

Teacher Edition

exploring SCIENCE

FIFTH
EDITION




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Part
1

CONTENTS

PART 1

Biblical Worldview Shaping in <i>Exploring Science</i>	x
Building Academic Rigor with <i>Exploring Science</i>	xii
Technology Solutions	xiv
Using Your Teacher Edition	xvi
<i>Product Objectives</i>	xvi
<i>New to This Edition</i>	xvii
<i>Resources</i>	xviii
<i>The Teaching Cycle in Exploring Science</i>	xix
<i>Teacher Edition Features</i>	xx
<i>Scheduling and Tracking Accommodations</i>	xxiii
Get Ready to Explore (from the Student Edition)	xxiv
Using Your Textbook (from the Student Edition)	xxvi

UNIT 1

MATTER

2

Chapter 1 Lesson Plan Overview

Chapter 1 Atoms and Molecules 4

1.1 ATOMIC STRUCTURE	5
<i>Case Study: Modeling Matter through Time</i>	7
1.2 THE PERIODIC TABLE OF ELEMENTS	9
<i>Mini Lab: Wanted: U or Your Element</i>	14
1.3 MOLECULES AND COMPOUNDS	16
<i>Ethics: Christian Ethics</i>	18
<i>Connections: Science and History—Niels Bohr</i>	23

Chapter 2 Lesson Plan Overview

Chapter 2 States of Matter and Thermal Energy 24

2.1 ENERGY	25
<i>Case Study: What Is Energy?</i>	29
2.2 STATES OF MATTER	30
<i>Case Study: Plasma—The Fourth State of Matter</i>	34
2.3 PHASE CHANGES	36
<i>Mini Lab: Melting Mystery</i>	37
2.4 THERMAL ENERGY TRANSFER	42

CONTENTS

Chapter 3 Lesson Plan Overview

Chapter 3 Changes in Matter	50
3.1 PROPERTIES OF MATTER	51
Mini Lab: What's the Matter?	55
3.2 PHYSICAL AND CHEMICAL CHANGES	57
3.3 CHEMICAL REACTIONS	62
Science Career: Food Scientist	67
Worldview Investigation: Recycling Batteries	68
3.4 CONSERVATION OF MATTER	70
Ethics: Strategies	73

UNIT 2

ENERGY AND MOTION

80

Chapter 4 Lesson Plan Overview

Chapter 4 Forces	82
4.1 INTRODUCTION TO FORCES	83
Case Study: Order or Chaos?	87
Mini Lab: Balancing Act	88
4.2 TYPES OF FORCES	89
4.3 GRAVITY	94
4.4 ELECTROMAGNETISM	99
Case Study: Shocking Abilities!	102
Ethics: Electrifying Science	104

Chapter 5 Lesson Plan Overview

Chapter 5 Laws of Motion	108
5.1 DESCRIBING MOTION	109
5.2 NEWTON'S FIRST LAW	117
Connections: Science and History—Isaac Newton	119
Case Study: Car Safety Stats	120
5.3 NEWTON'S SECOND LAW	122
Ethics: Speed Limit Safety	125
5.4 NEWTON'S THIRD LAW	126
Mini Lab: Off to the Balloon Races	128

CONTENTS

Chapter 6 Lesson Plan Overview

Chapter 6 Mechanical Energy 134

6.1 KINETIC ENERGY 135

Mini Lab: Graphing Kinetic Energy 137

6.2 POTENTIAL ENERGY 140

Worldview Investigation: Autonomous Cargo Drones 145

6.3 ENERGY TRANSFORMATIONS 146

Case Study: Right On-Target 148

Science Career: Mechanical Engineer 151

Connections: Science and History—The English Longbow:
Shaping History and Folklore 152

Chapter 7 Lesson Plan Overview

Chapter 7 Mechanical Waves 156

7.1 INTRODUCTION TO WAVES 157

Case Study: Tsunamis 160

7.2 WAVE BEHAVIOR 166

Mini Lab: Testing Homemade Telephones 170

Connections: Physical Science and Life Science—Using Waves 172

7.3 SOUND WAVES 173

Worldview Investigation: Noise Pollution 175

Chapter 8 Lesson Plan Overview

Chapter 8 Light 180

8.1 ELECTROMAGNETIC WAVES 181

8.2 THE ELECTROMAGNETIC SPECTRUM 185

Connections: Science and Art—A World of Light and Color 190

Mini Lab: CD Rainbows 193

Ethics: Light Pollution 194

8.3 USING WAVES IN TECHNOLOGY 195

CONTENTS

PART 2

UNIT 3

LIVING THINGS

204

Chapter 9 Lesson Plan Overview

Chapter 9 Cells

206

9.1 CHARACTERISTICS OF LIVING THINGS

207

Mini Lab: It's Alive!

