bju press

SECONDARY SUBJECT OVERVIEW

Science

Contents

2 Our Vision

3 Program Approach

4 Extending Scientific Knowledge & Skills

5 Applying Scientific Knowledge & Skills

6 Enabling Students to Use & Create Models

7 Equipping Students to Interpret Informational Text & Apply Knowledge

8 Materials

10 The Features

10 Teacher Edition

11 Student Edition

12 Teacher Lab Manual

13 Student Lab Manual

14 Technology Resources

14 BJU Press Trove®

15 AfterSchoolHelp

OUR VISION

To equip students to ethically engage in scientific inquiry, data analysis, and model-making so they will be able to solve real-world problems within the framework of a biblical worldview.

GOALS

- To extend scientific knowledge and laboratory skills
- To guide students in applying scientific knowledge and skills in ethical ways to solve real-world problems, using activities that include collaborative STEM experiences
- To enable students to create models that describe the natural world and use them to make predictions
- To equip students with the skills to interpret informational text and apply scientific knowledge in accordance with biblical teaching
- To equip students to ethically engage in scientific inquiry, data analysis, and model-making so they will be able to solve real-world problems within the framework of a biblical worldview

PROGRAM APPROACH

The BJU Press middle and high school science program uses a lab-based approach to equip students to ethically engage in the work of science. Our program teaches science content from an ethical perspective based on a biblical worldview and explores what science can do through strategic modeling in inquiry labs and collaborative STEM experiences. We then direct students to use their critical-thinking and problem-solving skills to develop workable models that will help them to find appropriate solutions.

To that end, each chapter includes opportunities for extended study that will challenge students to harness and develop their scientific understanding and laboratory skills to serve God and others. They will complete case studies, evaluate existing scientific models, and follow webquests that will require them to collect and analyze data. Ultimately, we want to equip teachers so that they can prepare a generation of student scientists who can use 21st century skills to solve real-world problems within the framework of a biblical worldview and who live in a way that's biblically faithful.

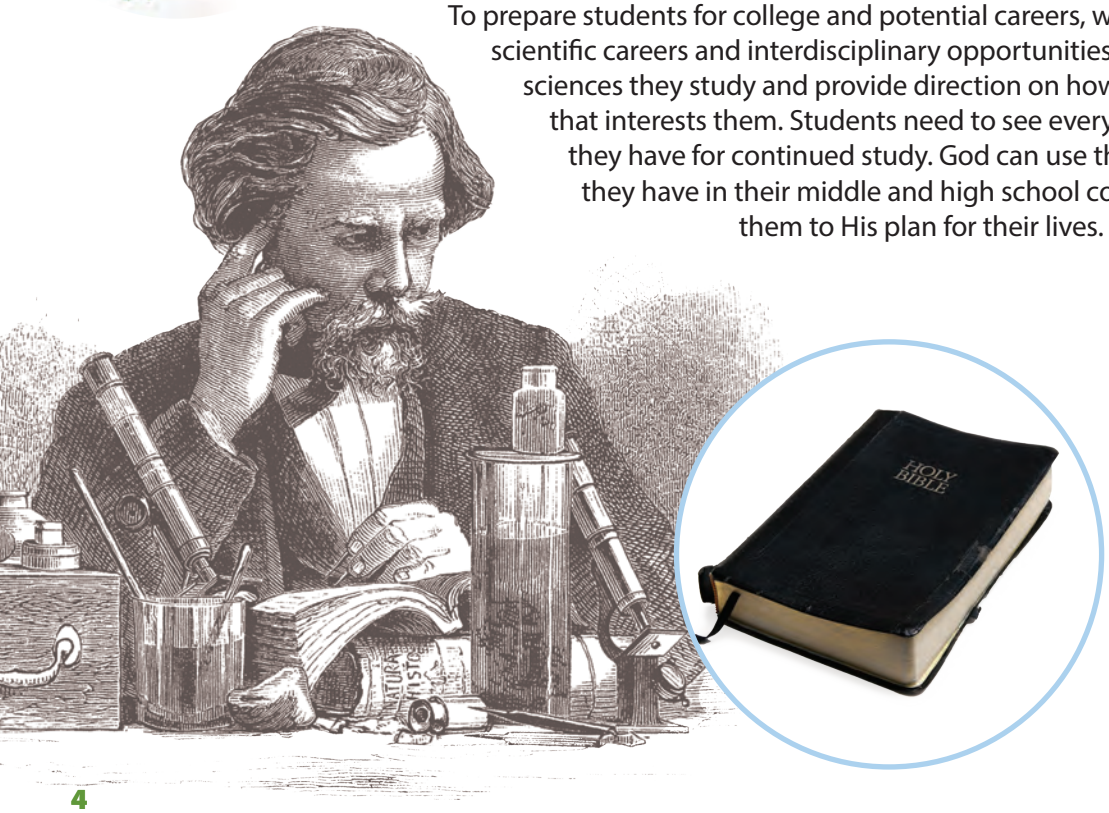
Extending Scientific Knowledge & Skills

Students will be able to develop solutions to real-world problems only with a thorough understanding and knowledge of the sciences, scientific principles, and laboratory skills. Most middle and high school students will have had introductions to the sciences and valuable laboratory skills, but future science study will be more enjoyable and comprehensible if students continue to expand their understanding in each successive secondary science course.

