Physics 4th Edition – Lesson Plan Overview

Chapter 1: Foundations of Physics (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 1.1 Solving Problems with Physics				
3–9	1.1.1 Justify the study of physics from the perspective of a biblical worldview. **BWS** Foundations (explain) 1.1.2 Analyze the challenges of doing physics. **BWS** Ethics (explain)	**Teacher Edition** • Careers: Serving as a Systems Engineer • Case Study: GPS and Scientific Inquiry • Section 1.1 Review **Assessments** • Section 1.1 Quiz	**Teacher Tools Online** • PPT Presentation: Section 1.1 Slides	Formative Assessment: *Types of Models* Section 1.1 Review Section 1.1 Quiz
Section 1.2 Dimensions of Physics				
10–15	1.2.1 Justify the use of the SI. 1.2.2 Explain how fundamental dimensions help define the universe. 1.2.3 Identify dimensions used in physics. 1.2.4 Indicate the characteristics of an SI unit. 1.2.5 Relate SI units to their corresponding fundamental dimensions. 1.2.6 Convert between SI units.	**Teacher Edition** • Section 1.2 Review **Assessments** • Section 1.2 Quiz **Material** • object (wood block, ball, or roll of tape) • food items (3) with both SI and US customary units (at least one item with mass/weight and one with volume)	**Teacher Tools Online** • PPT Presentation: Section 1.2 Slides • Web Links: SI, Which Cubit?	Formative Assessment: *The Système International (SI)* Section 1.2 Review Section 1.2 Quiz
Section 1.3 Principles of Measurement				
16–20	1.3.1 Explain the purpose and limitations of scientific instruments. **BWS** Foundations (explain) 1.3.2 Compare accuracy and precision. **BWS** Modeling (evaluate) 1.3.3 Determine the precision of data collected with a given instrument. 1.3.4 Analyze a graphical model for the determination of the speed of light.	**Teacher Edition** • Case Study: Measurement and Uncertainty • Section 1.3 Review **Assessments** • Section 1.3 Quiz **Material** • metric rulers (one for each student)	**Teacher Tools Online** • PPT Presentation: Section 1.3 Slides	Section 1.3 Review Section 1.3 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 1.4 Integrity in Data				
21–28	1.4.1 Explain the purpose of significant figures. 1.4.2 Express measurements and calculated answers with the correct number of significant figures.	**Teacher Edition** • Mini Lab: *Just Eyeball It!* (p. 28) • Section 1.4 Review **Assessments** • Section 1.4 Quiz **Material** • four-sided meter stick (one for every three students)	**Teacher Tools Online** • PPT Presentation: Section 1.4 Slides	Section 1.4 Review Section 1.4 Quiz
Lab 1A Long Shot—Creating Histograms				
LM 1–8	Organize collected data in a table. Calculate mean and standard deviation. Analyze data using a spreadsheet program. Display data on histograms.		**Teacher Tools Online** • Instructional Aid: Lab 1A Data	Lab Report
Lab 1B Zeroing In—Inquiring into Experimental Design				
LM 9–10	Modify an experiment to improve the consistency of the data. Evaluate your modified experimental procedures using statistical methods.	**Teacher Lab Manual** • Lab 1B Teacher Guide		Lab Report
Chapter 1 Review				
29–31	Apply the inquiry process and mindset to real-world problems. Convert measurements between SI units. Report data with appropriate accuracy and precision. Compare measured data with other values. Evaluate empirical data and methods using statistics. (Lab 1A) Evaluate an experimental procedure to improve accuracy of collected data. (Lab 1B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 1 Test				
	Demonstrate knowledge of concepts from Chapter 1 by taking the test.	**Assessments** • Chapter 1 Test	**Teacher Tools Online** • EV: Chapter 1 Bank	Chapter 1 Test

Chapter 2: Motion in One Dimension (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 2.1 Describing Motion (2 Days)				
33–43	2.1.1 Define ***motion***. 2.1.2 Explain how physics describes motion. 2.1.3 Create scientific diagrams. 2.1.4 Analyze motion (position-time and velocity-time graphs).	**Teacher Edition** • Section 2.1 Review **Assessment** • Section 2.1 Quiz **Materials** • tape for number lines • straightedge	**Teacher Tools Online** • PPT Presentation: Section 2.1 Slides	Formative Assessment: *Checking Distance and Displacement* Section 2.1 Review Section 2.1 Quiz
Lab 2A Keeping Things Rolling—Curve Fitting Using Video Analysis				
LM 11–18	Collect data using video capture. Explain the relationship between position, velocity, and acceleration. Analyze motion using curve fitting.		**Teacher Tools Online** • Web Link: Lab 2A Web Links • Instructional Aids: Lab 2A Videos, Lab 2A Data	Lab Report
Section 2.2 The Equations of Motion				
44–54	2.2.1 Solve motion problems algebraically and graphically. 2.2.2 Solve free fall problems. 2.2.3 Analyze data on vehicle speed and braking distance. **BWS** Modeling (explain) 2.2.4 Formulate a position on car seat safety laws. **BWS** Ethics (formulate)	**Teacher Edition** • Worldview Investigation: Crash Course • *Crash Course* Rubric • Case Study: Using Kinematics to Model Stopping Distance • Mini Lab: Tossup • Section 2.2 Review • Ethics: Car Seat Regulations (pp. 58–59) **Assessment** • Section 2.2 Quiz	**Teacher Tools Online** • PPT Presentation: Section 2.2 Slides • Instructional Aid: Crash Course Rubric • Web Link: Free Fall Video	Section 2.2 Review Section 2.2 Quiz *Crash Course* Debate Arguments
Lab 2B Time to Fall—Measuring Acceleration due to Gravity				
LM 19–24	Collect time interval data using both manual and automated methods. Compare the accuracy of manual and automated time measurement methods. Calculate the acceleration due to gravity.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Ethics Day: Car Seat Regulations				
58–59	2.2.4 Formulate a position on car seat safety laws. **BWS** Ethics (formulate)	**Teacher Edition** • Ethics: Car Seat Regulations		
Lab 2C Everyday Accelerations—Measuring Everyday Accelerations				
LM 25–28	Collect acceleration data for everyday motion using a smartphone app. Determine the directions of positive acceleration of a smartphone. Predict values for accelerations for everyday motion. Evaluate predictions on the basis of empirical data.			Lab Report
Chapter 2 Review				
55–59	Analyze graphical models of motion. Solve motion problems using models of motion. Create a graphical model of braking distance. Analyze motion data collected in the laboratory. (Lab 2A) Evaluate different methods for collecting data. (Lab 2B) Analyze data for everyday motion. (Lab 2C)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 2 Test				
	Demonstrate knowledge of concepts from Chapter 2 by taking the test.	**Assessments** • Chapter 2 Test	**Teacher Tools Online** • EV: Chapter 2 Bank	Chapter 2 Test

Chapter 3: Vectors and Scalars (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 3.1 Vector and Scalar Properties				
61–65	3.1.1 Identify vector and scalar quantities. 3.1.2 Compare angles measured on a graph with those on a map. 3.1.3 Explain how to transport vectors.	**Teacher Edition** • Case Study: Mapping Currents • Section 3.1 Review **Assessments** • Section 3.1 Quiz **Materials** • a large arrow made of foamboard or wood	**Teacher Tools Online** • PPT Presentation: Section 3.1 Slides • Web Links: Vector Basics, Current Map, Current Vectors	Section 3.1 Review Section 3.1 Quiz
Section 3.2 Graphical Vector Operations				
66–69	3.2.1 Summarize the process of adding vectors graphically. 3.2.2 Solve vector addition problems by scalar multiplication. 3.2.3 Solve vector addition problems graphically.	**Teacher Edition** • Section 3.2 Review **Assessments** • Section 3.2 Quiz **Materials** • two arrows: a large arrow (labeled 5 km) and a smaller arrow (labeled 2 km), both made of foamboard or wood • protractors and metric rulers (one for each student)	**Teacher Tools Online** • PPT Presentation: Section 3.2 Slides • Videos: Vector Addition, Commutative Property with Vector Addition	Section 3.2 Review Section 3.2 Quiz
Ethics Day				
85	3.3.5 Develop a position regarding when to evacuate for a hurricane. **BWS** Ethics (apply)	**Teacher Edition** • Ethics: Should I Stay or Should I Go? • Ethics Essay Rubric (Appendix J)	**Teacher Tools Online** • Instructional Aid: Ethics Essay Rubric	Ethics Essay
Lab 3A Parts of the Whole—Investigating Vector Components				
LM 29–34	Measure the components of a vector. Create a vector from its components. Relate trigonometric functions to the vector components that you worked with in the laboratory.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 3.3 Algebraic Vector Operations (3 Days)				
70–81	3.3.1 Solve right triangles by using trigonometric functions. 3.3.2 Resolve vectors into components. 3.3.3 Summarize the process of adding vectors algebraically. 3.3.4 Solve vector addition problems algebraically. 3.3.5 Develop a position regarding when to evacuate for a hurricane. **BWS** Ethics (apply)	**Teacher Edition** • Mini Lab: *Using Vectors to Predict Hurricane Movement* (p. 82) • Section 3.3 Review • Ethics: Should I Stay or Should I Go? (p. 85) **Assessments** • Section 3.3 Quiz **Materials** • pairs of similar triangles (Make enough so that each pair of students can have a triangle.) • meter sticks (one for each pair of students) • overhead projector or other strong light source (Using two light sources makes the demonstration more effective.)	**Teacher Tools Online** • PPT Presentation: Section 3.3 Slides • Videos: Vector Components, Vector Addition	Section 3.3 Review Section 3.3 Quiz
Lab 3B The Roundabout Way—Adding Vectors				
LM 35–39	Determine the vectors needed to represent the path between two positions. Determine the displacement between two positions both graphically and algebraically.			Lab Report
Chapter 3 Review				
83–85	Explain how vectors are a problem-solving tool of physics. Compare vectors and scalars. Perform vector operations to find a resultant vector. Determine how to use vectors to model forces in the real world. (Lab 3A) Measure the displacement between two positions using indirect means. (Lab 3B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 3 Test				

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
	Demonstrate knowledge of concepts from Chapter 3 by taking the test.	**Assessments** • Chapter 3 Test	**Teacher Tools Online** • EV: Chapter 3 Bank	Chapter 3 Test

