Teacher Edition

exploring SCIENCE

FIFTH EDITION

bju press

Greenville, South Carolina

Part 1

CONTENTS

PART 1

CONTENTS

CONTENTS

CONTENTS

PART 2

CONTENTS

CONTENTS

CONTENTS

Features

Case Studies

Connections

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.

Lesson Plan Overview

CHAPTER 4: FORCES

AKTLM 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. 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. PPT Foundations (explain)	**Activities & Lab Manual** • Activity 4.1: *Introduction to Forces—Identifying When Forces Are at Work* (pp. 31–32) **BJU Press Trove*** • 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* preassessment **Assessments** • Section 4.1 Quiz
SECTION 4.2 *TYPES OF FORCES (2 DAYS)*			
89–93	4.2.1 Differentiate between contact and field forces. 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.	**Activities & Lab Manual** • Activity 4.2: *Types of Forces—Classifying Forces* (pp. 33–34) **BJU Press Trove** • PPT Pres., Section 04.2 **Materials** • wooden blocks (2) • ruler • wall signs: normal force, tension, elastic force, friction/drag • images of forces in action	**Student Edition** • Section 4.2 Review **Assessments** • Section 4.2 Quiz
SECTION 4.3 *GRAVITY*			
94–98	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. PPT Limitations (evaluate)	**Activities & Lab Manual** • Activity 4.3: *Gravity—Understanding Gravity* (p. 35) **BJU Press Trove** • Link: Gravity Force 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
LAB 4 *THREE, TWO, ONE, LAUNCH!—RELATING FORCE AND MASS TO CHANGES IN MOTION*			
ALM 109–04	L4.1 Relate changes in mass and force to changes in motion. L4.2 Draw simple free-body diagrams.		

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

L-82a Chapter 4 Lesson Plan Overview

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.

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.
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
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.

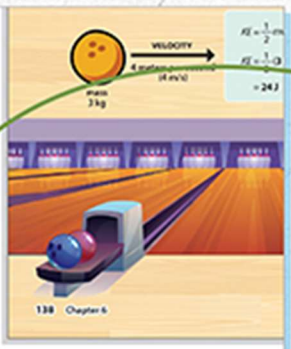
USING YOUR TEACHER EDITION

in the third scenario is twice as long as the arrows 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.



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?

a. It will be twice as much.

b. It will be three times as much.

c. It will be four times as much.

d. It will not change.

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

a. It will be ten times as much.

b. It will be one hundred times

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.

138 Chapter 6

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.

7. Which has more thermal energy, ice or the same amount of liquid water? Explain.

8. What information would you need to know to determine whether lemonade or an aluminum baking pan takes more energy from the body? Explain.

9. 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

9. 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 168.

BACKGROUND NOTES

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

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