BIOZONE

CLASSROOM GUIDE

BIOLOGY

FOR TEXAS

Contents

CLASSROOM GUIDE

First Edition 2024

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BIOZONE

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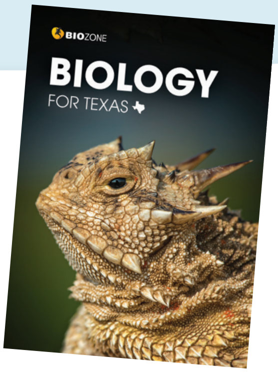
FAQs ABOUT BIOLOGY FOR TEXAS



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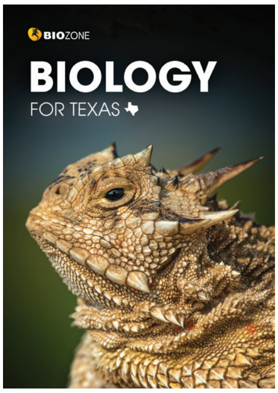
About Biology for Texas



Biology for Texas has been written for the **Texas Essential Knowledge and Skills** (TEKS) for Science (High School Biology) specified in **Proclamation 2024**. *Biology for Texas* is a well-rounded resource, combining the program's required elements with BIOZONE's trademark rigorous and highly visual approach. The nature of science, scientific inquiry and science and ethical components of the program are integral within the activities.

This *Biology for Texas* worktext combines the very best features of a textbook with the utility of a workbook. Students have textbook quality information delivered in an accessible and engaging way. Encouraging students to interact with the material and input their answers directly on to the page means that students form a record of work as they progress through the material. Revision is a breeze because the stimulus material and answers are in one place. Lastly, the wide variety of activity types in *Biology for Texas* allows teachers flexibility in how they assign activities, e.g. homework, revision, or group activity. This flexible approach has been designed to enable teachers to teach how they want, while still being assured the content, TEKS, and ELPS are covered.

This Classroom Guide has been designed to help teachers fully understand the features of *Biology for Texas* and provides some suggestions for how the worktext and associated resources can be used within a differentiated classroom. The information below provides an overview of the features of the worktext. More details on these (and other features) can be found throughout this Classroom Guide.

The TEKS form the foundation for the worktext structure. Chapters 1-9 align to the Science Content Knowledge and Skills Statements. The Scientific and Engineering Practices TEKS are carefully and purposefully integrated throughout the content chapters, and are also supported in a dedicated science practices chapter (chapter 10). TEKS are clearly identifiable to both students and teachers (CG12) via a simple coding system within the Student Edition (CG15). For teachers, additional coding within the Teacher's Edition identifies specific breakouts, allowing teachers to plan to a more granulated level if they wish to do so (CG46).

English Language Proficiency Standards (ELPS) have been integrated in context throughout the worktext. These are clearly visible to both teachers and students through a simple icon coding system (see (CG46). Identification of the proficiency level addressed in each instance is also provided.

We have included a wide range of practical investigations within *Biology for Texas.* Practical investigations help teachers meet the required practical component of the program and also provide students with an opportunity to carry out hands-on science exploration, enhancing collaboration, CG20.

Assessment tasks conclude chapters 1-9. These provide an opportunity for teachers to assess student understanding of a topic. See CG21-CG22.

The Teacher Toolkit

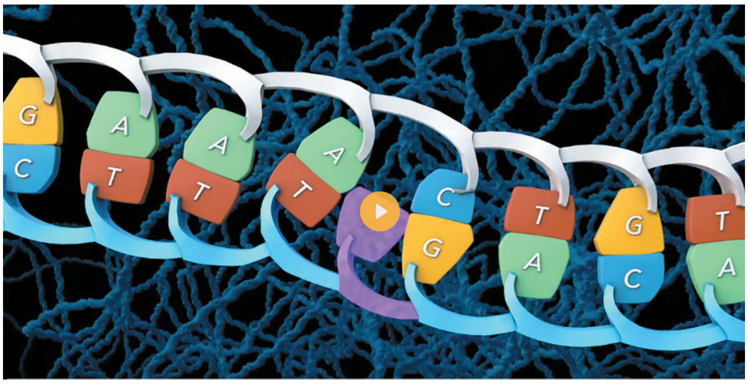
BIOZONE's Teacher Toolkit is a suite of resources specifically developed to help plan and deliver an engaging biology program. Additional assessment tools are provided, allowing teachers to easily assess student understanding of the content. A brief description of the tools is provided below and in the following pages.

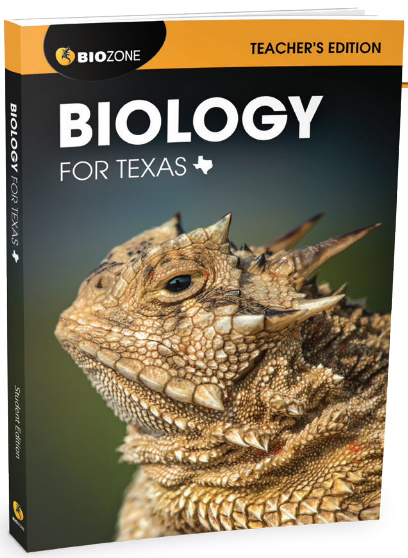
BIOZONE WORLD

BIOZONE WORLD, our new digital science platform, brings our digital worktexts and rich collection of digital resources together in a single place. Utilize BIOZONE's digital worktexts, presentation slides, 3D models, and curated videos to deliver engaging and robust science programs. Educators can easily plan lessons, assign work, and grade student responses using BIOZONE WORLD.

