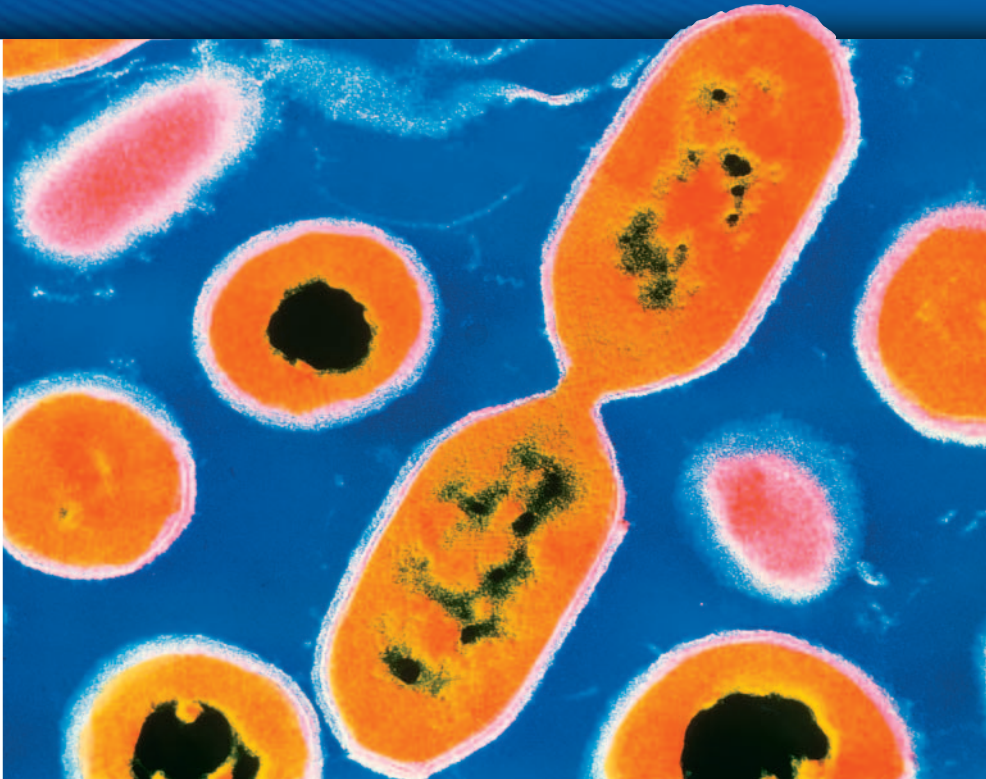
the BIG idea

All cells need energy and materials for life processes.

- 1 **Chemical reactions take place inside cells.** 533
SCIENCE ON THE JOB Natural Dyes and Cells 538
- 2 **Cells capture and release energy.** 539
MATH IN SCIENCE Interpreting Graphs 547
- 3 **Materials move across the cell's membranes.** 548
CHAPTER INVESTIGATION Diffusion 556

How do plants like these sunflowers change energy from the Sun?
page 530





Some of these bacterial cells are dividing. How are the cells formed in cell division like the other cells in the photograph? page 562

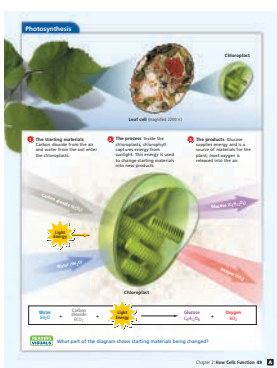
17 Cell Division

562

the BIG idea

Organisms grow, reproduce, and maintain themselves through cell division.

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|----------|--|-----|
| 1 | Cell division occurs in all organisms. | 565 |
| | CONNECTING SCIENCES <i>Chemical Dyes Show Nerve Growth</i> | 571 |
| 2 | Cell division is part of the cell cycle. | 572 |
| | CHAPTER INVESTIGATION <i>Stages of the Cell Cycle</i> | 578 |
| 3 | Both sexual and asexual reproduction involve cell division. | 580 |
| | MATH IN SCIENCE <i>Using Exponents</i> | 585 |



Visual Highlights

Parts of a Eukaryotic Cell	514
Levels of Organization	522
Photosynthesis	541
Cellular Respiration	543
Cell Division	575