BJU Press begins each middle and high school science course with an overview of the work of science and foundational biblical themes that should shape a Christian's understanding of the major issues in that field. Students will also regularly review the three-element foundation of Christian ethics: biblical principles, biblical outcomes, and biblical motivations.

In addition to supporting the students' worldview shaping, we also support their continued learning development. Our standards-based student textbooks use age-appropriate language to support learning and retention and include stunning visuals to illustrate concepts. Thoughtfully crafted chapter objectives and essential questions help students to look for key information as they read, and chapter reviews give easy-to-use bulleted reviews for each chapter.

To prepare students for college and potential careers, we highlight scientific careers and interdisciplinary opportunities related to the sciences they study and provide direction on how to pursue a field that interests them. Students need to see every opportunity they have for continued study. God can use the experiences they have in their middle and high school courses to lead them to His plan for their lives.



Applying Scientific Knowledge & Skills

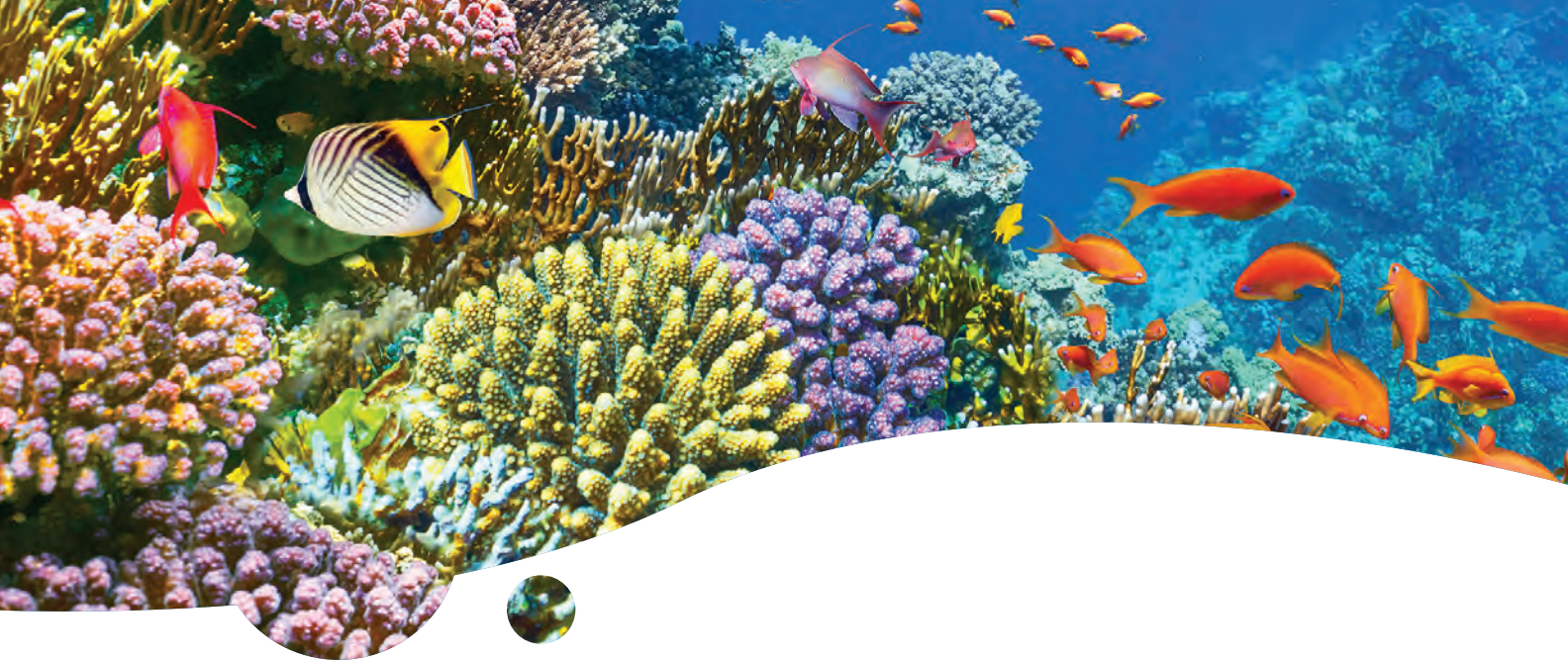
Knowledge often means very little without experience. Lab activities provide a vital opportunity for students to get hands-on application of the skills they're learning in class. In a broader sense, students gain the critical-thinking skills they need to ask better questions and create strong hypotheses by completing lab activities.

BJU Press secondary science lab manuals are designed to help guide students through hands-on activities that build critical-thinking skills and refine students' observational skills and their capacity to follow directions. Consistent lab work gives students an opportunity to develop and mature their way of thinking. Beyond critical thinking, each lab is also designed to accomplish specific science content learning objectives.