- Students' access to BIOZONE WORLD allows them to use tools to markup, highlight, and bookmark content. They can also answer questions online, to form a record of work, and they can submit the work for grading. Students have access to the curated collection of digital resources (e.g. presentation slides, 3D models, and curated videos).
- Teacher access to the online version of the book has significant teacher-only additional features, including:
  - Managing class student enrolments.
  - The ability to view and give feedback on submitted student work, with grading as an option.
  - Viewing model answers in place.
  - Teachers can display suggested answers via Show/Hide buttons - ideal for introducing and reviewing activities via a shared screen.
    Students do not have access to model answers.
- COMING SOON: BIOZONE WORLD will soon have text translation into multiple languages (including Spanish).

Find out more: **biozone.com/us/biozone-world**





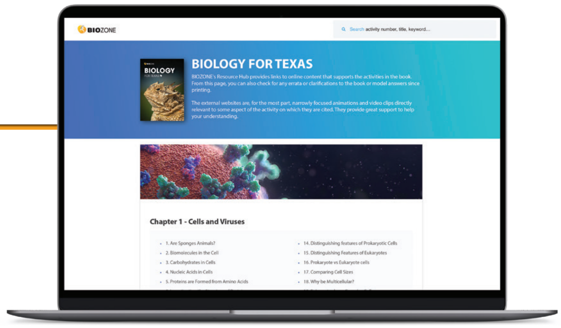
TEACHER'S EDITION - PRINT

The *Biology for Texas* Teacher's Edition is the teacher's companion to the student worktext. Use this resource to gain insight into the features of *Biology for Texas* and how to use them in your planning and delivery. The Teacher's Edition follows the same flow as the Student Edition for easy navigation.

Features of the Teacher's Edition include:

- Suggested **model answers** in place for each activity.
- A **Classroom Guide** at the beginning of the Teacher's Edition provides a guide to the best use of BIOZONE's resources. It includes strategies for teaching in a differentiated classroom, information about the assessment tools, practical investigations, extended Teacher's Notes, and summaries of where the TEKS and ELPS are located.

RESOURCE HUB



The BIOZONE **Resource Hub** is a **free resource**, available to both students and teachers. It offers a curated collection of Open Educational Resources (OER) specifically chosen to support the content of the worktext. Resources include videos, animations, games, 3D models, spreadsheets, and source material.

Resource Hub materials can be directly accessed through BIOZONE WORLD for digital users. Print users can easily access the content through QR codes and links provided in the teacher and student editions.

The BIOZONE **Resource Hub** is an effective tool to engage students of all abilities within a differentiated classroom. Most resources can be used by students of all abilities. 3D models, videos, games, and simulations are great tools for engaging students in a topic, or supporting striving students in their learning journey.

Some components have been tagged as extension material and can be used to extend more capable or gifted students. These types of resources may require more reading or synthesis of information. Our spreadsheet models can be used as is, or you can have students graph the information themselves. You may wish to challenge more capable students to build their own models, or manipulate the ones provided to observe the outcomes.

Some material is tagged as a teacher resource. Teacher resources often provide background or additional material to an activity. Capable students, or students with a particular interest in the topic can be assigned this material at your discretion.

BIOZONE **Resource Hub** content is easily shared with your students through your LMS. You can provide notes and guidance about what you want students to do with the resource.
The BIOZONE **Resource Hub** can be accessed directly via the QR code below:

Or bookmark the following link:

www.BIOZONEhub.com

Then enter the code in the text field

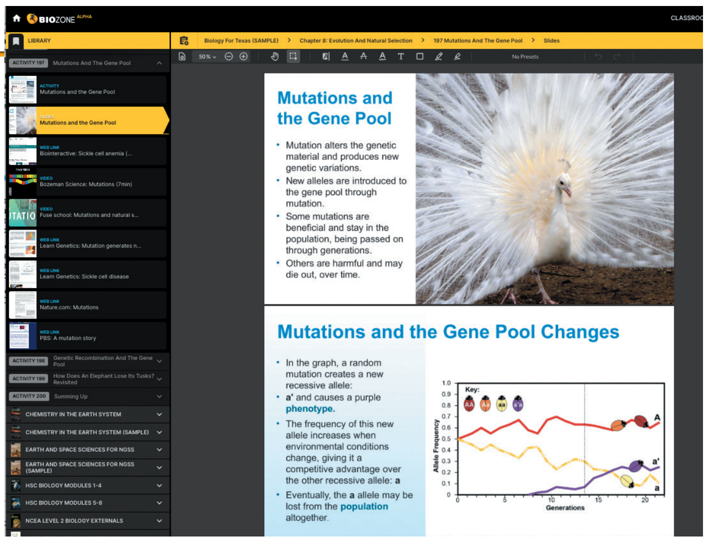
TXB1-4054

LIST OF RESOURCE HUB MATERIALS

Resource type	Number of resources*
PDFs	36
3D models	182
Videos	455
Weblinks	312
Interactives	245
Spreadsheets	7

* approximate number of resources

PRESENTATION SLIDES



Presentation Slides are a very popular way for teachers to deliver a lesson in a presentation style format. Presentation Slides are a useful delivery tool in both face to face or remote teaching.