Chapter 4: Motion in Two Dimensions (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 4.1 Kinematics of Two-Dimensional Motion				
87–91	4.1.1 Describe two-dimensional positions and motion using vectors. 4.1.2 Solve kinematic problems in two dimensions using vectors.	**Teacher Edition** • Careers: Serving as a Humanitarian Engineer • Section 4.1 Review **Assessments** • Section 4.1 Quiz	**Teacher Tools Online** • PPT Presentation: Section 4.1 Slides • Web Link: Engineers Without Borders	Section 4.1 Review Section 4.1 Quiz
Section 4.2 Projections				
92–102	4.2.1 Describe horizontal projections and the kinematic assumptions they involve. 4.2.2 Solve projectile motion problems. 4.2.3 Evaluate the effectiveness of humanitarian airdrops. **BWS** Ethics (evaluate)	**Teacher Edition** • Mini Lab: *Catapulting to Fame* • Case Study: Shot Put Release Angles • Section 4.2 Review • Ethics: Humanitarian Airdrops (p. 105) **Assessments** • Section 4.2 Quiz **Materials** • tennis ball • rollerblades	**Teacher Tools Online** • PPT Presentation: Section 4.2 Slides • Video: Projectile Motion • Web Link: Animation of Projectile Motion	Section 4.2 Review Section 4.2 Quiz
Lab 4A It's a Tossup—Analyzing Projectile Motion				
SLM 41–45	Analyze data using video analysis and curve-fitting techniques. Relate your models to the motion of the projectile. Evaluate your models for projectile motion.		**Teacher Tools Online** • Web Link: Tracker • Instructional Aids: Lab 4A Video, Lab 4A Data	Lab Report
Lab 4B Look Up in the Sky—Evaluating the Effect of Air Drag				
SLM 47–51	Collect data for projectiles using video analysis. Evaluate the data for projectiles with and without air drag effects. Communicate findings in a formal lab report.		**Teacher Tools Online** • Web Link: Tracker • Instructional Aids: Lab 4B Video, Lab 4B Data	Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Ethics Day				
105	4.2.3 Evaluate the effectiveness of humanitarian airdrops. **BWS** Ethics (evaluate)	**Teacher Edition** • Ethics: Humanitarian Airdrops • Ethics Essay Rubric (Appendix J)	**Teacher Tools Online** • Instructional Aid: Ethics Essay Rubric	Ethics Essay
Chapter 4 Review				
103–5	Solve motion problems in two dimensions. Solve projection problems. Analyze projectile motion with and without air resistance. (Labs 4A and 4B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 4 Test				
	Demonstrate knowledge of concepts from Chapter 4 by taking the test.	**Assessments** • Chapter 4 Test	**Teacher Tools Online** • EV: Chapter 4 Bank	Chapter 4 Test

Chapter 5: Newton's Laws (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 5.1 Forces				
109–19	5.1.1 Trace the historical development of the study of dynamics. **BWS** Modeling (explain) 5.1.2 Explain how to add forces. 5.1.3 Describe the four fundamental forces in nature. 5.1.4 Classify forces. 5.1.5 Evaluate the statement, "Newtonian physics describes how motion in the real world works." **BWS** Modeling (evaluate) 5.1.6 Solve force problems using vector addition techniques.	**Teacher Edition** • Preassessment: Forces • Mini Lab: Forcing the Issue • Formative Assessment: Changing Models • Formative Assessment: Forces • Section 5.1 Review **Assessments** • Section 5.1 Quiz	**Teacher Tools Online** • PPT Presentation: Section 5.1 Slides • Web Link: Bowling Ball and Feather	Preassessment: *Forces* Formative Assessment: *Changing Models* Formative Assessment: *Forces* Section 5.1 Review Section 5.1 Quiz
Lab 5A Balanced Approach—Investigating Balanced Forces				
LM 53–60	Evaluate systems of forces using a force table. Determine a resultant empirically using a force table. Analyze force table data to determine the value of an unknown mass.			Lab Report
Section 5.2 Newton's Laws of Motion				
120–30	5.2.1 State Newton's laws of motion. 5.2.2 Relate real-world motion to Newton's laws. 5.2.3 Solve dynamics problems using Newton's laws.	**Teacher Edition** • Careers: Naval Architect • STEM Connection: Getting Airborne with Newton's Third Law • Case Study: On a Carrier Flight Deck • Section 5.2 Review **Assessments** • Section 5.2 Quiz **Materials** • rollerblades, roller skates, or skateboard • heavy rolling cart	**Teacher Tools Online** • PPT Presentation: Section 5.2 Slides • Video: Turbofan Engines	Section 5.2 Review Section 5.2 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 5B Don't Be So Pushy!—Inquiring into Newton's Second Law				
LM 61–62	Design an experiment to investigate mass, constant force, and acceleration. Collect data for motion caused by the application of a constant force. Evaluate whether position-time and velocity-time graphs for data are consistent with Newton's laws.	**Teacher Lab Manual** • Lab 5B Teacher Guide	**Teacher Tools Online** • Instructional Aids: Lab 5B Video, Lab 5B Data	Lab Report
Lab 5C Bridging the Gap—Designing a Bridge				
LM 63–64	Design a bridge with the greatest load-to-weight ratio. Test a design to determine its load-to-weight ratio. Evaluate a bridge design to address its mode of failure and recommend improvements.	**Teacher Lab Manual** • Lab 5C Teacher Guide • *Bridging the Gap* Rubric	**Teacher Tools Online** • Instructional Aid: Bridging the Gap Rubric	Bridge Project Project Documentation
Chapter 5 Review				
131–33	Analyze forces at work on a system. Apply Newton's laws of motion. Evaluate forces in various real-world applications. (Lab 5A) Design an experiment to model Newton's second law. (Lab 5B) Design, build, and test a bridge within given constraints. (Lab 5C)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 5 Test				
	Demonstrate knowledge of concepts from Chapter 5 by taking the test.	**Assessments** • Chapter 5 Test	**Teacher Tools Online** • EV: Chapter 5 Bank	Chapter 5 Test

Chapter 6: Applying Newton's Laws (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 6.1 Simplifying Problems				
135–40	6.1.1 Identify a system and the forces acting on it in a real-world problem. 6.1.2 Explain why physicists use ideal strings to model tension problems. 6.1.3 Construct free-body diagrams of parts within a system of connected objects. 6.1.4 Solve dynamics problems involving objects connected by strings.	**Teacher Edition** • Mini Lab: *Stand Tall* • Careers: Serving as a Civil Engineer • Formative Assessment: Checking on Free-Body Diagrams • Section 6.1 Review **Assessments** • Section 6.1 Quiz	**Teacher Tools Online** • PPT Presentation: Section 6.1 Slides • Web Link: Free-Body Diagrams	Formative Assessment: *Checking on Free-Body Diagrams* Section 6.1 Review Section 6.1 Quiz
Section 6.2 Transmitting Mechanical Forces				
141–49	6.2.1 Identify the characteristics of an ideal pulley. 6.2.2 Determine a frame of reference for multipart systems. 6.2.3 Determine the normal force in real-world systems. 6.2.4 Construct free-body diagrams of systems involving transmitted forces. 6.2.5 Solve dynamics problems involving transmitted forces.	**Teacher Edition** • Section 6.2 Review **Assessments** • Section 6.2 Quiz **Materials** • electronic balance • wooden board • object • force plate or force sensor • laboratory mass	**Teacher Tools Online** • PPT Presentation: Section 6.2 Slides	Section 6.2 Review Section 6.2 Quiz
Section 6.3 Friction				
150–54	6.3.1 Analyze factors affecting friction. 6.3.2 Compare static and kinetic friction. 6.3.3 Construct free-body diagrams of systems involving frictional forces. 6.3.4 Solve problems involving kinetic and static friction.	**Teacher Edition** • Section 6.3 Review **Assessments** • Section 6.3 Quiz **Materials** • ring stand • rod and clamp • wooden board • mass, 500 g	**Teacher Tools Online** • PPT Presentation: Section 6.3 Slides	Section 6.3 Review Section 6.3 Quiz
Lab 6A Slipping Away—Measuring Coefficients of Friction				

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
LM 65–72	Analyze the relationship between friction and the normal force. Measure the coefficients of kinetic and static friction between two surfaces. Determine the types of friction involved in the two parts of the lab activity.			Lab Report
Section 6.4 More Applications				
154–60	6.4.1 Compare rolling friction with static and kinetic friction. 6.4.2 Construct free-body diagrams of complex, multipart systems. 6.4.3 Solve complex dynamics problems involving multipart systems. 6.4.4 Formulate a position on the role of government in civil engineering. **BWS** Ethics (formulate)	**Teacher Edition** • Formative Assessment: Checking on Free-Body Diagrams • STEM Connection: Using Forces to Prevent Accidents (p. 161) • Ethics: Building Codes (p. 165) • Section 6.4 Review **Assessments** • Section 6.4 Quiz	**Teacher Tools Online** • PPT Presentation: Section 6.4 Slides • Video: Using Forces to Prevent Accidents / The Jersey Barrier • Web Link: Road Barriers	Formative Assessment: *Checking on Free-Body Diagrams* Section 6.4 Review Section 6.4 Quiz
Lab 6B Putting It All Together—Investigating Combined Forces				
LM 73–78	Collect data using video capture technology. Analyze motion data with video analysis software. Compare calculated (expected) acceleration rates to measured rates. Evaluate experimental setup to account for variation in expected and observed values.		**Teacher Tools Online** • Instructional Aids: Lab 6B Videos, Lab 6B Data	Lab Report
Ethics Day				
165	6.4.4 Formulate a position on the role of government in civil engineering. **BWS** Ethics (formulate)	**Teacher Edition** • Ethics: Building Codes • Ethics Essay Rubric	**Teacher Tools Online** • Instructional Aid: Ethics Essay Rubric	Ethics Essay
Chapter 6 Review				

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
162–65	Represent a real-world system using a free-body diagram. Solve real-world problems involving the transmission of forces. Solve real-world problems involving friction. Determine the effects of transmitted forces using empirical data and free-body diagrams. Compare static and kinetic friction on the basis of empirical data. (Lab 6A) Analyze the motion caused by a system of forces. (Lab 6B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 6 Test				
	Demonstrate knowledge of concepts from Chapter 6 by taking the test.	**Assessments** • Chapter 6 Test	**Teacher Tools Online** • EV: Chapter 6 Bank	Chapter 6 Test