Mini labs within the student edition and guided discovery labs in the lab manuals of BJU Press materials give students abundant opportunities for application and for practice with technology, including probeware technology. By offering inquiry and STEM activities, we give students even more opportunities to learn and apply the skills from the classroom.

These activities give students ownership over the creative process, whether in groups or individually. Inquiry labs require students to use the scientific process and ask questions, form hypotheses, design investigations, analyze data, draw conclusions, communicate results, and often, ask additional questions. These activities foster curiosity and require students to think more critically than they would with traditional activities that spell out procedures and goals for them.

In addition, STEM activities require students to apply the engineering design process and use scientific inquiry, mathematical reasoning, and technology. To be successful in these activities, students must also develop 21st century skills, including collaboration, problem-solving, and communication. They learn what works, not just in the scientific process, but also with other people. BJU Press lab manual STEM activities present opportunities for students to refine their methods so that they discover more effective solutions and learn that many problems have more than one solution.



Enabling Students to Use & Create Models

Throughout the BJU Press science program, we show students how scientists use models to explain, describe, and represent the world more accurately. Models allow scientists to test their theories and apply predictions, especially when they're working with forces and structures that are too large or too small to be observed or that no longer exist today.

For example, the double-helix model of DNA brought biology to the field of molecular genetics. The heliocentric model of the solar system more accurately answered the questions proposed by observations of the night sky. We explain how historical documents, eggs, and bones help us to create models and study the behavior and habitats of extinct species such as the elephant bird or dinosaurs.

When scientists proposed these models, they didn't have the resources or capabilities to prove their theories. They created their models to accurately describe the natural world and then made predictions based on their models. As we know, scientists have had to adjust existing models to accommodate new information and observations, like the heliocentric model.

We teach students about models to show that science is not a progression toward greater truth. It's a quest for more workable models.

To equip students to create and use predictive models of the natural world, student lab manuals in BJU Press's secondary science program include technology-based modeling tools.

Students will use graphing technology to create mathematical models and scatterplots in spreadsheet activities. Other activities use internet modeling tools to create models of molecules and atoms. Teachers can also choose activities that require students to use apps on their devices to create animated models and explore the spread and severity of viruses. They will then use the models they create to link presentations and phenomena.

Equipping Students to Interpret Informational Text & Apply Knowledge

One of the biggest challenges for secondary science students can be interacting with rich informational texts. Science-related informational texts use discipline-specific vocabulary and technical scientific diagrams.

A prepared student can interpret scientific studies, engage with the information, evaluate it from a biblical worldview, and answer ethical questions presented in a study.

To properly prepare and equip students, we fill our textbooks with opportunities to engage with informational texts on a high level. Not only are the textbooks themselves informational texts, but the additional recommended ethics boxes and webquests will challenge students to find more informational texts to read and learn from.

Our textbooks introduce students to the vocabulary they will need, and present scientific diagrams that give students an opportunity to practice visual-analysis skills.

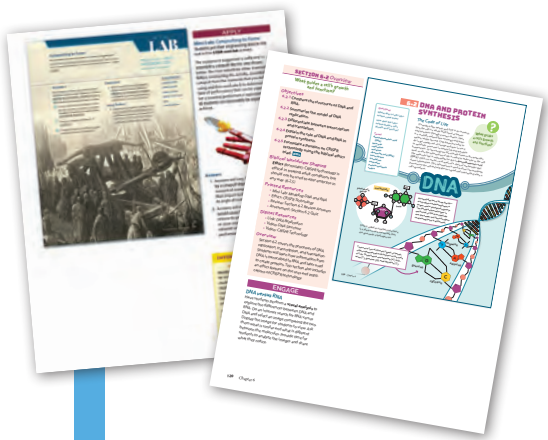
In assigned ethics boxes and webquests, students get to further develop and apply their informational-text reading skills to real-world situations, and then they will write responses to what they have learned.

MATERIALS

Below are the standard science materials provided for each secondary grade. Some grades may include additional pieces. For a comprehensive list, go to **bjupress.com/middle-high-school-science**. To request a no-cost exam kit, visit **bjupress.com/exam** or contact your Precept sales representative at **preceptmarketing.com/rep**.

Student Edition

Each Student Edition introduces students to a scientific field with a solid biblical worldview foundation and a focus on real-world applications. Students will explore discipline-specific terminology and existing models for each field as well as ethical issues presented. Extensive full-color and scientifically accurate illustrations, charts, and diagrams will help students to develop a visual understanding of the concepts they study. Case studies, worldview sleuthing activities, mini-labs, ethics boxes, and questions help students to think like scientists and view each scientific field from a biblical perspective.



Teacher Edition

The Teacher Edition for each grade offers research-based strategies, teaching notes, and suggested activities to give teachers options for daily lessons. The strategies focus on explaining concepts to students by moving from concrete to abstract and by linking scientific concepts and processes with prior learning. Each Teacher Edition features a suggested teaching schedule, full-color reduced student pages, icon-coded items like weblinks and demonstrations, complete answers to review questions, background information to enhance classroom instruction, and a full year lesson plan overview. Teachers will also find active learning opportunities, inquiry activities, group discussions, formative assessments, and intriguing chapter openers to add depth and variety to their daily teaching plan.