The Presentation Slides are a sizeable collection of slides specifically designed to support and enhance the content of the worktext. A set of slides will be available for each chapter of Biology for Texas.

The Presentation Slides are fully ingested into BIOZONE WORLD and automatically appear with the selected activity.

TEST BANK CONTENT

Test Bank content is complementary with multi-year purchases.

- **The Test Bank content** is a set of curated questions designed to test student understanding of the material in the worktext. A wide range of questions types are used, and the questions can be ingested into test generator software such as Illuminate and ExamView, or can be reformatted into Quizlet or Kahoot quizzes. Questions can also be ingested into LMS in a number of formats, e.g. Google forms, or a Google or word document.
- The Test Bank content is provided in QTI and RTF formats, providing teachers with flexibility in how they deliver and use the questions. Questions are fully editable, teachers can pick and mix questions from the entire suite of questions and edit the wording to customize the tests for individual classrooms.
- Test Banks can be used to gauge student understanding at the end of activities, a set of related activities, or at the end of a chapter.

QUESTION LIBRARY

Access to the question library is complementary with multi-year purchases.

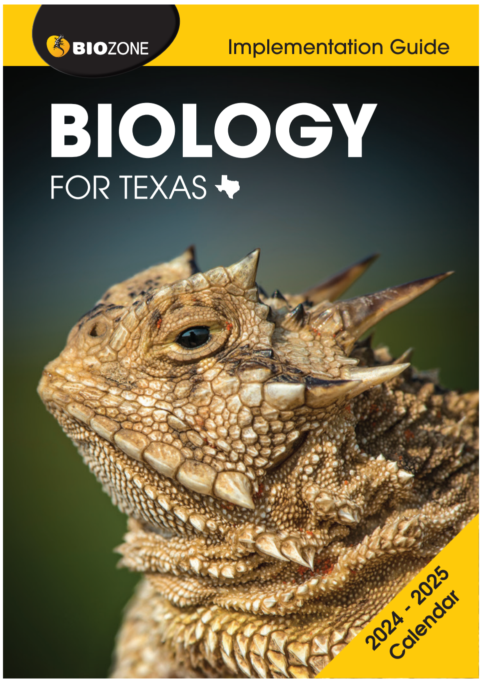
- The **Question Library** provides all of the questions from the Student Edition worktext in a format that can be ingested into a range of LMS or other digital delivery tools.
- Questions within the worktext are generally scaffolded; easier questions are asked first, to build student confidence, and the questions may become more complex or difficult as students progress through an activity.
- The Question Library content is fully editable, providing teachers with flexibility and control in assigning questions within a differentiated classroom. The questions can be customized to match a student's learning ability or reading level.

IMPLEMENTATION GUIDE

A comprehensive Implementation Guide is available as a FREE download from the BIOZONE website or Resource Hub. This guide supports teachers to confidently deliver and assess BIOZONE's Biology for Texas program. Digital components (e.g. digital progress trackers) are located on the BIOZONE Resource Hub. More about the Implementation Guide can be found on the following pages.

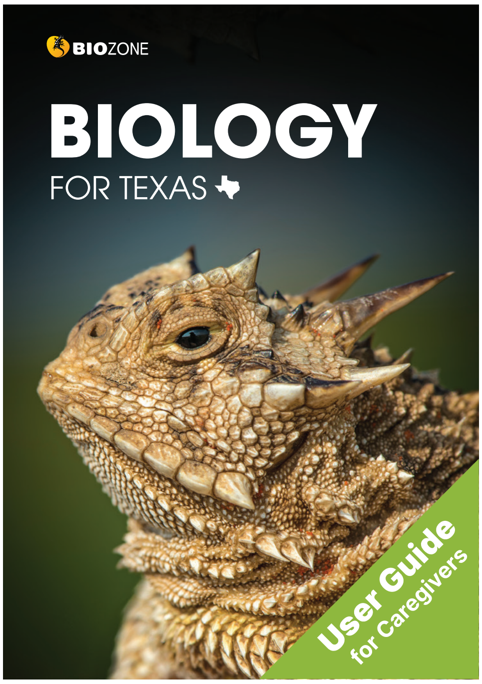
The guide includes:

- Scope and sequence guide.
- Lesson implementation guide.
- Pacing guide.
- Digital progress tracker (student and teacher versions).
- Concept maps.
- Vertical alignment guide.



USER GUIDE FOR CAREGIVERS

BIOZONE provides a helpful user guide to orientate parents and caregivers with the features of B*iology for Texas*. This is can be downloaded for FREE from our website.