214

9.2 CELL STRUCTURE

215

Science Career: Forensic Scientist

220

9.3 LEVELS OF ORGANIZATION

221

Case Study: Organ Transplants

223

9.4 THE HISTORY OF CELL THEORY

224

Connections: Science and Art—Hooke's Micrographia

228

Chapter 10 Lesson Plan Overview

Chapter 10 Heredity and Genetics

234

10.1 HEREDITY, GENES, AND DNA

235

Mini Lab: Terrific Traits

242

10.2 PASSING DOWN TRAITS

243

10.3 HUMAN IMPACT

250

Worldview Investigation: Blood Parrot Cichlids

252

Chapter 11 Lesson Plan Overview

Chapter 11 Plant Classification

260

11.1 INTRODUCTION TO CLASSIFICATION

261

Mini Lab: Pasta Classification

271

11.2 INTRODUCTION TO PLANTS

272

Case Study: Plant Products

274

11.3 NONVASCULAR PLANTS AND FERNS

277

11.4 CONE-BEARING VASCULAR PLANTS

282

11.5 FLOWERING VASCULAR PLANTS

286

Science Career: Arborist

289

CONTENTS

Chapter 12 Lesson Plan Overview

Chapter 12 Animal Classification 294

12.1 SPONGES, CNIDARIANS, AND MOLLUSKS 295

Connections: Science and Math—The Chambered Nautilus:
A Perfect Spiral 298

Mini Lab: Snail Terrarium 301

12.2 ECHINODERMS AND WORMS 302

Connections: Science and Medicine—
Putting a Nasty Parasite to Good Use 305

12.3 ARTHROPODS 307

12.4 FISH AND AMPHIBIANS 314

Case Study: Running Out of Fish? 317

12.5 REPTILES AND BIRDS 321

12.6 MAMMALS 326

Ethics: Domesticating Animals 332

Chapter 13 Lesson Plan Overview

Chapter 13 Reproduction and Adaptations of Organisms 338

13.1 REPRODUCTION OF ORGANISMS 339

13.2 GENERAL ADAPTATIONS 345

Case Study: Peppered Moths 347

Mini Lab: Blubber Mitts 349

13.3 REPRODUCTIVE ADAPTATIONS IN PLANTS 350

Science Career: Beekeeper 353

13.4 REPRODUCTIVE ADAPTATIONS IN ANIMALS 357

Ethics: Protecting Endangered Species 361

UNIT
4

EARTH SCIENCE 366

Chapter 14 Lesson Plan Overview

Chapter 14 Natural Resources 368

14.1 WHAT ARE NATURAL RESOURCES? 369

14.2 LOCATION OF NATURAL RESOURCES 374

Connections: Science and Technology—
Autonomous Underwater Vehicles 377

CONTENTS

14.3 STEWARDING OUR NATURAL RESOURCES	385
<i>Mini Lab:</i> Clean Up the Spill	391
<i>Worldview Investigation:</i> Blazing Trails	393
14.4 SYNTHETIC MATERIALS	395
<i>Ethics:</i> Should We Use Synthetic Materials?	398

Chapter 15 Lesson Plan Overview

Chapter 15 Weathering and Erosion 402

15.1 WEATHERING	403
<i>Mini Lab:</i> Chalk It Up to Erosion	411
15.2 EROSION AND DEPOSITION	412
15.3 HUMAN IMPACT	419
<i>Case Study:</i> Moving a Lighthouse	423
<i>Connections:</i> Science and History—Aswan High Dam	425