Student Activities & Lab Manuals

Each Student Activities or Lab Manual gives students opportunities to develop laboratory skills and apply what they have learned in real-world situations. Students will solidify their understanding of concepts by connecting the content with real-world problems. Discovery labs give guidance for exploring God's world; inquiry labs require students to use the scientific process to create their own activity; and STEM activities develop key science, engineering, and problem-solving skills through observing, recording, and analyzing samples and data to make models. Students then test those models to understand their workability.

Teacher Lab Manual/ Activities Answer Key

The Teacher Lab Manual and Activities Answer Key contain full-color, reduced-size lab manual pages with answers as well as additional instructions on preparation and the safe execution of lab exercises.

Assessments

The assessment packets provide summative assessment opportunities to measure students' knowledge and understanding of key concepts. The tests and quizzes include opportunities for students to infer information from images, and they assess students' recall and higher-order thinking skills. An Assessments Answer Key is available for each grade.

eTexts of student and teacher materials, along with resources referenced in the Teacher Edition, are available in BJU Press Trove.

THE FEATURES *Page Examples*

Section 8.3 Overview

How can someone who exercises and eats well be unhealthy?

Objectives

8.3.1 **Summarize the types of pathogens that cause disease.**

8.3.2 **Examine the causes and symptoms of communicable (infectious) and noncommunicable (noninfectious) diseases.** BWS

8.3.3 **Propose strategies to prevent communicable (infectious) and noncommunicable (noninfectious) diseases.** BWS

Biblical Worldview Shaping

- **Identity** (explain): Disease affects all people to some degree and shapes the way people perceive themselves and others. (8.3.2)
- **Identity** (apply): In keeping with Christ's compassionate, healing ministry, preventing diseases and showing love to those who hav… strate a proper valuati… person. (8.3.3)

Printed Resources

- Hands-On Health: *Am…*
- Review: Section 8.3 Re…

Digital Resource

- Link: *Cholera Epidemic of 1854*

ENGAGE

Use the **link** *Cholera Epidemic of 1854* to access a video with a brief explanation of how John Snow traced the source of the epidemic and ended it.

INSTRUCT

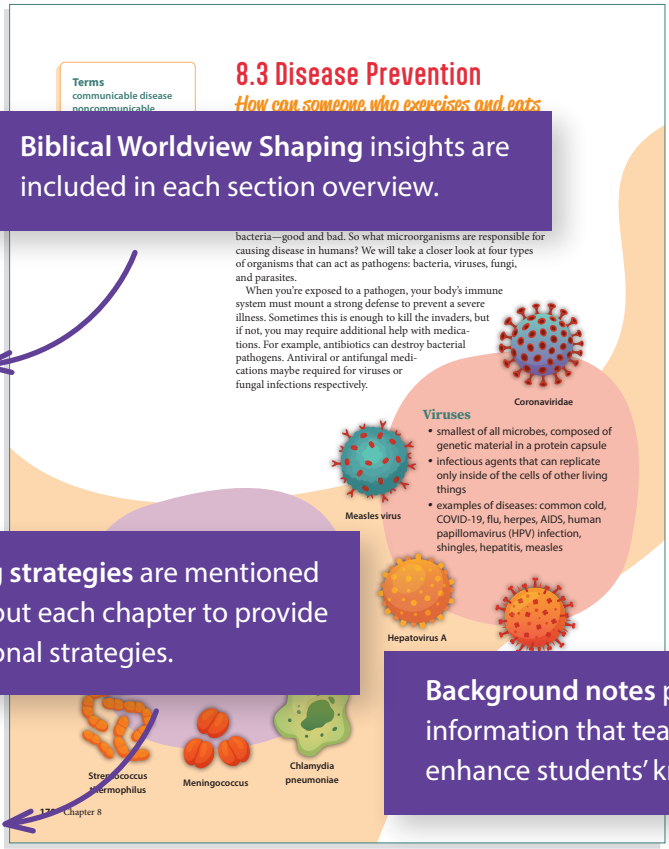
Pathogens

Have students create a **graphic organizer** to summarize the information in the infographic.

DIFFERENTIATED INSTRUCTION

John Snow and the Cholera Epidemic of 1854

Advanced students may find it interesting to do more **research** on John Snow's methods of tracing the source of the cholera epidemic, how the disease was spread, and how he stopped the spread. Allow students to present their findings to the rest of the class.



Terms
communicable disease
noncommunicable

8.3 Disease Prevention

How can someone who exercises and eats

bacteria—good and bad. So what microorganisms are responsible for causing disease in humans? We will take a closer look at four types of organisms that can act as pathogens: bacteria, viruses, fungi, and parasites.

When you're exposed to a pathogen, your body's immune system must mount a strong defense to prevent a severe illness. Sometimes this is enough to kill the invaders, but if not, you may require additional help with medications. For example, antibiotics can destroy bacterial pathogens. Antiviral or antifungal medications maybe required for viruses or fungal infections respectively.