Chapter 7: Rotational and Circular Motion (Key)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 7.1 Rotational Motion				
167–76	7.1.1 Describe rotational motion. 7.1.2 Explain how rotational motion and circular motion are related. 7.1.3 Solve problems involving rotational motion. 7.1.4 Compare Newton's three equations of motion for linear and rotational motion. 7.1.5 Describe the conditions required for rotational equilibrium.	**Teacher Edition** • Formative Assessment: Assessing Rotational Motion • Section 7.1 Review **Assessments** • Section 7.1 Quiz **Materials** • turntable (or lazy Susan) • coins (2) • wooden dowel, 30 cm (2) • string, 35 cm • tape	**Teacher Tools Online** • PPT Presentation: Section 7.1 Slides • Video: Equations of Rotational versus Linear Motion	Formative Assessment: *Assessing Rotational Motion* Section 7.1 Review Section 7.1 Quiz
Section 7.2 Circular Motion				
177–82	7.2.1 Define ***circular motion***. 7.2.2 Identify the source of the centripetal force in different systems. 7.2.3 Solve real-world circular motion problems. 7.2.4 Explain how space exploration partly fulfills the Creation Mandate. **BWS** Environment (explain)	**Teacher Edition** • Worldview Investigation: Artificial Gravity • *Artificial Gravity* Rubric • Section 7.2 Review **Assessments** • Section 7.2 Quiz **Materials** • wooden platform (15 cm × 15 cm) • light rope, 2 m • clear plastic cup • water	**Teacher Tools Online** • PPT Presentation: Section 7.2 Slides • Web Links: Centripetal Force, NASA Centripetal Force • Instructional Aid: Artificial Gravity Rubric	Section 7.2 Review Section 7.2 Quiz *Artificial Gravity* Article
Lab 7A Around the Curve—Investigating Circular Motion				
LM 79–86	Investigate the factors that affect circular motion by doing a controlled experiment. Determine the relationship between the factors that affect circular motion using graphical analysis techniques.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 7B Take It for a Spin—Exploring Angular Acceleration				
LM 87–90	Determine the relationship between angular velocity and centripetal acceleration. Determine the relationship between radius and centripetal acceleration.		**Teacher Tools Online** • Instructional Aids: Lab 7B Videos, Lab 7B Data	Lab Report
Section 7.3 Universal Gravitation				
183–90	7.3.1 Describe Kepler's three laws of planetary motion. 7.3.2 Describe Newton's law of universal gravitation. 7.3.3 Solve problems involving Kepler's and Newton's laws. 7.3.4 Prove that the principles of motion model Saturn's system of moons well. **BWS** Modeling (formulate)	**Teacher Edition** • STEM Connection: Gravity Assist • Mini Lab: *Designing a Loop Coaster* • Case Study: Geology and Newton's Law • Section 7.3 Review **Assessments** • Section 7.3 Quiz	**Teacher Tools Online** • PPT Presentation: Section 7.3 Slides • Video: Gravity Assist • Instructional Aid: Saturnian Moons.xls	Section 7.3 Review Section 7.3 Quiz
Chapter 7 Review				
191–93	Solve real-world problems involving rotational motion. Analyze the dynamics of systems experiencing circular motion. Analyze systems experiencing gravitational forces. Determine factors that influence centripetal and rotational acceleration using empirical data. (Lab 7A) Explain how circular and rotational motion are related in a rotational system. (Lab 7B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 7 Test				
	Demonstrate knowledge of concepts from Chapter 7 by taking the test.	**Assessments** • Chapter 7 Test	**Teacher Tools Online** • EV: Chapter 7 Bank	Chapter 7 Test

Chapter 8: Work and Energy (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 8.1 Work and Power				
195–201	8.1.1 Explain the physics concept of work. 8.1.2 Solve work problems algebraically and graphically. 8.1.3 Calculate mechanical power for a system.	**Teacher Edition** • Section 8.1 Review **Assessments** • Section 8.1 Quiz **Materials** • apple • balloon • brick	**Teacher Tools Online** • PPT Presentation: Section 8.1 Slides • Web Link: Work	Section 8.1 Review Section 8.1 Quiz
Section 8.2 Energy				
201–8	8.2.1 Compare kinetic and potential energy. 8.2.2 Relate changes to work and power. 8.2.3 Solve energy problems.	**Teacher Edition** • Careers: Serving as a Hydroelectric Engineer • Section 8.2 Review **Assessments** • Section 8.2 Quiz **Materials** • bowling ball • cardboard box	**Teacher Tools Online** • PPT Presentation: Section 8.2 Slides	Section 8.2 Review Section 8.2 Quiz
Section 8.3 Conservation of Energy				
209–16	8.3.1 Contrast conservative and nonconservative forces. 8.3.2 Relate the conservation of energy to total mechanical energy. 8.3.3 Solve mechanical energy problems using the conservation of mechanical energy. 8.3.4 Evaluate the ethics of hydroelectric dam construction on the basis of biblical teaching. **BWS** Environment (evaluate)	**Teacher Edition** • Case Study: A Study in Energy Transformations • Mini Lab: Water Falls • Section 8.3 Review • Formative Assessment: *Extending the Skier Problem* • Ethics: The Human Race and the Environment **Assessments** • Section 8.3 Quiz	**Teacher Tools Online** • PPT Presentation: Section 8.3 Slides • Video: Conservation of Energy Problems 8-10 and 8-11	Formative Assessment: *Extending the Skier Problem* Section 8.3 Review Section 8.3 Quiz
Lab 8A Losing Energy?—Investigating Conservation of Energy				
LM 91–93	Collect data on the motion of a projectile. Analyze the energy of a projectile using graphical means. Analyze the mechanical energy of a system to determine whether energy is conserved.		**Teacher Tools Online** • Instructional Aids: Lab 8A Videos, Lab 8A Data	Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 8B Big Bill's Better Bungees—Designing a Better Bungee				
LM 95–97	Design a bungee jump within the given constraints. Conduct research and experiments to determine the elastic properties of your designed bungee cord. Assess your designed bungee jump on the basis of data.	**Teacher Lab Manual** • Teacher Guide • *Big Bill's Better Bungees* Rubric	**Teacher Tools Online** • Instructional Aid: Big Bill's Better Bungees Rubric	Bungee and Project Report
Ethics Day				
219	8.3.4 Evaluate the ethics of hydroelectric dam construction on the basis of biblical teaching. **BWS** Environment (evaluate)	**Teacher Edition** • Ethics: The Human Race and the Environment • Ethics Essay Rubric	**Teacher Tools Online** • Instructional Aid: Ethics Essay Rubric	Ethics Essay
Chapter 8 Review				
217–19	Relate work, force, and energy both conceptually and mathematically. Relate kinetic and potential energy both conceptually and mathematically. Solve mechanical energy conservation problems with both conservative and nonconservative forces. Apply concepts of conservation of energy to real-world systems. (Lab 8A) Design and test a bungee for a bungee jump. (Lab 8B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 8 Test				
	Demonstrate knowledge of concepts from Chapter 8 by taking the test.	**Assessments** • Chapter 8 Test	**Teacher Tools Online** • EV: Chapter 8 Bank	Chapter 8 Test

Chapter 9: Momentum (Key)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 9.1 Principles of Momentum				
221–27	9.1.1 Describe momentum. 9.1.2 Calculate linear momentum under varying conditions. 9.1.3 Relate momentum and impulse conceptually and mathematically. 9.1.4 Apply the conservation of momentum to rocket propulsion and thrust in space.	**Teacher Edition** • Case Study: Creating SAFER Space • Section 9.1 Review **Assessments** • Section 9.1 Quiz **Materials** • spring scale • dynamics carts (2) • laboratory masses • string • Newton's cradle • balloons, long, thin (2) • straws (2)	**Teacher Tools Online** • PPT Presentation: Section 9.1 Slides • Video: Impulse-Momentum Theorem • Web Link: Breaking Boards	Section 9.1 Review Section 9.1 Quiz
Lab 9A Striving for Eggcellence—Designing a Safer Restraint System				
LM 99–101	Design a car within the given parameters that includes elements to protect the vehicle occupant during a crash. Test the car in a series of collisions. Assess the design on the basis of collected data.	**Teacher Lab Manual** • Lab 9A Teacher Guide • *Striving for Eggcellence* Rubric	**Teacher Tools Online** • Instructional Aid: *Striving for Eggcellence* Rubric	Project and Project Report
Section 9.2 Collisions				
228–37	9.2.1 Compare elastic and inelastic collisions. 9.2.2 Solve collision problems using conservation of momentum and energy. 9.2.3 Formulate a public comment on proposed implementation of the wooden bat rule. **BWS** Ethics (formulate)	**Teacher Edition** • Worldview Investigation: Crack versus Clank • *Crack versus Clank* Rubric • Careers: Serving as a Sports Engineer • Section 9.2 Review **Assessments** • Section 9.2 Quiz **Materials** • billiard balls (2) • playground balls (2) • clay, 2 balls • ballistic pendulum	**Teacher Tools Online** • PPT Presentation: Section 9.2 Slides • Video: Collision Modes • Web Links: Collisions, Ballistic Pendulum, 2D Collision • Instructional Aid: Crack versus Clank Rubric	Section 9.2 Review Section 9.2 Quiz *Crack versus Clank* Position Statement

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 9B Collision Course—Investigating Conservation during Collisions				
LM 103–10	Collect data for various dynamic cart collision scenarios. Analyze collision data to determine whether momentum and kinetic energy are conserved.		**Teacher Tools Online** • Instructional Aids: Lab 9B Video, Lab 9B Data	Lab Report
Section 9.3 Center of Mass and Angular Momentum				
238–43	9.3.1 Explain why physicists utilize the center of mass concept. 9.3.2 Solve momentum problems for a multi-object system. 9.3.3 Predict the change in angular momentum of a spinning object.	**Teacher Edition** • Mini Lab: *A Massive Task* • Section 9.3 Review **Assessments** • Section 9.3 Quiz **Materials** • meter stick • softball bat • rotation turntable • 5 lb. hand weights (2)	**Teacher Tools Online** • PPT Presentation: Section 9.3 Slides • Web Link: Angular Momentum	Section 9.3 Review Section 9.3 Quiz
Chapter 9 Review				
244–47	Solve problems involving changes in the momentum of an object. Solve problems involving collisions. Solve problems involving center of mass and angular momentum. Design and test a car with a passenger restraint system. (Lab 9A) Verify the law of conservation of momentum in real systems through the analysis of empirical data. (Lab 9B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 9 Test				
	Demonstrate knowledge of concepts from Chapter 9 by taking the test.	**Assessments** • Chapter 9 Test	**Teacher Tools Online** • EV: Chapter 9 Bank	Chapter 9 Test