Chapter 16 Lesson Plan Overview

Chapter 16 Earthquakes and Volcanoes 430

16.1 EARTHQUAKES	431
<i>Science Career:</i> Seismic Engineer	437
16.2 VOLCANOES	439
<i>Case Study:</i> Hot Spots	442
<i>Connections:</i> Science and Technology: Exploring Volcanoes Safely	446
16.3 HUMAN IMPACT	450
<i>Connections:</i> Science and Math: Calculating Probabilities	452
<i>Mini Lab:</i> Construction Site	455
<i>Ethics:</i> Living with Earthquakes	456
<i>Ethics:</i> Your Turn!	461

CONTENTS

Student Edition Appendixes

A READING TABLES, GRAPHS, AND SCIENTIFIC DIAGRAMS

B METRIC PREFIXES

Glossary

Instructional Aid

Teacher Edition Appendix

C MINI LAB EQUIPMENT AND MATERIALS LIST

Student Edition Index

Explaining the Gospel

Periodic Table of Elements

Features

Case Studies

Modeling Matter through Time	7	Tsunamis	160
What Is Energy?	29	Organ Transplants	223
Plasma—The Fourth State of Matter	34	Plant Products	274
Order or Chaos?	87	Running Out of Fish?	317
Shocking Abilities!	102	Peppered Moths	347
Car Safety Stats	120	Moving a Lighthouse	423
Right On-Target	148	Hot Spots	442

Connections

Science and History: Niels Bohr	23	Science and Medicine: Putting a Nasty Parasite to Good Use	305
Science and History: Isaac Newton	119	Science and Technology: Autonomous Underwater Vehicles	377
Science and History: The English Longbow— Shaping History and Folklore	152	Science and History: Aswan High Dam	425
Physical Science and Life Science: Using Waves	172	Science and Technology: Exploring Volcanoes Safely	446
Science and Art: A World of Light and Color	190	Science and Math: Calculating Probabilities	452
Science and Art: Hooke's Micrographia	228		
Science and Math: The Chambered Nautilus— A Perfect Spiral	298		

USING YOUR TEACHER EDITION

Teacher Edition Features

You have a lot of great material at your fingertips in this resource! *Exploring Science* Teacher Edition 5th Edition features reduced student pages with side and bottom margins packed with educational content. Take a look at what it offers, whether you are a classroom teacher or a home educator.

LESSON PLAN OVERVIEW

Lesson plan overviews at the beginning of each chapter provide a consolidated view of the schedule, along with objectives, resources, materials, and assessments for that chapter.

CHAPTER OVERVIEWS

Chapter overviews give you a bird's-eye view of the key concepts covered in each chapter.

CHAPTER 5

Objectives

- Use mathematical models to relate speed, force, and mass.
- Summarize Newton's laws of motion.
- Identify how Newton's laws of motion are at work in a collision.
- Explain how specific safety features work to prevent injury.
- Relate mass, force, and acceleration on the basis of experimental data. (Lab 5A)
- Create an effective helmet to protect an egg during a collision by using the engineering design process. (Lab 5B)

Overview

Chapter 5 continues the discussion on the topic of motion. The chapter looks at how to describe motion and how to cause motion to change. The emphasis of the chapter is Newton's three laws of motion.

Can a person move as fast as a car?

Section 5.1

Objectives

5.1.1 Describe the motion of an object.

5.1.2 Relate speed, velocity, and acceleration.

5.1.3 Calculate the speed of a moving object.

5.1.4 Graph motion.

Lesson Plan Overview

CHAPTER 4: FORCES

ALM Activities Answer Key & Teacher Lab Manual ALM Activities & Lab Manual IA Instructional Aid PPT Pres. PowerPoint Presentation