Coronaviridae

Viruses

- smallest of all microbes, composed of genetic material in a protein capsule
- infectious agents that can replicate only inside of the cells of other living things
- examples of diseases: common cold, COVID-19, flu, herpes, AIDS, human papillomavirus (HPV) infection, shingles, hepatitis, measles

Measles virus

Hepatovirus A

Meningococcus

Chlamydia pneumoniae

170 Chapter 8

Hepatitis

Hepatitis A is an acute illness from which most people recover completely. Hepatitis B can be acute or chronic, but it is acute in most cases. Most people recover from it completely, but a few people may develop long-term liver damage. Hepatitis C can be acute, but it is chronic for most people who contract it and leads to cirrhosis or liver cancer.

Good Bacteria vs. Antibiotics

When a person takes a strong antibiotic, the good bacteria in the body are killed along with the pathogenic bacteria the medicine is targeting. When this happens, certain fungi can grow without the good bacteria there to stop them. Thrush, a fungal yeast infection in the mouth, can occur after taking a course of antibiotics. Many people will take probiotic supplements to increase the number of healthy bacteria in their system after finishing a course of antibiotics.

170 Chapter 8

Biblical Worldview Shaping insights are included in each section overview.

Teaching strategies are mentioned throughout each chapter to provide instructional strategies.

Background notes provide extra information that teachers can use to enhance students' knowledge.

Differentiated Instruction boxes help teachers make every student successful.

Health TE, 2nd Ed.

TEACHER EDITION

Healing Poisons

Socrates put the cup to his lips, knowing that the poison hemlock that it contained would bring him certain death. Accused of corr… recognizing the Greek gods, h… rather than exile. But how cou… plant bring on death with just…

The odd thing is that the Greeks used this same poison as medicine to relieve nagging coughs, arthritis, and …in babies! We still use …t ails us. Snake, spider, and …sonous plants contain amazing …cardiac arrest, and stroke.

An **Essential Question** presents what the section will discuss.

2.1 MATTER, ENERGY, AND LIFE

Matter

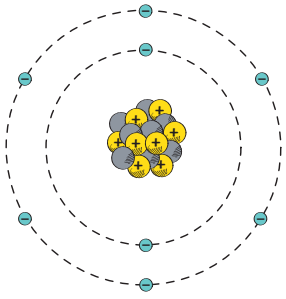
So what is the d… are both chemical… One of the most f… cals from living things, like the poison from the hemlock, to develop medications that can save and improve people's lives. And lives matter because we are made in God's image.

Living things are deeply affected by matter and the changes that it undergoes. The study of matter and the changes that it experiences is called *chemistry*. **Matter** is anything that takes up space and has mass. We are made of matter and are breathing, using, and eating matter all the time! But we aren't the only ones. All living things—bees, banana trees, chimpanzees—interact with chemicals this way. There is a vital relationship between life and matter.

Atoms are the basic building blocks of matter. They are the smallest possible particles of an element. They have a nucleus that is heavy but extremely tiny compared to the rest of the atom. It is in the nucleus …s and neutral *neutrons* are found. Whizzing around the nucleus is a cloud of negatively charged *electrons* that seem to occupy different levels, like th… around the s… outermost le… *electrons*, and… for interacti…

An atom w… bers of electr… electrically neutral. If these numbers are different, then the atom has an electrical charge, making it an *ion*. Extra electrons produce a negative ion, or *anion*. When there are fewer electrons than protons, the result is a *cation*, which has a net positive charge.

…8 electrons. There are 6 valence electrons in the outer level.



Bolded terms are terms that a student needs to know.

Italicized terms are other important terms for the student to be aware of.

What is the difference between medicine and poison?

Questions

What is matter, and what is it made of?

What is energy, and how do living things get it?

What is the difference between a physical and a chemical change?

Which kinds of chemical compounds are involved in living things?