Unpacking the Implementation Guide

SCOPE AND SEQUENCE GUIDE

The suggested scope and sequence order of the concepts taught follows the structure of the worktext, with consideration given to building from cellular level in chapter 1 to the interconnected ecosystem level in chapter 9. Concepts covered earlier in the course are designed to be built upon, and incorporated, as the biological systems expand. A full version of the scope and sequence guide is located within the Implementation Guide for *Biology for Texas*.
It can be download for free from the website: biozone.com/us/product/txb1

AUGUST 2024

Lesson Identifier	Sun	Monday	Tuesday	Wednesday	Thursday	Friday	Sat
GC: 1 **Week:** 1	18	19 1st grading cycle starts **1** What is a sponge 5.B	20 **2** Biomolecules in the cell **3** Carbohydrates in the cell 5.A	21 **4** Nucleic acids in the cell **5** Proteins are formed from amino acids 5.A	22 **6** Inv1.1 Investigating the structure of proteins 5.A 1.G 3.A	23 **7** The functions of proteins in the cell **8** Lipids in the cell 5.A 1.G 3.A	24
GC: 1 **Week:** 2	25	26 **9** The development of microscopes 5.A 1.G 3.A	27 **10** Microscopes and magnification 5.A 2.C	28 *Catch-up lesson **270** Biological drawing **271** Practicing biological drawing 1.F	29 **11** Inv. 1.2 Studying cells 1.B 1.C 1.D 1.F	30 **12** Life arises from life **13** The cell is the unit of life 5.B 5.D 1.B 4.B	31

LESSON IMPLEMENTATION GUIDE

This lesson implementation guide has collated information from across the BIOZONE Teacher's Edition and Student Edition of Biology for Texas to assist teachers in planning and implementing lessons based on activities in the worktext. A full version of the lesson implementation guide is located within the Implementation Guide for *Biology for Texas*.
It can be download for free from the website biozone.com/us/product/txb1

Date	Time	Activity	Student Expectation	ELPS	Notes	Inv.	Assessment
GC: Week: Date:	0.5	5 Proteins are formed from amino acids	5.A relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell		**Key Question:** How is protein formed in the cell, and how is the final form of the protein linked to its function? This introductory activity requires students to identify that amino acids link together to form proteins. **Prior knowledge:** Students should understand that globular and fibrous proteins have different functions. The role of proteins is explored further in the following activities. **Scaffolding:** Teachers could make amino acid cards, which the students can link together to make particular proteins or, more correctly, polypeptide chains, the precursor to proteins. Provide the name of the amino acid, and a 'recipe' for particular chains, that the students need to construct. **Extension:** Chemistry minded students can take a closer look at the condensation reaction that links the amino acids. **Keywords:** Protein, amino acids, nucleotides		**Learning Outcome:** Discuss how cellular proteins are formed. Short answer questions
GC: Week: Date:	1	6 Investigating the structure of proteins	5.A relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell 1.G 3.A	3.D.i	**Key Question:** How does modeling help us understand the structure of a protein? This investigation provides a hands-on opportunity to model how polypeptide chains fold into functional proteins. **Extension:** Students can annotate the notes with examples of the different protein structure types. **Keywords:** Protein, amino acids **Homelink:** If there is not time to construct the models in class, students can take the activity home and complete, recording with photographs to bring back to class	1.1 Modeling protein structure	**Learning Outcome:** Discuss how cellular proteins are formed, including their folding. Classroom investigation - small group Short and longer answer questions
GC: Week: Date:	0.5	7 The functions of proteins in cell	5.A relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell 1.G		**Key Question:** What kinds of proteins are found in the cells and what are their numerous roles? This cut and match activity uses specific protein examples to reinforce that different proteins have different functions. **Extension:** Students can cut and glue correct squares back-to-back to create a flip card set for revision, or to test each other in pairs. **Keywords:** Cells, nucleus, proteins, genes, nuclear membrane, glucose For any card type resources made by students, a zip-lock type plastic bag can be stapled to the back cover of the worktext, and cards placed inside for storage.		**Learning Outcome:** Match the function of proteins to examples found in cells. Short and longer answer questions Cut and paste - mix and match models, function, text example, and photo example of different proteins.
GC: Week: Date:	0.5	8 Lipids in cells	5.A relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell 3.A		**Key Question:** What features characterize lipid molecules, how are they formed, and what are their biological roles in cells? Lipids are discussed more fully in the context of the cell membrane later in the chapter. **Scaffolding:** Students may need some support interpreting the organic chemical drawing to understand the shorthand used for the carbon-hydrogen chain and the atoms involved in the ester bond. **Extension:** Like the condensation reaction for polypeptide chain reaction (activity 6), some students can be extended by looking further into the hydrolysis reaction that breaks apart the ester bonds in the triglycerides. Soap making is an engaging activity that could be carried out, if time permits **Keywords:** Lipids, phospholipids, cell		**Learning Outcome:** Link the structure of lipids to their function in cells. Short and longer answer questions

Digital Student Progress Analysis Tools

Digital Student Progress Trackers are available as a student tool and teacher tool. These Google sheets can be downloaded from BIOZONE's Resource Hub, and are an excellent tool to track student progress through the program. More information about how to use these analysis tools are provided in the Implementation Guide for Biology for Texas.
This can be downloaded from the resource Hub.

STUDENT PROGRESS TRACKER (STUDENT VERSION)

The student version allows students to self-report their grades for each Learning Outcome, as part of the Texas Essential Knowledge and Skills (TEKS) for Biology. Students can track their progress as they move through each TEKS, identify patterns in their understanding, and then respond by working with more scaffolding, extension, or targeted revision.