Chapter 10: Periodic Motion (Key)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 10.1 Simple Harmonic Motion				
249–57	10.1.1 Describe simple harmonic motion. 10.1.2 Calculate periods and frequencies for systems exhibiting simple harmonic motion. 10.1.3 Compare ideal and real oscillating systems. 10.1.4 Compare damped and driven oscillations.	**Teacher Edition** • Section 10.1 Review **Assessments** • Section 10.1 Quiz **Materials** • springs (two different springs, different stiffness) • laboratory masses (Five 100 g masses should work, but it will depend on the springs that you use.) • plastic ruler • tuning fork • rubber mallet	**Teacher Tools Online** • PPT Presentation: Section 10.1 Slides • Web Links: Simple Harmonic Motion, Tacoma Narrows Bridge, Tacoma Narrows Bridge Video, Pendulum Lab	Section 10.1 Review Section 10.1 Quiz
Lab 10A Taking a Swing at It—Inquiring into the Period of a Pendulum				
LM 111–12	Design an experiment to determine the variables that affect the period of a pendulum. Determine the formula for the period of a pendulum from the empirical data using curve-fitting techniques. Evaluate the experimental design, considering modifications to the procedures that would result in more accurate data.	**Teacher Lab Manual** • Lab 10A Teacher Guide		Lab Report
Section 10.2 Periodic Motion and the Pendulum				
258–61	10.2.1 Explain how a pendulum works conceptually and mathematically. 10.2.2 Analyze the motion of a pendulum.	**Teacher Edition** • Section 10.2 Review **Assessments** • Section 10.2 Quiz **Materials** • string, 2 m (for pendulum) • laboratory masses, 500 g (for pendulum)	**Teacher Tools Online** • PPT Presentation: Section 10.2 Slides • Web Links: Physical Pendulum, Physical Pendulum Video	Section 10.2 Review Section 10.2 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 10.3 Waves				
262–69	10.3.1 Describe waves. 10.3.2 Solve wave problems. 10.3.3 Describe how waves interact with their environment. 10.3.4 Explain how a standing wave is formed.	**Teacher Edition** • Mini Lab: *Changing the Harmonics of a Bottle* • Section 10.3 Review **Assessments** • Section 10.3 Quiz **Materials** • one SLINKY® for each pair of students • sympathetic and differential tuning fork set	**Teacher Tools Online** • PPT Presentation: Section 10.3 Slides	Section 10.3 Review Section 10.3 Quiz
Section 10.4 Sound				
270–76	10.4.1 Describe sound waves and how we perceive them. 10.4.2 Explain how different instruments produce sound. 10.4.3 Solve problems involving sound waves. 10.4.4 Model the speed of sound in the atmosphere. **BWS** Modeling (formulate) 10.4.5 Evaluate the use of technologies creating sound pollution near populated areas. **BWS** Environment (evaluate)	**Teacher Edition** • Worldview Investigation: Oh the Noise • Oh the Noise Rubric • Case Study: *Foucault Pendulum* (p. 277) • Section 10.4 Review **Assessments** • Section 10.4 Quiz **Materials** • musical instruments (Ask students to bring theirs too.)	**Teacher Tools Online** • PPT Presentation: Section 10.4 Slides • Web Link: Decibels • Video: Doppler Effect • Instructional Aids: Speed of Sound, Oh the Noise Rubric	• Section 10.4 Review • Section 10.4 Quiz • Oh the Noise paper
Lab 10B Sonic Boom—Measuring the Speed of Sound in Air				
LM 113–19	Determine the wavelength of a sound wave in a resonating column of air. Calculate the speed of sound in air. Compare your experimental value to the accepted value.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Chapter 10 Review				
278–81	Analyze systems exhibiting simple harmonic motion. Solve problems involving pendulums. Describe the characteristics and behavior of waves. Describe sound waves conceptually and mathematically. Determine empirically the factors affecting harmonic motion. Design an experiment to determine the factors affecting harmonic motion. (Lab 10A) Determine the speed of sound in air using resonance. (Lab 10B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 10 Test				
	Demonstrate knowledge of concepts from Chapter 10 by taking the test.	**Assessments** • Chapter 10 Test	**Teacher Tools Online** • EV: Chapter 10 Bank	Chapter 10 Test

Chapter 11: Expansion and Temperature (Enrichment)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 11.1 Thermal Expansion				
285–91	11.1.1 Describe how thermal expansion occurs at the particle level. 11.1.2 Describe the consequences of thermal properties in real-world situations. 11.1.3 Mathematically model linear and volumetric thermal expansion.	**Teacher Edition** •STEM Connection: Expansion Joints •Section 11.1 Review **Assessments** •Section 11.1 Quiz **Materials** •bimetallic strip •ball and ring demonstration kit	**Teacher Tools Online** •PPT Presentation: Section 11.1 Slides •Video: Expansion Joints	Section 11.1 Review Section 11.1 Quiz
Lab 11A Across the Expanse—Investigating Thermal Expansion				
LM 121–28	Determine the coefficient of linear expansion for one or more metals. Compare the experimental value of the coefficient of linear expansion to the known value.	**Teacher Lab Manual** •Alternate Procedures		Lab Report
Section 11.2 Measuring Temperature				
292–96	11.2.1 Describe how thermometers work. 11.2.2 Compare the three principal temperature scales. 11.2.3 Convert temperatures from one unit to another.	**Teacher Edition** •Section 11.2 Review **Assessments** •Section 11.2 Quiz **Materials** •giant thermometers (for wall display) (3) •labels: Celsius, Fahrenheit, Kelvin, low mass, thin wall, calibration, narrow inner diameter, appropriate liquid	**Teacher Tools Online** •PPT Presentation: Section 11.2 Slides •Video: Temperature Conversion and Graphs	Preassessment: *Temperature Conversions* Section 11.2 Review Section 11.2 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 11B Under Pressure—Investigating Boyle's Law				
LM 129–34	Collect data on the volume of a gas at different pressures. Determine the relationships between pressure and volume using graphical analysis. Compare experimental values to theoretical values from calculations.			Lab Report
Section 11.3 Gas Laws				
297–306	11.3.1 Describe the properties of an ideal gas. 11.3.2 Relate the properties of ideal gases to each other. 11.3.3 Analyze changing properties of a gas. 11.3.4 Compare ideal and real gases. 11.3.5 Explain how the development of Forrest Bird's respirator helped many who had respiratory ailments. **BWS** Ethics (explain)	**Teacher Edition** •Worldview Investigation: The Need to Breathe •*The Need to Breathe* Rubric •Mini Lab: *Ball and Ring* •Section 11.3 Review **Assessments** •Section 11.3 Quiz **Materials** •vacuum chamber •vacuum pump •balloons, 8 in. (5) •marshmallow or PEEPS® (optional) •hot plate •ice water •beaker, 400 mL or 600 mL •dishpan •soda can •beaker tongs	**Teacher Tools Online** •PPT Presentation: Section 11.3 Slides •Web Link: Gas Simulation •Instructional Aid: The Need to Breathe Rubric	Section 11.3 Review Section 11.3 Quiz *The Need to Breathe* Report
Lab 11C Hot Space—Investigating Charles's law				
LM 135–41	Measure the volume of a sample of gas as it responds to changes in temperature at constant pressure. Determine the relationship between gas temperature and volume using graphical analysis. Extrapolate the temperature-volume curve of the gas to estimate the value of absolute zero. Compare the experimental and accepted values for absolute zero.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Chapter 11 Review				
307–9	Compare the thermal expansion of solids, liquids, and gases. Relate thermometric properties to temperature scales. Solve problems using the gas laws. Compare the measured coefficient of linear expansion to the accepted value. (Lab 11A) Investigate the relationships between pressure, volume, and temperature of gases. (Labs 11B and C)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 11 Test				
	Demonstrate knowledge of concepts from Chapter 11 by taking the test.	**Assessments** • Chapter 11 Test	**Teacher Tools Online** • EV: Chapter 11 Bank	Chapter 11 Test

Chapter 12: Thermal Energy and Heat (Key)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 12.1 Theories of Heat				
311–16	12.1.1 Describe the evidence for the kinetic-molecular model of matter. 12.1.2 Explain why people stopped using the caloric theory. **BWS** Foundations (evaluate) 12.1.3 Relate thermal energy, heat, and temperature.	**Teacher Edition** • Section 12.1 Review **Assessments** • Section 12.1 Quiz	**Teacher Tools Online** • PPT Presentation: Section 12.1 Slides • Web Links: Diffusion, Brownian Motion, Equivalence of Mechanical Energy and Heat	Section 12.1 Review Section 12.1 Quiz
Section 12.2 Thermal Energy and Matter				
316–26	12.2.1 Define ***specific heat capacity***. 12.2.2 Create a model relating the molar mass and specific heat for selected metals. 12.2.3 Solve problems in which thermal energy is conserved. 12.2.4 Solve problems involving phase transitions.	**Teacher Edition** • Mini Lab: *Finding the Heat Capacity* (p. 327) • Section 12.2 Review **Assessments** • Section 12.2 Quiz **Materials** • solid metal object (100 g laboratory mass) • wooden block • candle • balloons (2) • hot plate • beaker, 1000 mL • glass cup • foam cup • metal cup • cardboard lids for cups (3) • thermometers (3) • beaker, 400 mL • temperature probe • computer with data-logging program • ice	**Teacher Tools Online** • PPT Presentation: Section 12.2 Slides • Instructional Aid: Data • Web Links: Balloons, Heating Curve	Section 12.2 Review Section 12.2 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 12A The Capacity to Understand—Understanding Heat Capacity and Specific Heat Capacity				
LM 143–48	Collect thermal energy transfer data with a calorimeter. Determine the heat capacity and specific heat capacity of metal cylinders. Compare the heat capacity and specific heat capacities of metal cylinders. Evaluate the experimental design on the basis of the collected data			Lab Report
Section 12.3 Mechanisms for Thermal Energy Transfer				
328–34	12.3.1 Compare mechanisms of heat transfer. 12.3.2 Classify examples of each kind of heat transfer. 12.3.3 Explain why open bodies of water freeze from the top down. 12.3.4 Explain the phenomenon of lake turnover. **BWS** Environment (explain) 12.3.5 Determine the radiant energy emission of an object using the Stefan-Boltzmann law.	**Teacher Edition** • Formative Assessment: Conduction and Convection • Worldview Investigation: Lake Turnover • *Lake Turnover* Rubric • STEM Connection: Car Cooling System • Section 12.3 Review **Assessments** • Section 12.3 Quiz	**Teacher Tools Online** • PPT Presentation: Section 12.3 Slides • Instructional Aid: Lake Turnover Rubric • Video: Car Cooling System	Formative Assessment: *Conduction and Convection* Section 12.3 Review Section 12.3 Quiz Worldview Investigation Product
Lab 12B What's Cooking?—Building a Better Solar Oven				
LM 149–51	Design and build a solar oven that can cook a specific food. Design a test for the effectiveness of the oven. Modify the design to improve its efficiency.	**Teacher Lab Manual** • Teacher Guide • *What's Cooking?* Rubric	**Teacher Tools Online** • Instructional Aid: *What's Cooking? Rubric*	Project and Project Report
Chapter 12 Review				
335–37	Summarize the development of theories of heat. Relate thermal energy to changes in matter. Solve problems involving heat transfer. Investigate the thermal energy transfer materials with calorimetry. (Lab 12A) Evaluate a student-designed and student-built solar oven. (Lab 12B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Chapter 12 Test				
	Demonstrate knowledge of concepts from Chapter 12 by taking the test.	**Assessments** • Chapter 12 Test	**Teacher Tools Online** • EV: Chapter 12 Bank	Chapter 12 Test