Terms

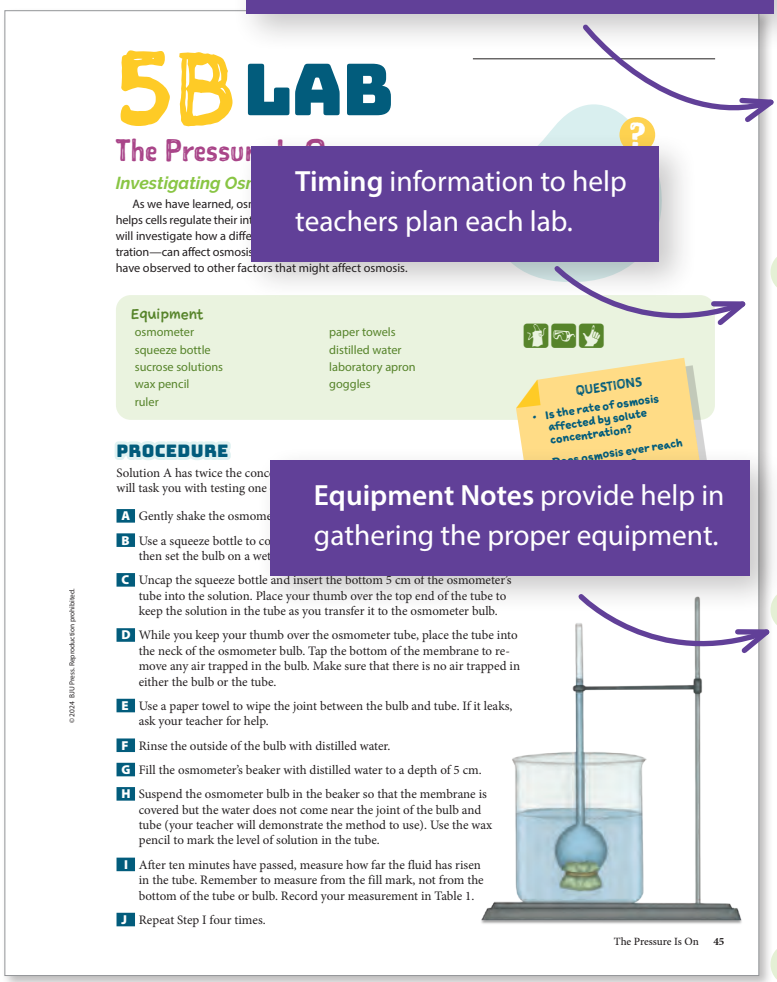
matter
atom
element

Key Questions are smaller questions for students to ask as they read each section to help them answer the Essential Question.

A list of **Objectives** starts each lab.

Timing information to help teachers plan each lab.

Equipment Notes provide help in gathering the proper equipment.



5B LAB

The Pressu… Is On

Investigating Osr…

As we have learned, osr… helps cells regulate their int… will investigate how a diffe… tration—can affect osmosis… have observed to other factors that might affect osmosis.

Equipment

osmometer
squeeze bottle
sucrose solutions
wax pencil
ruler
paper towels
distilled water
laboratory apron
goggles

QUESTIONS
- Is the rate of osmosis affected by solute concentration?
- Does osmosis ever reach …

PROCEDURE

Solution A has twice the conc… will task you with testing one …

A Gently shake the osmome…

B Use a squeeze bottle to co… then set the bulb on a wet …

C Uncap the squeeze bottle and insert the bottom 5 cm of the osmometer's tube into the solution. Place your thumb over the top end of the tube to keep the solution in the tube as you transfer it to the osmometer bulb.

D While you keep your thumb over the osmometer tube, place the tube into the neck of the osmometer bulb. Tap the bottom of the membrane to remove any air trapped in the bulb. Make sure that there is no air trapped in either the bulb or the tube.

E Use a paper towel to wipe the joint between the bulb and tube. If it leaks, ask your teacher for help.

F Rinse the outside of the bulb with distilled water.

G Fill the osmometer's beaker with distilled water to a depth of 5 cm.

H Suspend the osmometer bulb in the beaker so that the membrane is covered but the water does not come near the joint of the bulb and tube (your teacher will demonstrate the method to use). Use the wax pencil to mark the level of solution in the tube.

I After ten minutes have passed, measure how far the fluid has risen in the tube. Remember to measure from the fill mark, not from the bottom of the tube or bulb. Record your measurement in Table 1.

J Repeat Step I four times.

The Pressure Is On 45

LAB 5B OBJECTIVES

- Explain the effect of solute concentration on osmosis.
- Identify whether an osmotic system has reached equilibrium.
- Make predictions about how other factors may affect osmosis.

Timing

As you can see, the time needed for this lab activity is significant. The differences between the two sucrose solutions should be apparent as early as twenty minutes into the procedure but will become more pronounced with additional time. You can save time by demonstrating the procedure to students ahead of lab day and having them practice the setup with plain water.

Alternatively, this activity can be done as a class demonstration and the sample data provided to students for analysis.

Equipment Notes

The osmometer described in this activity includes a tube and bulb, collectively referred to as a *thistle tube*, and a 250 mL beaker. Thistle tubes and membranes can be purchased from science equipment suppliers.

The solutions are approximately 1 molal (Solution A) and 0.5 molal (Solution B). They can be made using the formulas below.

Solution A: 25.0 g of sucrose (table sugar) in 75.0 mL of distilled water

Solution B: 15.0 g of sucrose in 85.0 mL of distilled water

Joining the Tube to the Bulb (Step D)

One way to help reduce the likelihood of air being trapped in the osmometer when its parts are joined is to release your thumb from the tube right as the tube is inserted into the bulb. The liquid flowing out of the tube and momentarily overflowing the bulb will prevent any air from entering through the joint.

The **Essential Question** defines the main lab objective.

5B LAB

The Pressure Is On

Investigating Osmosis

As we have learned, osmosis is a form of passive transport that ir internal environment. In this activity you difference in one factor—solute concen- osis. Afterward, you will extend what you r factors that might affect osmosis.

How do different solute concentrations affect osmosis?