BIOZONE

Biology for Texas

Chapter 1 Cells and Viruses	NAME	TEACHER	SUBJECT	GRADE
	A. Student	B. Teacher	Biology	9-12

Topic	Biomolecules				
Activity number	2	3	4	5-7	8
TEK covered	**5.A** relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell				
Learning Outcome	Summarize the role of key biomolecules in the cell	Distinguish between monosaccarides and polysaccarides and understand their role in cell structure and function.	Identify components of nucleic acids, and explain the role they have in cells.	Discuss how cellular proteins are formed, including their folding, and match their function to examples found in cells.	Link the structure of lipids to their function in cells.
Status	Approaching	Proficient	Mastery	Mastery	Yet to do

Topic	Prokaryotes and Eukaryotes				
Activity number	13	14-16	17	18	19
TEK covered	**5.B** compare and contrast prokaryotic and eukaryotic cells, including their complexity, and compare and contrast scientific explanations for cellular complexity				
Learning Outcome	Identify key features of different groups of cells.	Compare and contrast prokaryote and eukaryote cells, including presence of organelles.	Compare and contrast prokaryote and eukaryote cells, including size.	Compare and contrast prokaryote and eukaryote cells, including multicellular forms.	Evaluate evidence for eukaryote complexity, including endosymbiosis, and bacteria engulfment by protists.
Status	Yet to do	Yet to do	Yet to do	Yet to do	Yet to do

STUDENT PROGRESS TRACKER (TEACHER VERSION)

Teachers can collate the self reported grades on their Teacher Version of the Student Progress Tracker, and easily identify both individual student and whole class trends with the embedded data analysis tools.

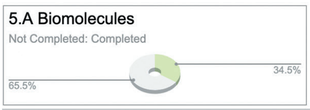
SCHOOL	TEACHER
SUBJECT	**GRADE**

Biology for Texas

Chapter 1	Cells and Viruses

BIOZONE

Students	
Surname / last name	First name/s

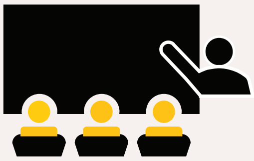


Biomolecules				
2	3	4	5-7	8
5.A Relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell				
Summarize the role of key biomolecules in the cell.	Distinguish between monosaccarides and polysaccarides and understand their role in cell structure and function.	Identify components of nucleic acids, and explain the role they have in cells.	Discuss how cellular proteins are formed, including their folding, and match their function to examples found in cells.	Link the structure of lipids to their function in cells.
57.24%	7.97%	97.83%	7.25%	2.17%
Yet to do	Yet to do	Yet to do	Mastery	Yet to do
Yet to do	Proficient	Mastery	Yet to do	Yet to do
Yet to do	Yet to do	Mastery	Yet to do	Yet to do
Yet to do	Yet to do	Mastery	Proficient	Yet to do
Yet to do	Yet to do	Mastery	Yet to do	Yet to do
Mastery	Approaching	Mastery	Proficient	Mastery
Mastery	Mastery	Mastery	Yet to do	Yet to do
Mastery	Mastery	Mastery	Yet to do	Yet to do
Mastery	Yet to do	Mastery	Yet to do	Yet to do
Mastery	Yet to do	Mastery	Yet to do	Yet to do
Mastery	Yet to do	Mastery	Yet to do	Yet to do
Mastery	Proficient	Mastery	Yet to do	Yet to do
Mastery	Yet to do	Mastery	Yet to do	Yet to do
Approaching	Yet to do	Mastery	Mastery	Yet to do
Mastery	Yet to do	Mastery	Yet to do	Yet to do
Mastery	Yet to do	Mastery	Yet to do	Yet to do

Suggestions for Planning, Delivery, and Assessment

Lesson planning

- *Biology for Texas* is structured on the Science Concepts listed in the TEKS for High School Biology. The Scientific and Engineering Practices TEKS are inserted where appropriate. Teachers can be assured that all of the Knowledge and Skills Statements of the program are covered, ensuring easy and efficient lesson planning, with no content gaps.
- Use the tabs on activity pages, chapter introductions, TEKS tables and breakout coding (found in the Teacher's Edition) to identify the TEKS covered in specific activities.
- Margin icons on activities and ELPS statements in the chapter introduction can be used to identify where specific ELPS are covered. Proficiency levels are identified, making it easy to deliver the ELPS in a differentiated classroom. Summary tables in the Teacher's Edition are another way to identify where the ELPS are incorporated.
- Refer to the Teacher's Notes while planning. These provide suggestions for delivery content, opportunities to support or extend students, and ways to incorporate BIOZONE **Resource Hub** material into teaching.
- Add interest to your lessons by utilizing the BIOZONE **Resource Hub**. The FREE, curated resources can easily be incorporated into your planning. We have curated high quality resources to support the content of the activities to save you planning time. Use these as a way to introduce and prepare students for upcoming topics, or consolidate understanding after lessons.
- Use the contents pages to help with lesson planning too. A green circle next to an activity in the contents pages identifies where there is a practical investigation. The equipment list provided in the worktext (pages 466-467) will help prepare for the investigation.