PAGES	OBJECTIVES	RESOURCES	ASSESSMENTS
SECTION 4.1 INTRODUCTION TO FORCES			
83-88	4.1.1 Recall the definition of a force.	Activities & Lab Manual • Activity 4.1: Introduction to Forces—Identifying When Forces Are at Work (pp. 83-85) BU Press Trivia* • Video: Forces and Motion • Link: Forces and Motion—Basics • PPT Pres. Section 04.1 Materials • book • stress ball	Student Edition • Section 4.1 Review Teacher Edition • Introducing Forces and Motion assessment Assessments • Section 4.1 Quiz
	4.1.2 Relate force, energy, and work.		
	4.1.3 Determine whether the forces acting on an object are balanced or unbalanced.		
	4.1.4 Predict the motion of an object on the basis of the forces acting on it.		
	4.1.5 Explain the basis for predictability in motion. <i>(2020 Foundations: Inquiry)</i>		
SECTION 4.2 TYPES OF FORCES (2 DAYS)			
89-93	4.2.1 Differentiate between contact and field forces.	Activities & Lab Manual • Activity 4.2: Types of Forces—Classifying Forces (pp. 93-94) BU Press Trivia • PPT Pres. Section 04.2 Materials • wooden blocks (2) • ruler • wall signs: normal force, tension, elastic force, friction • images of forces in action	Student Edition • Section 4.2 Review Assessments • Section 4.2 Quiz
	4.2.2 Determine the types of forces at work on an object.		
	4.2.3 Create a force diagram to show the forces that are acting on an object.		
SECTION 4.3 GRAVITY			
94-98	4.3.1 Summarize the law of universal gravitation.	Activities & Lab Manual • Activity 4.3: Gravity—Understanding Gravity (p. 95) BU Press Trivia • Link: Gravity from Lab—Basics • PPT Pres. Section 04.3	Student Edition • Section 4.3 Review Teacher Edition • Personal Gravity Part 2 formative assessment Assessments • Section 4.3 Quiz
	4.3.2 Explain the factors that affect the force of gravity acting on an object.		
	4.3.3 Predict how the force of gravity on an object will change in various parts of the solar system.		
	4.3.4 Evaluate the claim that gravity can be understood. <i>(2020 Foundations: Inquiry)</i>		
LAB 4: THREE, TWO, ONE, LAUNCH!—RELATING FORCE AND MASS TO CHANGES IN MOTION			
ALM 109-114	LA.1 Relate changes in mass and force to changes in motion.		
	LA.2 Draw simple free-body diagrams.		

*Digital resources for homeschool users are available on Homeschool Hub.

L-82a Chapter 4 Lesson Plan Overview

*Digital resources for homebased users are available on Homebased Hub.

L-82a Chapter 4 Lesson Plan Overview

OBJECTIVES

Chapter-level and section-level objectives communicate specific, measurable outcomes that the students should be able to accomplish or demonstrate by the end of the lesson.

If no one knows what gravity is, then how do we know how it works?

Section 4.3

Objectives

- 4.3.1 Summarize the law of universal gravitation.
- 4.3.2 Explain the factors that affect the force of gravity acting on an object.
- 4.3.3 Predict how the force of gravity on an object will change in various parts of the solar system.
- 4.3.4 Evaluate the claim that gravity can be understood. **BWS**

Biblical Worldview Shaping

Limitations (evaluate): Even the most fundamental scientific concepts may never be fully understood scientifically. (4.3.4)

Printed Resources

- Lab 4: Three, Two, One, Launch!—Relating Force and Mass to Changes in Motion (pp. 189–94)
- Activity 4.3: Gravity—Understanding Gravity (p. 35)
- Assessment: Personal Gravity? Part 2 formative assessment

ESSENTIAL QUESTION

An essential question is a question posed to students at the beginning of a lesson or chapter to motivate, engage, and demonstrate the relevance of the content in a way that drives the student to persevere through instruction to find the answer.

LESSON OPENER

Lesson openers provide a snapshot of the lesson's essential question, objectives, biblical worldview shaping opportunities, resources, and materials.

BIBLICAL WORLDVIEW SHAPING STATEMENT

Biblical worldview shaping statements link an objective to its biblical worldview theme and level on the biblical worldview shaping taxonomy.

PRINTED RESOURCES

Printed resources are available from BJU Press and include materials from the Activities & Lab Manual and Assessments.

DIGITAL RESOURCES

Digital resources are available in BJU Press Trove and include digital instructional aids such as videos or links.

MATERIALS

Materials lists physical objects and supplies needed for a lesson.

Section 5.4

Objectives

- 5.4.1 Describe an example of Newton's third law.
- 5.4.2 Identify an action-reaction pair in a simple scenario.
- 5.4.3 Explain how knowledge of Newton's third law can be used to create useful devices.