Equipment list & safety icons help students prepare for the lab.

Equipment

- osmometer
- squeeze bottle
- sucrose solutions
- wax pencil
- ruler
- paper towels
- distilled water
- laboratory apron
- goggles

QUESTIONS

- Is the rate of osmosis affected by solute concentration?
- Does osmosis ever reach an equilibrium?
- Can I predict an effect on osmosis on the basis of solute particle size?

Key Questions define secondary lab objectives.

PROCEDURE

Solution A has twice the concentration of sucrose as Solution B. Your teacher will task you with testing one of the two solutions.

Procedure notes guide students through conducting lab experiments and applying thinking skills.

A Gently shake the osmometer bulb to remove all water.

B Use a squeeze bottle to completely fill the bulb with the then set the bulb on a wet paper towel.

C Uncap the squeeze bottle and insert the bottom 5 cm o tube into the solution. Place your thumb over the top e keep the solution in the tube as you transfer it to the os

over the osmometer tube, place the tube into ulb. Tap the bottom of the membrane to re- bulb. Make sure that there is no air trapped in

e joint between the bulb and tube. If it leaks,

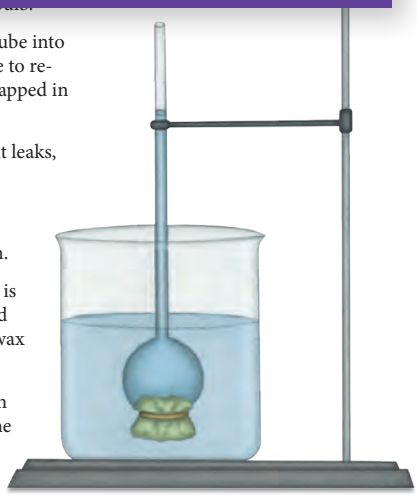
F Rinse the outside of the bulb with distilled water.

G Fill the osmometer's beaker with distilled water to a depth of 5 cm.

H Suspend the osmometer bulb in the beaker so that the membrane is covered but the water does not come near the joint of the bulb and tube (your teacher will demonstrate the method to use). Use the wax pencil to mark the level of solution in the tube.

I After ten minutes have passed, measure how far the fluid has risen in the tube. Remember to measure from the fill mark, not from the bottom of the tube or bulb. Record your measurement in Table 1.

J Repeat Step I four times.



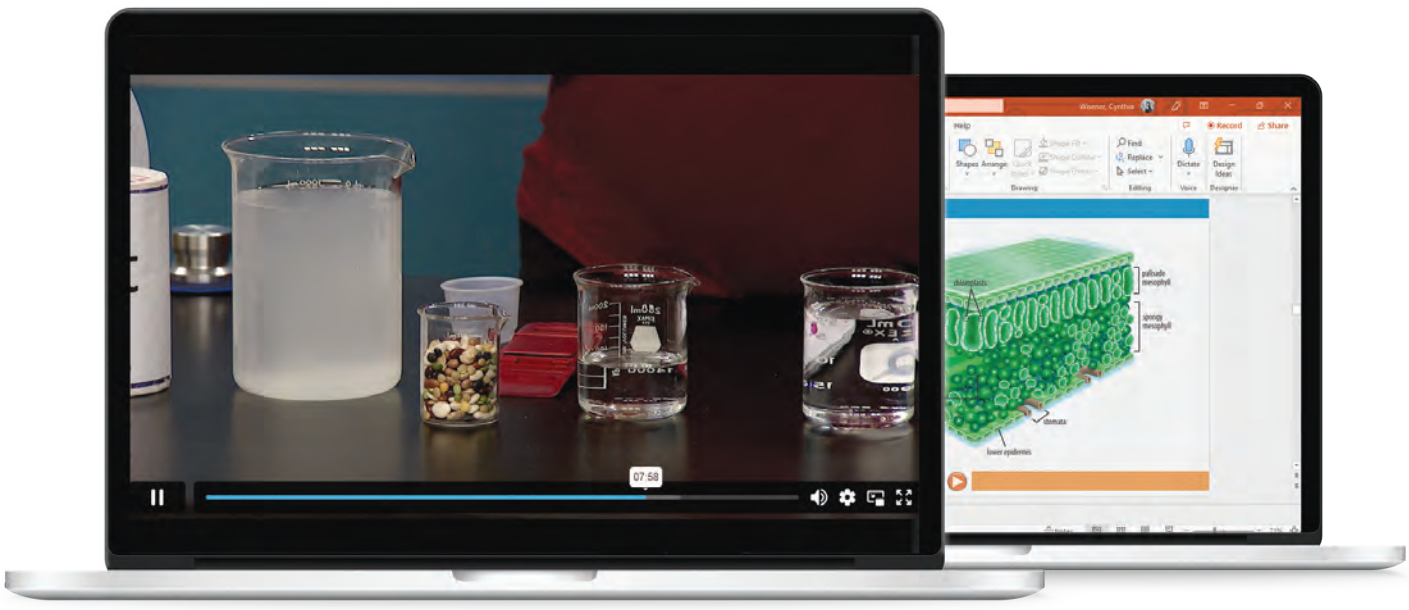
TECHNOLOGY RESOURCES

BJU Press Trove®

bjupress.com/technology/trove

Broaden your students' science skills with extra resources that aid in planning and presenting concepts to your students in an engaging way.