Teaching

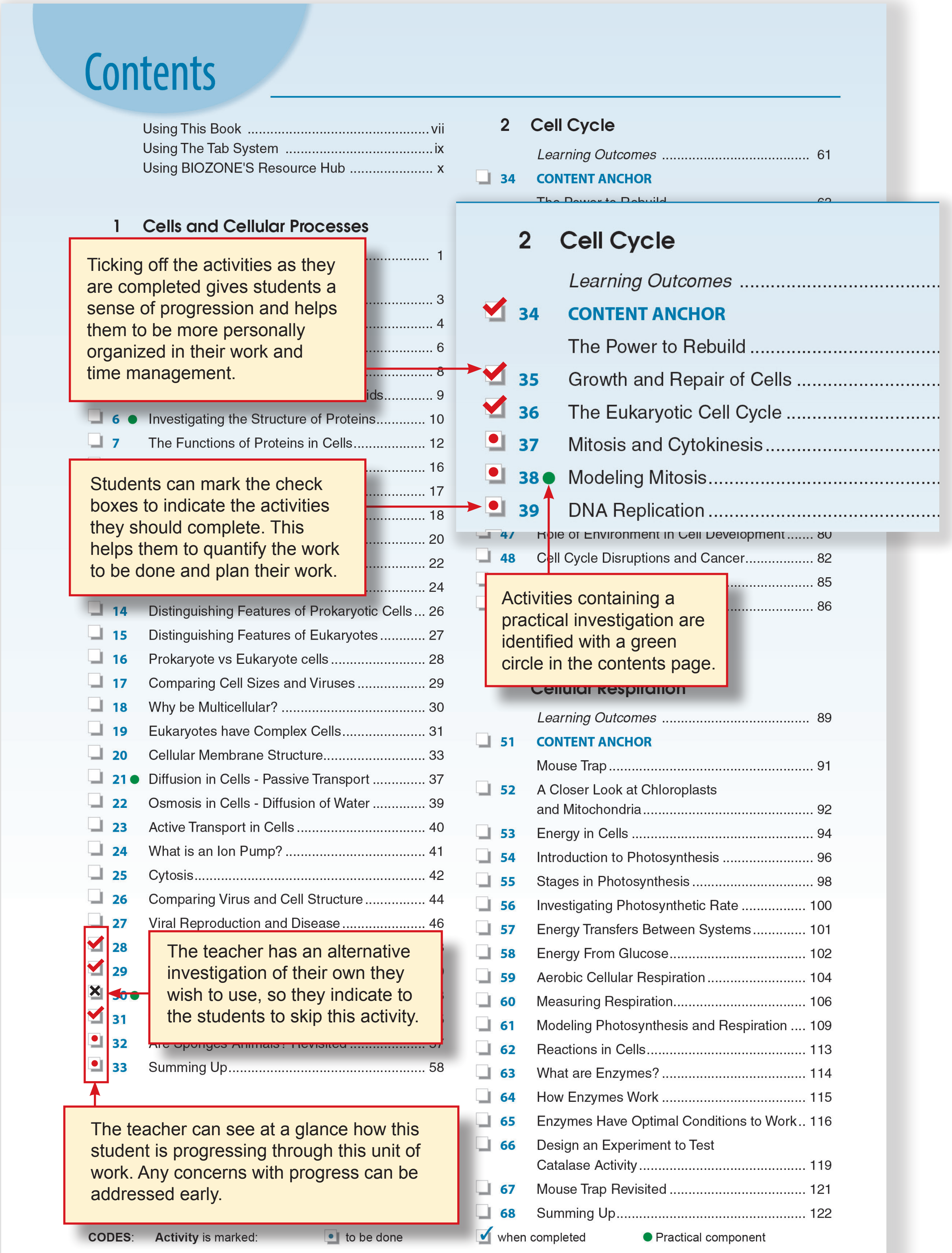
- We have structured the chapters so that students are provided with foundation knowledge first, e.g. cell structure and function, and topics broaden from there. While we recommend the content is delivered in the order in which it is presented (with the exception of chapter 10), teachers can deliver the material in a different order if they wish.
- Chapter 10, the Science Practices chapter, provides support for the Scientific and Engineering Practices TEKS. Encourage students to refer to chapter 10 as the need arises, or before attempting an activity that addresses a specific skill, such as drawing a line graph. These activities can be assigned as homework, or they can be completed in class.
- Encourage peer-to-peer learning by assigning students to groups of mixed abilities when carrying out group research projects or practical investigations.
- Activities that manipulate data using statistical formulas or model data may be supported by fully editable spreadsheets on BIOZONE's **Resource Hub**. Tailor how you use the spreadsheets: for example, students can analyze the spreadsheet model provided, then change the data and observe the outcome. Students could add formulae to enhance the model.
- Extend students' scientific vocabulary by encouraging them to look up unfamiliar words in the glossary. This is provided in both English and Spanish.

Assessment

- Provide feedback (formative and summative) to students to update them on their progress. This can highlight areas of strength or areas needing work.
- Select activities as a formative assessment task to identify areas a student or the class needs to revisit before progressing to the next topic or chapter. Methods of formative assessment include reviewing student answers on selected activities, observing students carrying out practical work, or evaluating their contribution and understanding in practical work.
- Use the Assessment tasks at the end of each chapter to assess student understanding. This could be carried out as a test in class. Alternatively, you can set them as homework or open book assessments if you wish.
- BIOZONE's **Test Bank content** provide a flexible and fun way to test student understanding using a range of question types which can be ingested into a range of testing software or quiz generators.