Printed Resources

- Lab 5B: Safety First!—Designing a Helmet Using Newton's Third Law (pp. 199–203)
- Activity 5.4: Newton's Third Law—Applying Newton's Third Law (p. 47)
- Assessment: Newton's Law Review formative assessment
- Assessment: Lab 5B Rubric
- Assessment: Section 5.4 Quiz

Digital Resources

- Video: Helmet Safety
- Link: Newton's Third Law
- Assessment: Lab 5B Rubric

Materials

- office chairs (2, with wheels)

Section Overview

- Action-reaction pairs as described by Newton's third law are the focus of Section 5.4.

ENGAGE

USING YOUR TEACHER EDITION

velocity. Velocity remains the same in the first and second scenarios.

How much did doubling the mass (Scenario 1 versus Scenario 2) change the kinetic energy of the ball? Doubling the mass doubled the kinetic energy.

How much did doubling the velocity (Scenario 1 versus Scenario 3) change the kinetic energy of the ball? Doubling the velocity made the kinetic energy four times higher.

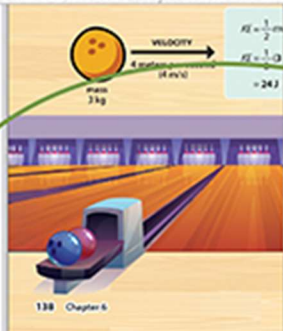
Kinetic Energy Formula

We use the formula for calculating kinetic energy here only because it clearly demonstrates the greater effect of velocity on the outcome. Students will typically be expected to use these formulas for their work in a physical science course. They will not be expected to do so for this course.

DIFFERENTIATED INSTRUCTION

Math

Adapt your visual analysis of these pages to the mathematical abilities of your students. Advanced students may enjoy the challenge of doing some kinetic energy calculations. Use a more conceptual approach for struggling students. It is sufficient for them to understand that changing the velocity of a moving object has a much greater effect on its kinetic energy than changing its mass.



Squaring the Velocity

Use a poll to check students' understanding of the effect that squaring the velocity of an object has on its kinetic energy.

How much will the kinetic energy of an object increase if its velocity doubles?

- It will be twice as much.
- It will be three times as much.
- It will be four times as much.
- It will not change.

How much will the kinetic energy of an object increase if its velocity increases tenfold?

- It will be ten times as much.
- It will be one hundred times as much.

CLARIFYING NOTES

Clarifying notes (shaded in blue) provide additional information that may facilitate teaching the material.

TEACHING STRATEGIES

A variety of teaching strategies aligned with each lesson's objectives offer ideas to teach, reinforce, and assess content while promoting engagement and critical thinking. Student-centered technology activities have been added to this edition.

DIFFERENTIATED INSTRUCTION

Differentiated instruction notes (shaded in yellow) provide ideas to adjust instruction to meet the needs of a particular group of students with exceptional needs.

138 Chapter 6

BACKGROUND NOTES

Background notes (shaded in gray) provide enrichment information that you may share with students during instruction to enhance their learning.

- Which has more thermal energy, ice or the same amount of liquid water? Explain.
- What information would you need to know to determine whether temperate or an aluminum ball has more thermal energy?
- Many years ago, scientists set up an experiment at Trinity College in Dublin, Ireland. They monitored a container of pitch, which is made from tar, to see how long it would take for the pitch to drip. In 2013, after sixty-nine years, they finally recorded a drip. Would you classify the pitch as a solid or a liquid? Explain.

States of Matter and Thermal Energy 35

- Because the pitch formed a drip, it showed that its particles could flow, even though extremely slowly. It must therefore be classified as a liquid. (2.2.2, p. 32)

Viscosity

Viscosity is the measure of a substance's resistance to flowing. Students will explore the concept of viscosity in Lab 16B.

attractive forces between their particles. Their thermal energy is sufficient to partially or completely overcome those forces.

ASSESS

Section 2.2 Review

Assign the section review as a **formative assessment** to help students solidify their understanding of Section 2.2.

Section 2.2 Quiz

Use the Section 2.2 Quiz as a **formative assessment** to check students' understanding of Section 2.2.

FORMATIVE ASSESSMENTS

Formative assessments help you determine whether your students have mastered the main ideas of a lesson or whether you need to reteach some material.

States of Matter and Thermal Energy 35