Chapter 13: Thermodynamic Laws (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 13.1 The Zeroth and First Laws				
339–48	13.1.1 State the zeroth, first, and conservation laws of thermodynamics. 13.1.2 Apply the zeroth, first, and conservation laws of thermodynamics to real-world thermodynamic systems. 13.1.3 Describe how a heat engine functions. 13.1.4 Analyze thermodynamic systems with ***PV*** diagrams. 13.1.5 Describe thermodynamic systems and processes.	**Teacher Edition** • Section 13.1 Review **Assessments** • Section 13.1 Quiz **Materials** • small aquarium • Erlenmeyer flasks, 250 mL (2) • rubber stoppers (2) • food coloring, red and blue	**Teacher Tools Online** • PPT Presentation: Section 13.1 Slides	Section 13.1 Review Section 13.1 Quiz
Section 13.2 The Second and Third Laws				
349–54	13.2.1 State the second and third laws of thermodynamics. 13.2.2 Apply the second and third laws of thermodynamics to real-world thermodynamic systems. 13.2.3 Compare real heat engines with ideal heat engines. 13.2.4 Describe how refrigeration works. 13.2.5 Anaylze the effects of air conditioning on American culture. **BWS** Ethics (explain)	**Teacher Edition** • Case Study: Giving Yellow Fever the Cold Shoulder (p. 355) • Mini Lab: *Cooling Air* (p. 356) • Section 13.2 Review **Assessments** • Section 13.2 Quiz	**Teacher Tools Online** • PPT Presentation: Section 13.2 Slides • Web Links: Carnot Cycle, Heat Engine, Heat Pump	Section 13.2 Review Section 13.2 Quiz
Section 13.3 Entropy and Its Consequences				
357–62	13.3.1 Describe entropy conceptually and mathematically. 13.3.2 Explain how entropy changes for natural irreversible processes. 13.3.3 Evaluate scientific theories as they relate to entropy. **BWS** Foundations (evaluate) 13.3.4 Formulate a position regarding our society's obligation to make new technologies available to all. **BWS** Ethics (formulate)	**Teacher Edition** • Section 13.3 Review • Ethics: Technology Help for All (p. 365) **Assessments** • Section 13.3 Quiz	**Teacher Tools Online** • PPT Presentation: Section 13.3 Slides • Web Link: Entropy	Section 13.3 Review Section 13.3 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 13 Microstates—Understanding Entropy				
LM 153–58	Collect data of the possible outcomes when rolling two dice. Determine the possible microstates of two dice. Explain how entropy is determined by the number of possible microstates for each macrostate. Evaluate the empirical data to determine the most likely macrostate of two dice.			Lab Report
Ethics Day				
365	13.3.4 Formulate a position regarding our society's obligation to make new technologies available to all. **BWS** Ethics (formulate)	**Teacher Edition** • Ethics: Technology Help for All • Ethics Essay Rubric	• Instructional Aid: Ethics Essay Rubric	Ethics Essay
Chapter 13 Review				
363–65	Apply the laws of thermodynamics to thermodynamic systems. Analyze pressure-versus-volume diagrams. Apply the laws of thermodynamics to heat engines. Explain entropy in terms of microstates using empirical data. (Lab 13)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 13 Test				
	Demonstrate knowledge of concepts from Chapter 13 by taking the test.	**Assessments** • Chapter 13 Test	**Teacher Tools Online** • EV: Chapter 13 Bank	Chapter 13 Test

Chapter 14: Fluid Mechanics (Key)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 14.1 Hydrostatics: Fluids at Rest				
367–79	14.1.1 Describe the properties of a fluid. 14.1.2 Calculate the pressure of a fluid at a given depth. 14.1.3 Solve real-world problems related to hydraulic devices. 14.1.4 Solve real-world problems related to the buoyancy of an object in a fluid using Archimedes's principle.	**Teacher Edition** • Mini Lab: *Determining Draft* • Section 14.1 Review **Assessments** • Section 14.1 Quiz **Materials** • pinewood block (Approximately 15 cm × 5 cm × 3 cm. A pinewood derby block would work well.) • small aquarium • water • 1 gal milk jug • PRINGLES® potato chips can • beaker, 1000 mL • dishpan • clear tape • balsa wood block (approximately 15 cm × 5 cm × 3 cm)	**Teacher Tools Online** • PPT Presentation: Section 14.1 Slides • Video: Buoyant Force • Web Links: Hydrostatic Pressure App, Hydrostatic Pressure, Barrel Experiment, Density and Floating	Section 14.1 Review Section 14.1 Quiz
Lab 14A Navigating Water Weighs—Understanding Buoyancy				
LM 159–65	Determine the buoyant force on an object by measuring its apparent weight. Determine the buoyant force on an object by measuring the weight of the water it displaces. Calculate the expected buoyant force on an object according to Archimedes's principle. Evaluate the three methods of determining the buoyant force.			Lab Report
Lab 14B Draft Day—Designing a Paper Boat				
LM 167–69	Design a paper boat that is optimized for a particular draft. Test your design for its compliance with the design task. Redesign the boat to improve on meeting the design task.	**Teacher Lab Manual** • *Teacher Guide* • *Draft Day* Rubric	**Teacher Tools Online** • Instructional Aid: *Draft Day Rubric*	Project and Project Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 14.2 Hydrodynamics: Fluids in Motion				
380–88	14.2.1 Describe what affects the flow of a fluid. 14.2.2 Solve problems for hydrodynamic fluids using Bernoulli's principle. 14.2.3 Explain what causes lift in an airplane. 14.2.4 Evaluate the implementation of wind power on a large scale. **BWS** Environment (evaluate)	**Teacher Edition** • Careers: Aerospace Engineer • Worldview Investigation: Wind Power (p. 389) • *Wind Power* Rubric • Section 14.2 Review **Assessments** • Section 14.2 Quiz **Materials** • soda cans (2) • drinking straw • Bernoulli bags (4) • graduated cylinders, plastic, 100 mL (4) • water, 100 mL • vegetable oil, 100 mL • corn syrup, 100 mL • isopropyl alcohol, 100 mL • ball bearings (4)	**Teacher Tools Online** • PPT Presentation: Section 14.2 Slides • Web Links: Venturi Effect, Generating Lift • Instructional Aid: Wind Power Rubric	Section 14.2 Review Section 14.2 Quiz Wind Power Editorial
Chapter 14 Review				
390–91	Solve real-world problems related to the properties of static fluids. Solve real-world problems related to the properties of hydrodynamic fluids. Compare experimental values for the buoyant force exerted on an object determined by different methods. (Lab 14A) Evaluate a student-designed boat. (Lab 14B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 14 Test				
	Demonstrate knowledge of concepts from Chapter 14 by taking the test.	**Assessments** • Chapter 14 Test	**Teacher Tools Online** • EV: Chapter 14 Bank	Chapter 14 Test

Chapter 15: Static Electricity (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 15.1 Electric Charge				
395–99	15.1.1 Explain how people experimented with static electricity. 15.1.2 Describe the experiment that determined the charge of an electron. 15.1.3 Classify substances by their electrical properties. 15.1.4 Explain how Millikan's experiment refined the model of how electricity works. **BWS** Modeling (explain) 15.1.5 Determine the value of the fundamental electrical charge from Robert Millikan's data.	**Teacher Edition** • STEM Connection: The Faraday Cage • Mini Lab: *Investigating Static Electricity* • Section 15.1 Review **Assessments** • Section 15.1 Quiz **Materials** • Van de Graaff generator or Wimhurst generator • friction rod kit • support stand • string	**Teacher Tools Online** • PPT Presentation: Section 15.1 Slides • Video: Faraday Cage • Web Links: Van de Graaff, Wimhurst, Millikan Oil Drop Experiment • Instructional Aid: Millikan Experiment Data	Section 15.1 Review Section 15.1 Quiz
Lab 15A Are You Positive?—Inquiring into Electric Charge				
LM 171–72	Design an experiment to determine the type of charge on a charged object. Evaluate the experimental design, considering modifications to the procedures that would result in more conclusive findings.	**Teacher Lab Manual** • Teacher Guide		Lab Report
Section 15.2 Detecting Electric Charge				
400–408	15.2.1 Describe how we can detect and measure electric charge. 15.2.2 Describe how we establish an electric charge on an object. 15.2.3 Compare Coulomb's law with Newton's law of universal gravitation. 15.2.4 Solve problems involving charged objects using Coulomb's law.	**Teacher Edition** • Careers: High-Voltage Power Line Inspector • Section 15.2 Review **Assessments** • Section 15.2 Quiz **Materials** • electroscopes (2) • friction rod set • sheets of aluminum foil, 30 cm × 30 cm (2) • beakers, 500 mL (2) • support stand • string • pith ball	**Teacher Tools Online** • PPT Presentation: Section 15.2 Slides • Web Links: DIY Electroscope, Torsion Balance (General), Torsion Balance (Coulomb)	Section 15.2 Review Section 15.2 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 15B Simply Shocking–Investigating Electric Charge				
LM 173–78	Identify the type of charge on objects on the basis of the interaction between charged objects. Compare the processes of charging by induction and charging by conduction using empirical data. Classify materials as conductors or insulators on the basis of empirical data.			Lab Report
Chapter 15 Review				
409–11	Summarize the history of the study of static electricity. Evaluate historical studies of static electricity. Solve problems involving charged objects. Design an experiment to test the triboelectric effect. (Lab 15A) Demonstrate the effects of the transfer of static charges by friction, induction, and conduction. (Lab 15B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 15 Test				
	Demonstrate knowledge of concepts from Chapter 15 by taking the test.	**Assessments** • Chapter 15 Test	**Teacher Tools Online** • EV: Chapter 15 Bank	Chapter 15 Test