The Contents: A Planning Tool

The contents pages are not merely a list of the activities in the student edition. Encourage your students to use them as a planning tool for their program of work. Students can identify the activities they are to complete and then tick them off when completed. The teacher can also see at a glance how quickly the student is progressing through the assigned material.



Contents

CODES: **Activity** is marked: to be done; when completed; ● Practical component

Ticking off the activities as they are completed gives students a sense of progression and helps them to be more personally organized in their work and time management.

Students can mark the check boxes to indicate the activities they should complete. This helps them to quantify the work to be done and plan their work.

Activities containing a practical investigation are identified with a green circle in the contents page.

The teacher has an alternative investigation of their own they wish to use, so they indicate to the students to skip this activity.

The teacher can see at a glance how this student is progressing through this unit of work. Any concerns with progress can be addressed early.

How Long Should it Take to Complete an Activity?

Many variables, including the nature of the activity, level of student support required, and student's own prior knowledge, contribute to how long it will take to work through the content in *Biology for Texas*:

- A pacing guide and suggested lesson implementation plans are provided in the Implementation Guide.
- Opportunities exist for students to spend longer on some activities, e.g. in improving or refining their investigations or in exploring simulations beyond the minimum. These elaborations will demand more time.
- The time allocated for investigations will depend on (1) how you choose to organize the class (which may be determined by available resources) and (2) how far students take the investigation. Adjust your lesson plan to incorporate more or less material as needed. You may have investigations you already like to use, so you could choose to leave out equivalent investigations in the worktext. To help you, activities including a practical investigation are identified with a green dot (●) in the contents.
- For spreadsheet modeling activities, completed models are available on BIOZONE's **Resource Hub**. If you need to save time, students can use these spreadsheets instead of taking time to construct them.
- The pace may quicken as students complete more of the book and become more familiar with the style and information flow. Students gain increasing levels of competence and learn valuable skills that enable them to arrive at solutions more quickly.
- Depending on the ability of your students, you may need to use the Science Practices chapter more often to help develop Scientific and Engineering Practices TEKS. Have students carry out the activities as homework if you are short on time.

Structure of a Chapter

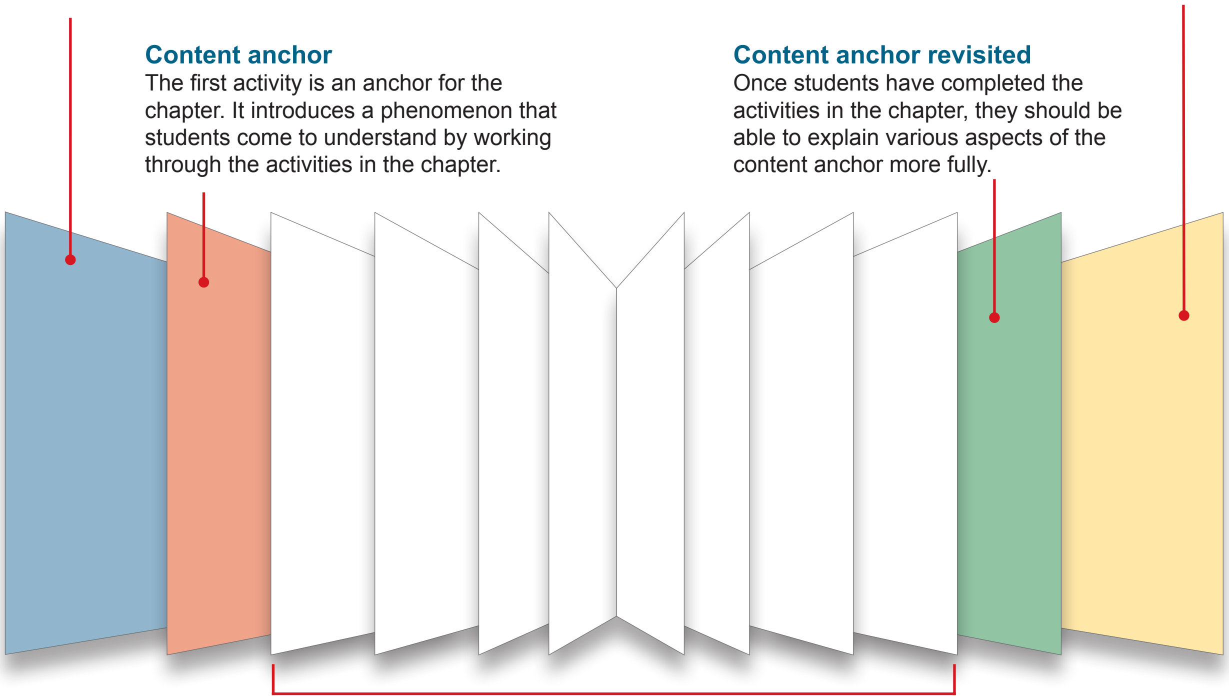
The content of *Biology for Texas* is organized into 10 chapters based on the TEKS of the High School Biology framework. Chapters 1-9 are based on the Science Concepts and chapter 10 provides support for the Scientific and Engineering Practices TEKS. Chapters 1-9 begin with an introduction outlining learning outcomes, which is immediately followed by the content anchor. Activities make up the bulk of each chapter, with each one focusing on the student investigating and developing understanding of the content anchor, applying that understanding to new scenarios, and developing (or practicing) a skill or essential science practice, such as graphing, data analysis, modeling, or evidence-based explanation.