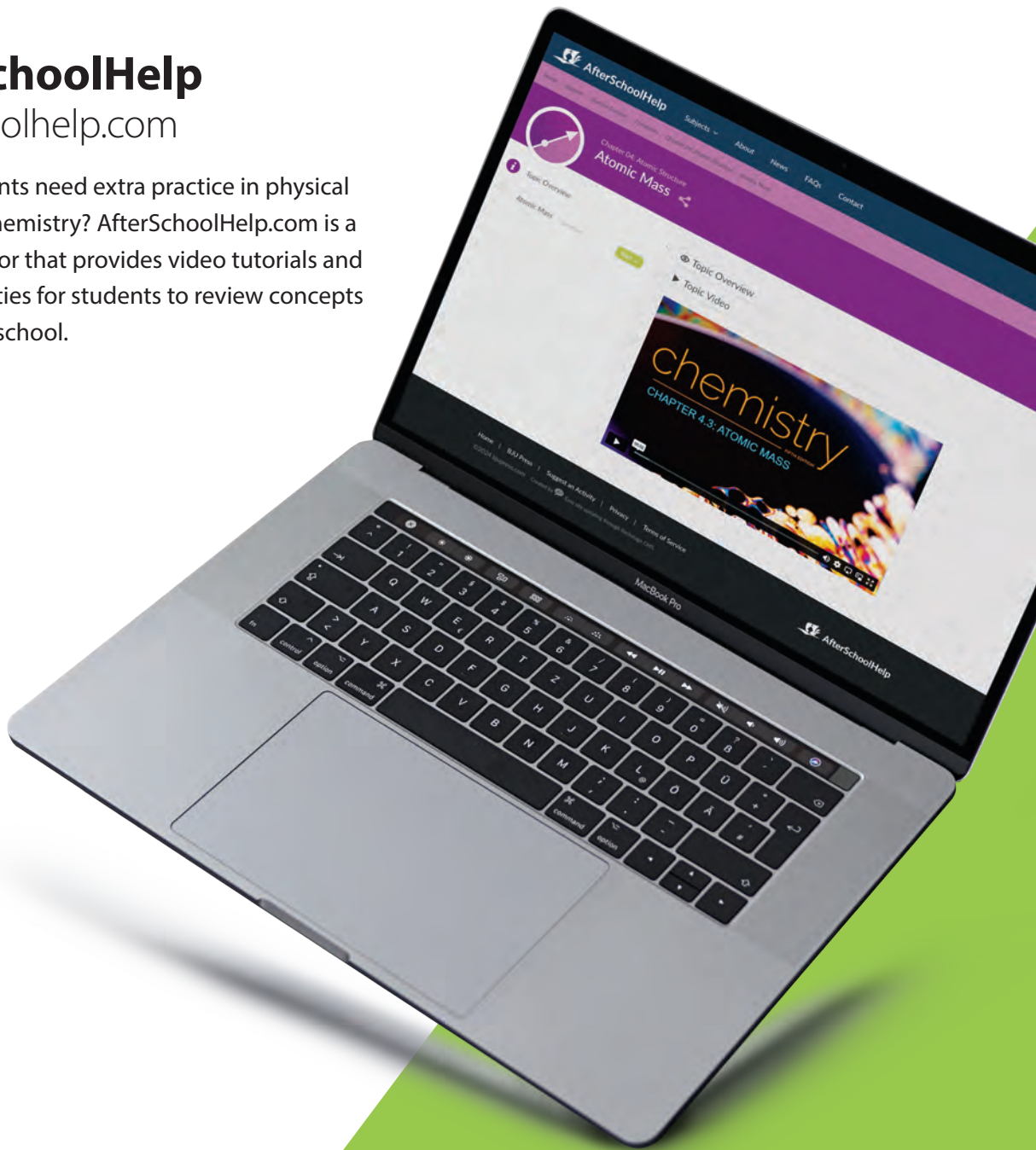
- Short videos introduce new skills and concepts. These videos explain concepts visually for a differentiated explanation.
- Editable Microsoft PowerPoint presentations give you support for your instruction, including informative visuals that make demonstrating, displaying, and explaining scientific principles and concepts easier.
- Project and interact with digital copies of the student and teacher editions.
- The Trove assessment builder includes test banks, allowing you to create customized quizzes and tests. You can edit questions and answers and easily create multiple versions of tests to encourage integrity.



AfterSchoolHelp

afterschoolhelp.com

Do your students need extra practice in physical science and chemistry? AfterSchoolHelp.com is a free digital tutor that provides video tutorials and practice activities for students to review concepts at home or at school.



Middle and high school science materials are available for grades 6–12. For more information, contact your Precept sales representative at **preceptmarketing.com/rep** or visit **bjupress.com**.

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