Chapter 16: Electric Fields (Key)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 16.1 Modeling Electric Fields				
413–21	16.1.1 Model an electric field using lines of force. 16.1.2 Calculate electric field strength on various charged particles. 16.1.3 Compare electric potential and potential difference. 16.1.4 Calculate electric potential difference at various positions in an electric field. 16.1.5 Describe how electric forces and fields are used in N95 masks to protect doctors and nurses.	**Teacher Edition** • Case Study: N95 Mask • Section 16.1 Review **Assessments** • Section 16.1 Quiz **Materials** • Van de Graaff generator • wig • overhead projector • petri dish • 6 V battery • heavy gauge insulated wires, 20 cm (2) • grass seed • distilled water	**Teacher Tools Online** • PPT Presentation: Section 16.1 Slides	Section 16.1 Review Section 16.1 Quiz
Lab 16A Field Work—Mapping Electric Fields				
LM 179–85	Identify equipotential surfaces between charged objects by collecting potential difference data. Map the electric field between two charged objects on the basis of the equipotential surfaces that they produce. Predict the shape of the electric field between two charged objects. Evaluate your prediction about the fields on the basis of empirical data.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 16.2 Capacitors				
422–29	16.2.1 Relate a capacitor's design to its field strength, potential difference, and charge. 16.2.2 Relate capacitance to other electric properties. 16.2.3 Calculate capacitance for individual and connected capacitors.	**Teacher Edition** • STEM Connection: Defibrillator • Mini Lab: *Making a Capacitor* • Section 16.2 Review **Assessments** • Section 16.2 Quiz **Materials** • camera flash • battery • lamp • switch • wires (3)	**Teacher Tools Online** • PPT Presentation: Section 16.2 Slides • Videos: Dielectrics, Defibrillator, Combining Capacitors • Web Links: Capacitor Operation, Dielectric and Capacitance	Section 16.2 Review Section 16.2 Quiz
Lab 16B Charge It—Investigating Capacitance				
LM 187–93	Collect data on the capacitance of a parallel plate capacitor. Determine the relationship between capacitance and capacitor plate area and between capacitance and plate separation. Compare measured capacitance to expected capacitance.			Lab Report
Chapter 16 Review				
430–31	Analyze electric fields using qualitative and quantitative models. Solve problems related to capacitors. Investigate electric fields by mapping equipotential surfaces. (Lab 16A) Evaluate the factors that affect the capacitance of a capacitor. (Lab 16B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 16 Test				
	Demonstrate knowledge of concepts from Chapter 16 by taking the test.	**Assessments** • Chapter 16 Test	**Teacher Tools Online** • EV: Chapter 16 Bank	Chapter 16 Test

Chapter 17: Current Electricity (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 17.1 Current, Voltage, and Resistance				
433–43	17.1.1 Describe electric current. 17.1.2 Compare conductors using their properties. 17.1.3 Solve electric resistance problems. 17.1.4 Solve electric power and energy problems.	**Teacher Edition** • Worldview Investigation: Talking Tech Trash • *Talking Tech Trash* Rubric • Section 17.1 Review **Lab Manual** • Appendix I **Assessments** • Section 17.1 Quiz **Materials** • battery, switch, lamp, wires (3) for each pair of students	**Teacher Tools Online** • PPT Presentation: Section 17.1 Slides • Web Link: Ohm's Law • Instructional Aid: Talking Tech Trash Rubric	Talking Tech Trash Report Section 17.1 Review Section 17.1 Quiz
Section 17.2 Electric Circuits				
444–56	17.2.1 Analyze electrical circuits using electrical symbols. 17.2.2 Compare properties of series and parallel electrical circuits. 17.2.3 Analyze circuits using equivalent resistance, Ohm's law, and Kirchhoff's laws. 17.2.4 Relate electrical instruments to the quantities they measure. 17.2.5 Formulate a position regarding building codes for privately owned buildings. **BWS** Ethics (formulate)	**Teacher Edition** • Section 17.2 Review • Mini Lab: *Learning about Multimeters* (p. 457) • Ethics: Electrical Codes (p. 461) **Assessments** • Section 17.2 Quiz **Materials** • batteries (2) • lamps (4) • wires (7)	**Teacher Tools Online** • PPT Presentation: Section 17.2 Slides • Video: Combining Resistors • Web Links: Voltage Law, Current Law	Section 17.2 Review Section 17.2 Quiz
Lab 17A Circuit Court—Understanding Circuits and Resistors				
LM 195–200	Build a simple circuit from a circuit diagram. Compare the labeled and measured values of resistance for a resistor. Collect current, voltage, and resistance data using a multimeter. Determine the relationships between current and voltage and current and resistance in simple circuits.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 17B The Lineup—Investigating Series Circuits				
LM 201–8	Build a series circuit from a circuit diagram. Collect current, voltage, and resistance data using a multimeter. Determine the effect of adding resistors in series on current, voltage, and equivalent resistance.			Lab Report
Lab 17C The Path Less Traveled—Investigating Parallel Circuits				
LM 209–16	Build a parallel circuit on the basis of a circuit diagram. Collect current, voltage, and resistance data using a multimeter. Determine the effect of adding resistors in parallel on current, voltage, and equivalent resistance.			Lab Report
Ethics Day				
461	17.2.5 Formulate a position regarding building codes for privately owned buildings. **BWS** Ethics (formulate)	**Teacher Edition** • Ethics: Electrical Codes • Ethics Essay Rubric	• Instructional Aid: Ethics Essay Rubric	Ethics Essay
Chapter 17 Review				
458–61	Solve problems related to current, electrical work, and power. Solve problems involving DC circuits of various configurations. Analyze data from a circuit to confirm Ohm's law. (Lab 17A) Evaluate data from a series circuit to determine the effect of connecting resistors in series. (Lab 17B) Evaluate data from a parallel circuit to determine the effect of connecting resistors in parallel. (Lab 17C)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 17 Test				
	Demonstrate knowledge of concepts from Chapter 17 by taking the test.	**Assessments** • Chapter 17 Test	**Teacher Tools Online** • EV: Chapter 17 Bank	Chapter 17 Test

Chapter 18: Magnetism (Key)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 18.1 Describing Magnetism				
463–69	18.1.1 Summarize the history of the study of magnetism. 18.1.2 Describe magnetic fields. 18.1.3 Explain what causes magnetic fields at the particle level. 18.1.4 Describe the magnetic properties of Earth. 18.1.5 Defend the position that the magnetosphere is evidence for Earth's good design. **BWS** Foundations (formulate)	**Teacher Edition** • Section 18.1 Review • Case Study: Paleomagnetism and Earth's Age (p. 470) **Assessments** • Section 18.1 Quiz **Materials** • rare-earth magnet • ferrofluid • bar or horseshoe magnet • glass plate • iron filings • iron nail • paper clips	**Teacher Tools Online** • PPT Presentation: Section 18.1 Slides • Web Links: Ferrofluid, Magnetic Poles, Terrestrial Magnetism, Declination, Magnetic Anomalies	Section 18.1 Review Section 18.1 Quiz
Lab 18 Navigating Magnetism—Mapping a Magnetic Field				
LM 217–22	Model the magnetic field surrounding a magnet using field lines. Model the interaction of the magnetic fields of two magnets using field lines. Describe the magnetic field around a wire, including its dependence on current direction.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 18.2 Magnetism and Charges				
471–80	18.2.1 Describe the magnetic force exerted on a charge moving through a magnetic field conceptually and mathematically. 18.2.2 Determine the direction of the force on a charge moving through a magnetic field using the right-hand rule. 18.2.3 Solve problems involving a charge moving through electric and magnetic fields. 18.2.4 Summarize how J. J. Thomson discovered the electron. 18.2.5 Model the mass-to-charge ratio of an electron using Thomson's original data. 18.2.6 Evaluate the statement, "The electron is part of a model, and since the Bible doesn't mention models, they are most likely not real." **BWS** Modeling (evaluate)	**Teacher Edition** • Section 18.2 Review **Assessments** • Section 18.2 Quiz	**Teacher Tools Online** • PPT Presentation: Section 18.2 Slides • Web Links: Cloud Chamber, Velocity Selector • Video: Right-Hand Rule • Instructional Aid: *m/q* Data	Section 18.2 Review Section 18.2 Quiz
Section 18.3 Magnetism and Conductors				
481–88	18.3.1 Describe the magnetic force acting on a current-carrying wire conceptually and mathematically. 18.3.2 Explain how a current-carrying loop of wire in a magnetic field can generate torque. 18.3.3 Predict the direction in which a current-carrying loop will rotate in a magnetic field. 18.3.4 Solve problems involving a current-carrying wire in a magnetic field.	**Teacher Edition** • Mini Lab: *Mapping a Magnetic Field* • STEM Connection: DC Motors • Section 18.3 Review **Assessments** • Section 18.3 Quiz **Materials** • DC motors (2) • ROMEX® wire, 1 m • ROMEX wire square loop, ≈ 25 cm per side • ROMEX wire loop, ≈ 30 cm diameter	**Teacher Tools Online** • PPT Presentation: Section 18.3 Slides • Web Link: Galvanometer • Video: DC Motor	Section 18.3 Review Section 18.3 Quiz
Chapter 18 Review				
489–91	Relate magnetism to Earth. Relate electricity and magnetism. Relate magnetic fields to current-carrying wires. Map various magnetic fields using empirical observations. (Lab 18)	**Teacher Edition** • Chapter Review Solutions		Chapter Review

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Chapter 18 Test				
	Demonstrate knowledge of concepts from Chapter 18 by taking the test.	**Assessments** • Chapter 18 Test	**Teacher Tools Online** • EV: Chapter 18 Bank	Chapter 18 Test

Chapter 19: Electromagnetism (Key)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 19.1 Currents and Magnetic Fields				
493–502	19.1.1 Determine the magnitude and direction of the magnetic field around a conductor. 19.1.2 Solve problems involving electromagnetic induction. 19.1.3 Predict changes to a magnetic field using Faraday's law and Lenz's law.	**Teacher Edition** • Mini Lab: *Magnets and Current* • Section 19.1 Review **Assessments** • Section 19.1 Quiz **Materials** • galvanometer • wire, insulated, 60 cm • graduated cylinder, 100 mL • magnet, bar • tape, clear • copper or aluminum tube • magnet, cylindrical (slightly smaller diameter than the pipe) • triple beam balances (2)	**Teacher Tools Online** • PPT Presentation: Section 19.1 Slides • Web Links: 2003 Cascading Failure, Electromagnetic Induction, Faraday's Experiment, Eddy Currents	Section 19.1 Review Section 19.1 Quiz
Lab 19A Make the Wheels Go Round—Measuring Work in an Electric Motor				
LM 223–31	Collect data related to the electrical energy consumed to do a particular amount of mechanical work. Compare the mechanical work done by a DC motor with the electrical energy used. Determine the efficiency of a DC motor under different loads.			Lab Report
Section 19.2 Generating Current				
503–13	19.2.1 Compare AC and DC power generation and distribution. 19.2.2 Explain what affects inductance. 19.2.3 Solve real-world problems involving inductance. 19.2.4 Formulate a position on the development of a smart grid for the US electrical system. **BWS** Environment (formulate)	**Teacher Edition** • Careers: Serving as an Electrical Engineer • Section 19.2 Review • Worldview Investigation: *Smart Grids* (p. 514) • *Smart Grids* Rubric **Assessments** • Section 19.2 Quiz	**Teacher Tools Online** • PPT Presentation: Section 19.2 Slides • Web Links: AC Generation, Motors and Generators • Instructional Aid: Smart Grids Rubric	Section 19.2 Review *Smart Grids* Letter Section 19.2 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 19B Maglev Training—Designing a Maglev Train				
LM 233–34	Design a maglev train that is levitated using electromagnets. Test the design for its compliance with the design task.	**Teacher Lab Manual** • Teacher Guide • *Maglev Training* Rubric	**Teacher Tools Online** • Instructional Aid: Maglev Training Rubric	Project and Project Report
Chapter 19 Review				
515–17	Relate magnetic fields to current-carrying wires. Compare the functions and features of AC and DC circuits. Evaluate the efficiency of a DC motor under different loads. (Lab 19A) Evaluate the performance of a student-designed maglev train. (Lab 19B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 19 Test				
	Demonstrate knowledge of concepts from Chapter 19 by taking the test.	**Assessments** • Chapter 19 Test	**Teacher Tools Online** • EV: Chapter 19 Bank	Chapter 19 Test

Chapter 20: Light and Reflection (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 20.1 Forms and Sources of Light				
521–30	20.1.1 Provide evidence that light is a form of energy. 20.1.2 Describe divisions of the electromagnetic spectrum. 20.1.3 Compare the different sources of light. 20.1.4 Explain why bioluminescence is unique. **BWS** Foundations (explain) 20.1.5 Explain how scientists of the past investigated the speed of light. 20.1.6 Describe light as a wave conceptually and mathematically.	**Teacher Edition** • Section 20.1 Review **Assessments** • Section 20.1 Quiz **Materials** • radiometer • lamp with a bright bulb • chemical light stick	**Teacher Tools Online** • PPT Presentation: Section 20.1 Slides • Web Links: Hooke's Radiometer, Foucault's Speed of Light	Section 20.1 Review Section 20.1 Quiz
Section 20.2 Intensity and Color				
530–37	20.2.1 Explain how to measure luminosity. 20.2.2 Solve luminosity problems. 20.2.3 Describe how different colors are formed.	**Teacher Edition** • Section 20.2 Review **Assessments** • Section 20.2 Quiz **Materials** • flashlight (or overhead projector)	**Teacher Tools Online** • PPT Presentation: Section 20.2 Slides • Web Links: Mixing Light, Mixing Pigments	Section 20.2 Review Section 20.2 Quiz
Lab 20A Illuminating Illumination—Investigating Luminous Flux and Illuminance				
LM 235–40	Determine the relationship between illuminance and the distance from a light source. Determine the relationship between illuminance and luminous flux. Relate luminous flux to distance in a real-world application.			Lab Report
Lab 20B Mirror, Mirror—Investigating Plane Mirrors				
LM 241–46	Create a ray diagram for the formation of an image in a plane mirror. Determine the angles of incidence and reflection for a ray interacting with a plane mirror. Compare the image and object distances and heights from the ray diagram. Compare the image to the object.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 20.3 Reflection and Mirrors				
538–50	20.3.1 Describe optical reflection conceptually and mathematically. 20.3.2 Solve mirror problems using ray diagrams. 20.3.3 Explain the derivation of the magnification and mirror equations. 20.3.4 Solve mirror problems using the magnification and mirror equations. 20.3.5 Create a mathematical model for astronomical albedo. 20.3.6 Assess the workability of the albedo model in describing reality. **BWS** Modeling (evaluate) 20.3.7 Formulate a position on using mirrors for geoengineering to reduce global warming. **BWS** Ethics (formulate)	**Teacher Edition** • Mini Lab: *Pinhole Camera* • Case Study: Astronomical Albedo • Section 20.3 Review • Ethics: Could Mirrors Stop Global Warming? (p. 553) **Assessments** • Section 20.3 Quiz **Materials** • large mirrors (plane, concave, and convex) • stencil of asymmetrical letter	**Teacher Tools Online** • PPT Presentation: Section 20.3 Slides • Web Link: Optics Bench • Instructional Aid: Albedo	Section 20.3 Review Section 20.3 Quiz
Lab 20C Closer Than They Appear—Investigating Curved Mirrors				
LM 247–54	Determine the focal length of a concave mirror. Describe the images formed by curved mirrors on the basis of object distance. Compare magnification values calculated on the basis of distances to those calculated on the basis of heights.			Lab Report
Ethics Day				
553	20.3.7 Formulate a position on using mirrors for geoengineering to reduce global warming. **BWS** Ethics (formulate)	**Teacher Edition** • Ethics: Could Mirrors Stop Global Warming? • Ethics Essay Rubric	**Teacher Tools Online** • Instructional Aids: Albedo, Ethics Essay Rubric	Ethics Essay

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Chapter 20 Review				
551–53	Describe the types and uses of light energy. Relate light sources to color. Solve real-world problems related to reflection. Evaluate the effect on illuminance when you change the distance from the source or the flux of the source. (Lab 20A) Explain why plane mirrors form the images they do. (Lab 20B) Evaluate the effect of object distance on the images formed by a curved mirror. (Lab 20C)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 20 Test				
	Demonstrate knowledge of concepts from Chapter 20 by taking the test.	**Assessments** • Chapter 20 Test	**Teacher Tools Online** • EV: Chapter 20 Bank	Chapter 20 Test

Chapter 21: Refraction (Foundational)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 21.1 Theory of Refraction				
555–64	21.1.1 Describe refraction qualitatively and mathematically. 21.1.2 Solve problems involving refraction. 21.1.3 Relate refraction to various phenomena. 21.1.4 Assess the workability of a model of the relationship between the index of refraction and mass density of glass. **BWS** Modeling (evaluate)	**Teacher Edition** • Section 21.1 Review **Assessments** • Section 21.1 Quiz **Materials** • beaker, 400 mL • drinking straw • water • prism	**Teacher Tools Online** • PPT Presentation: Section 21.1 Slides • Videos: Refraction, Critical Angle and Total Internal Reflection • Instructional Aid: Density	Section 21.1 Review Section 21.1 Quiz
Lab 21A All Bent Out of Shape—Investigating Refraction				
LM 255–63	Compare the measured index of refraction for water to its accepted value. Compare the critical angle of the water-air interface to its accepted value. Determine the index of refraction for glass. Compare the measured refractive index for glass to its accepted value.			Lab Report
Section 21.2 Application of Refraction				
566–78	21.2.1 Classify a lens on the basis of its shape. 21.2.2 Describe converging and diverging lenses qualitatively and mathematically. 21.2.3 Solve lens problems using ray diagrams or the lens equations.	**Teacher Edition** • Mini Lab: *Magnifying Glass* (p. 565) • Careers: Serving as an Optometrist • STEM Connection: Eyeglasses • Section 21.2 Review **Assessments** • Section 21.2 Quiz	**Teacher Tools Online** • PPT Presentation: Section 21.2 Slides • Videos: Lens Ray Diagrams, Eyeglasses • Web Link: Optics Bench	Section 21.2 Review Section 21.2 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Lab 21B Call the Ball—Investigating Thin Lenses				
LM 265–72	Describe the images formed by a converging lens. Determine the focal length of a converging lens. Compare the measured and calculated focal lengths. Compare the magnification values calculated from measured distances with those calculated from measured heights.			Lab Report
Chapter 21 Review				
579–81	Solve real-world problems related to optical refraction. Solve real-world problems related to lenses. Compare refractive materials on the basis of empirical data. (Lab 21A) Analyze the effect of object distance on the images formed by a lens. (Lab 21B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 21 Test				
	Demonstrate knowledge of concepts from Chapter 21 by taking the test.	**Assessments** • Chapter 21 Test	**Teacher Tools Online** • EV: Chapter 21 Bank	Chapter 21 Test

Chapter 22: Wave Optics (Enrichment)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 22.1 Wave Interference				
583–90	22.1.1 Describe wave interference. 22.1.2 Summarize Thomas Young's double- slit experiment. 22.1.3 Formulate a position on the nature of scientific knowledge on the basis of the double-slit experiment. **BWS** Foundations (formulate) 22.1.4 Solve interference problems.	**Teacher Edition** • Section 22.1 Review **Assessments** • Section 22.1 Quiz **Materials** • ripple tank • light source • long springs (2) • drinking glass • bubble solution	**Teacher Tools Online** • PPT Presentation: Section 22.1 Slides • Web Links: Wave Simulator, Acoustical Engineering	Section 22.1 Review Section 22.1 Quiz
Lab 22 In the Groove—Investigating Diffraction				
LM 273–79	Collect data for the interference pattern generated by reflected diffraction. Determine the distance between adjacent data tracks on a compact disc (CD). Compare the experimental and actual values for the CD track separation.			Lab Report
Section 22.2 Diffraction				
591–98	22.2.1 Describe diffraction. 22.2.2 Explain how diffraction can be used to solve problems. 22.2.3 Explain how diffraction limits our ability to observe distant objects. 22.2.4 Solve problems involving diffraction.	**Teacher Edition** • Section 22.2 Review • Careers: Serving as an Optical Tester • Mini Lab: *Optical Resolving Power of the Human Eye* (p. 599) • Optical Test Sheet **Assessments** • Section 22.2 Quiz **Materials** • ripple tank • light source • laser • razor blade • diffraction gratings (one per student)	**Teacher Tools Online** • PPT Presentation: Section 22.2 Slides • Web Links: Wave Simulator, Diffraction • Instructional Aid: Optical Test Sheet	Section 22.2 Review Section 22.2 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 22.3 Polarization of Light				
600–604	22.3.1 Describe polarization. 22.3.2 Solve polarization problems. 22.3.3 Explain methods of polarization.	**Teacher Edition** • Worldview Investigation: Busting Counterfeiters • *Busting Counterfeiters* Rubric • Section 22.3 Review **Assessments** • Section 22.3 Quiz **Materials** • polarizing film (one per student)	**Teacher Tools Online** • PPT Presentation: Section 22.3 Slides • Instructional Aid: Busting Counterfeiters Rubric	Busting Counterfeiters Presentation Section 22.3 Review Section 22.3 Quiz
Chapter 22 Review				
605–7	Explain the significance of the interference of light. Solve real-world problems related to diffraction. Relate methods of polarization with optical observations. Compare the experimental and actual values of the distance between data tracks on a DVD while using it as a diffraction grating. (Lab 22)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 22 Test				
	Demonstrate knowledge of concepts from Chapter 22 by taking the test.	**Assessments** • Chapter 22 Test	**Teacher Tools Online** • EV: Chapter 22 Bank	Chapter 22 Test

Chapter 23: Relativity (Enrichment)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 23.1 Galilean Relativity				
611–18	23.1.1 Relate frames of reference to relativity. 23.1.2 Transform coordinates from one Galilean frame of reference to another. 23.1.3 Explain how a failed experiment can be a success.	**Teacher Edition** • Section 23.1 Review • Mini Lab: *Accounting for Relativity* (p. 619) **Assessments** • Section 23.1 Quiz **Materials** • tennis ball • long piece of construction paper.	**Teacher Tools Online** • PPT Presentation: Section 23.1 Slides • Web Link: Relativity	Section 23.1 Review Section 23.1 Quiz
Section 23.2 Special Relativity				
620–36	23.2.1 Explain the assumptions of special relativity. 23.2.2 Describe how coordinates are transformed between relativistic frames of reference. 23.2.3 Make predictions on the basis of special relativity. 23.2.4 Describe applications of special relativity.	**Teacher Edition** • STEM Connection: Warp Drive • Section 23.2 Review **Assessments** • Section 23.2 Quiz	**Teacher Tools Online** • PPT Presentation: Section 23.2 Slides • Web Link: Special Relativity • Videos: Predictions of Special Relativity, Twins Paradox, Warp Drive	Section 23.2 Review Section 23.2 Quiz
Lab 23 Absolutely Relative—Investigating the Effects of Relativity				
LM 281–86	Determine the speed of light using a simulation of the Michaelson-Morley interferometer. Explain why two events are not viewed as simultaneous in frames of reference that are moving relative to each other. Explain why clocks in frames of reference that are moving relative to each other run at different rates. Explain why length must be contracted in the direction that an object is moving.		**Teacher Tools Online** • Web Links: Relativity Simulators, Light Clock	Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 23.3 General Relativity				
637–40	23.3.1 Describe the limitations of special relativity. 23.3.2 Relate gravity and acceleration within the model of general relativity. 23.3.3 Evaluate evidence for general relativity. 23.3.4 Describe black holes.	**Teacher Edition** • Case Study: Gravitational Red Shift • Section 23.3 Review **Assessments** • Section 23.3 Quiz **Materials** • large SPANDEX® sheet • chairs to make a large circle (slightly smaller than the SPANDEX sheet) • large binder clips (one per chair) • 500 g masses (2) • marbles	**Teacher Tools Online** • PPT Presentation: Section 23.3 Slides • Web Links: Gravity and Spacetime, Equivalence, Equivalence Experiment	Section 23.3 Review Section 23.3 Quiz
Chapter 23 Review				
641–43	Evaluate Galilean relativity as a model. Analyze special relativity as a model. Analyze general relativity as a model. Analyze relativistic effects using applets. (Lab 23)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 23 Test				
	Demonstrate knowledge of concepts from Chapter 23 by taking the test.	**Assessments** • Chapter 23 Test	**Teacher Tools Online** • EV: Chapter 23 Bank	Chapter 23 Test

Chapter 24: Quantum Physics (Enrichment)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 24.1 Quantum Theory				
645–52	24.1.1 Describe the properties of a blackbody radiator. 24.1.2 Summarize the historical development of the quantum theory by Max Planck. 24.1.3 Solve blackbody problems. 24.1.4 Relate the quantum theory of energy to the development of models. **BWS** Modeling (explain)	**Teacher Edition** • Mini Lab: *Approximating a Blackbody* • Section 24.1 Review **Assessments** • Section 24.1 Quiz	**Teacher Tools Online** • PPT Presentation: Section 24.1 Slides • Web Link: Photoelectric Effect	Section 24.1 Review Section 24.1 Quiz
Lab 24 Fill In the Planck—Determining the Planck Constant				
LM 287–93	Measure the wavelength of an LED by diffraction. Determine the threshold voltage of an LED. Analyze the relationship between the wavelength and the threshold voltage to determine the Planck constant using graphical analysis. Evaluate the experimental design by comparing the measured and accepted values of the Planck constant.			Lab Report
Section 24.2 Quantum Mechanics and the Atom				
652–61	24.2.1 Summarize the development of atomic theory. 24.2.2 Relate the planetary and Bohr models to quantum theory. 24.2.3 Describe how an electron can behave as both a particle and a wave conceptually and mathematically. 24.2.4 Summarize the ethics of quantum cryptography.	**Teacher Edition** • Worldview Investigation: Quantum Cryptography • *Quantum Cryptography* Rubric • Section 24.2 Review • Ethics: Information Security and Identity Theft (p. 669) **Assessments** • Section 24.2 Quiz	**Teacher Tools Online** • PPT Presentation: Section 24.2 Slides • Web Links: Atomic Models, Line Spectra • Instructional Aid: Quantum Cryptography Rubric	Quantum Cryptography Paper Section 24.2 Review Section 24.2 Quiz

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 24.3 Modern Atomic Models				
662–66	24.3.1 Describe the four quantum numbers used to uniquely identify electrons in an atom. 24.3.2 Identify the location of electrons in an element with quantum numbers. 24.3.3 Describe applications of quantum physics. 24.3.4 Evaluate the ethics of information security to prevent identity theft. **BWS** Ethics (evaluate)	**Teacher Edition** • Case Study: Lasers • Section 24.3 Review **Assessments** • Section 24.3 Quiz	**Teacher Tools Online** • PPT Presentation: Section 24.3 Slides • Web Link: Quantum Numbers	Section 24.3 Review Section 24.3 Quiz
Chapter 24 Review				
667–69	Analyze quantum theory as a model. Relate quantum theory to atomic theory. Analyze atomic theory as a model. Determine the Planck constant with the cutoff voltage of LEDs. (Lab 24)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 24 Test				
	Demonstrate knowledge of concepts from Chapter 24 by taking the test.	**Assessments** • Chapter 24 Test	**Teacher Tools Online** • EV: Chapter 24 Bank	Chapter 24 Test
Ethics Day				
669	24.3.4 Evaluate the ethics of information security to prevent identity theft. **BWS** Ethics (evaluate)	**Teacher Edition** • Ethics: Information Security and Identity Theft • Ethics Essay Rubric	**Teacher Tools Online** • Instructional Aid: Ethics Essay Rubric	Ethics Essay

Chapter 25: Nuclear Physics (Enrichment)

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 25.1 The Nucleus				
671–76	25.1.1 Describe the nucleus. 25.1.2 Explain how atoms of the same element can have different mass numbers. 25.1.3 Explain what determines the stability of a nucleus. 25.1.4 Relate the stability of the nucleus to the mass defect and binding energy.	**Teacher Edition** • Section 25.1 Review **Assessments** • Section 25.1 Quiz	**Teacher Tools Online** • PPT presentation: Section 25.1 Slides	Section 25.1 Review Section 25.1 Quiz
Section 25.2 Radiation and Radioactivity				
676–88	25.2.1 Explain what radiation is. 25.2.2 Describe the kinds of nuclear radiation. 25.2.3 Describe half-life. 25.2.4 Explain how radiometric dating works. 25.2.5 Analyze the problems and uses of radiometric dating. **BWS** Foundations (evaluate) 25.2.6 Create a model to determine the historical ages of archaeological artifacts.	**Teacher Edition** • Mini Lab: *Predicting the Flip of a Coin* • Case Study: Geochronology • Section 25.2 Review **Assessments** • Section 25.2 Quiz **Materials** • coins (one for each student) • beaker, 250 mL • mortar and pestle • vitamin B2 tablet • stirring rod • filter paper • filter funnel • UVA light source	**Teacher Tools Online** • PPT Presentation: Section 25.2 Slides • Web Links: Alpha Decay, Radioactive Dating Game, Nuclear Decay, Fluctuating Decay Rates, Decay Rates and Solar Flares	Section 25.2 Review Section 25.2 Quiz
Lab 25A Halftime Show—Simulation of Radioactive Decay				
LM 295–301	Compare radioactivity and radiation. Simulate the radioactive decay of a hypothetical nuclide. Analyze simulated radioactive decay data using graphical analysis.			Lab Report

Pages	Objectives	Printed Resources & Materials	Digital Resources	Assessments
Section 25.3 Nuclear Reactions				
689–96	25.3.1 Describe nuclear fission and fusion. 25.3.2 Predict whether a particular nuclide will undergo fission or fusion. 25.3.3 Calculate the energy released in a nuclear reaction. 25.3.4 Describe the design and function of nuclear reactors and nuclear weapons. 25.3.5 Formulate a position on a good use of radioactivity. **BWS** Ethics (formulate)	**Teacher Edition** • Worldview Investigation: Good Radiation • *Good Radiation* Rubric • Section 25.3 Review **Assessments** • Section 25.3 Quiz **Materials** • dominoes (31)	**Teacher Tools Online** • PPT Presentation: Section 25.3 Slides • Web Links: Nuclear Energy, Fission and Fusion, Nuclear Reactor • Instructional Aid: Good Radiation Rubric	Section 25.3 Review Section 25.3 Quiz Good Radiation Display
Section 25.4 Subatomic Particles				
697–701	25.4.1 Relate subatomic, elementary, and composite particles. 25.4.2 Explain how subatomic particles are classified. 25.4.3 Explain how quarks can combine to form charged protons and neutral neutrons.	**Teacher Edition** • Careers: Serving as a Particle Physicist • Section 25.4 Review **Assessments** • Section 25.4 Quiz	**Teacher Tools Online** • PPT Presentation: Section 25.4 Slides • Web Link: Particle Accelerator	Section 25.4 Review Section 25.4 Quiz
Lab 25B Elementary, My Dear—Investigating Subatomic Particles				
LM 303–15	Analyze a variety of elementary and composite subatomic particles using graphical and mathematical techniques. Demonstrate that conservation laws are still valid at the subatomic level.			Lab Report
Chapter 25 Review				
702–5	Compare the forms of radiation. Evaluate the uses of radiometric dating. Compare fission and fusion reactions. Compare subatomic particles. Analyze radioactive decay using simulations and data. (Lab 25A) Identify subatomic particles using particle accelerator data. (Lab 25B)	**Teacher Edition** • Chapter Review Solutions		Chapter Review
Chapter 25 Test				
	Demonstrate knowledge of concepts from Chapter 25 by taking the test.	**Assessments** • Chapter 25 Test	**Teacher Tools Online** • EV: Chapter 25 Bank	Chapter 25 Test