Chapter introduction
Identifies the activities relating to the learning outcomes. Relevant TEKS and ELPS are identified

Summing up
Find out what students know about the content and skills they have explored in the chapter.

Content anchor
The first activity is an anchor for the chapter. It introduces a phenomenon that students come to understand by working through the activities in the chapter.

Content anchor revisited
Once students have completed the activities in the chapter, they should be able to explain various aspects of the content anchor more fully.



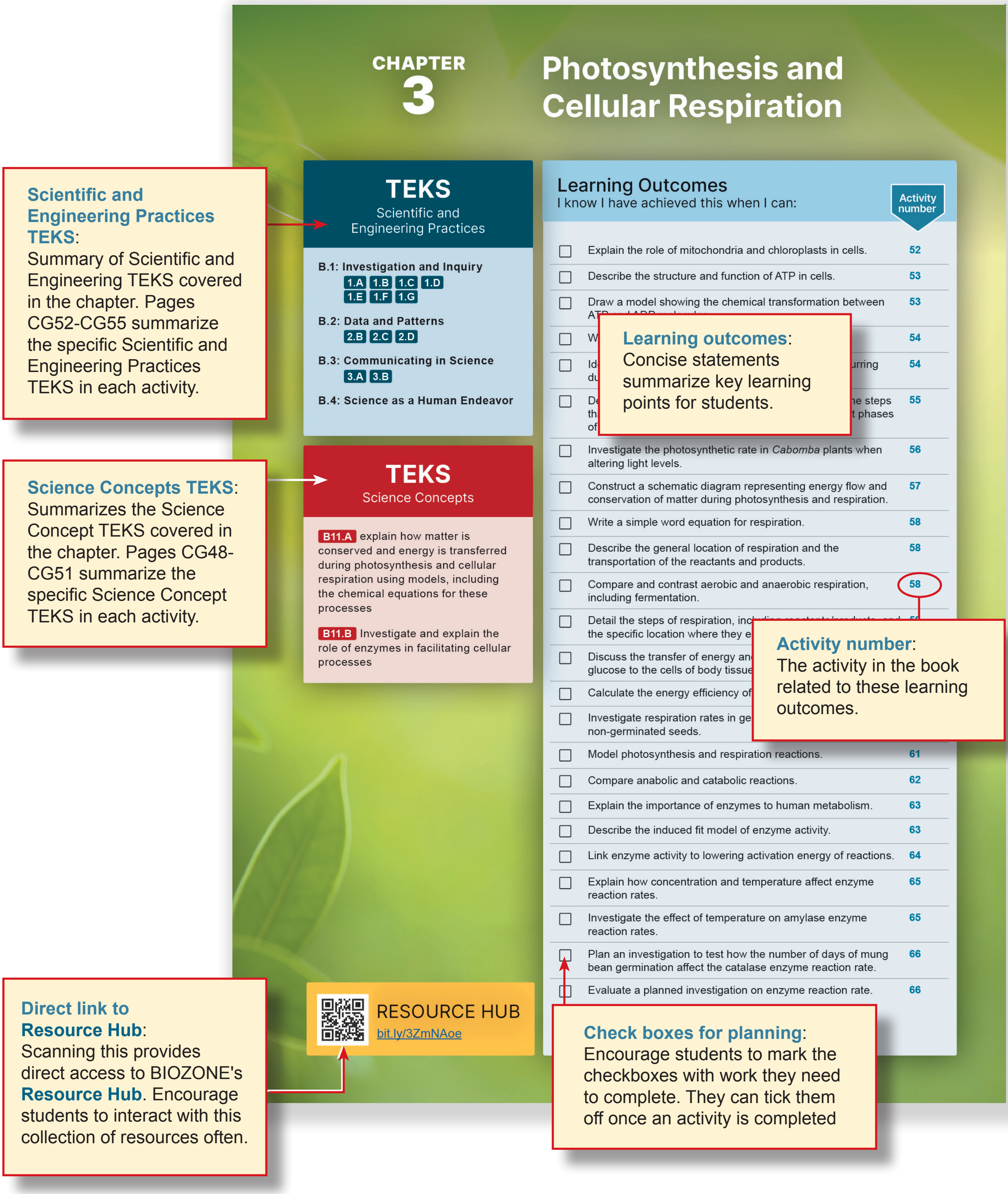
Activity pages
Material is scaffolded over a learning sequence in a series of related activities. Questions allow students to demonstrate their understanding of the material.

Unpacking Chapter Introductions

The chapter introductions provide an overview of the chapter content presented as a set of concise learning objectives. We have deliberately kept these brief to make them accessible to students. This list shows students what they should know, or be able to do, once they have completed the chapter. The check-boxes can be used as an organization and planning tool. Students can use the check-boxes to mark work to be done, and tick it off when completed.

The chapter introduction also provides a list of the TEKS and ELPS covered in the chapter. Refer students to page ix in the Student Edition for explanations of the codes used to identify the TEKS and ELPS. For teachers, tables on pages CG48-CG60 provide a detailed breakdown of the TEKS and ELPS included in this worktext.

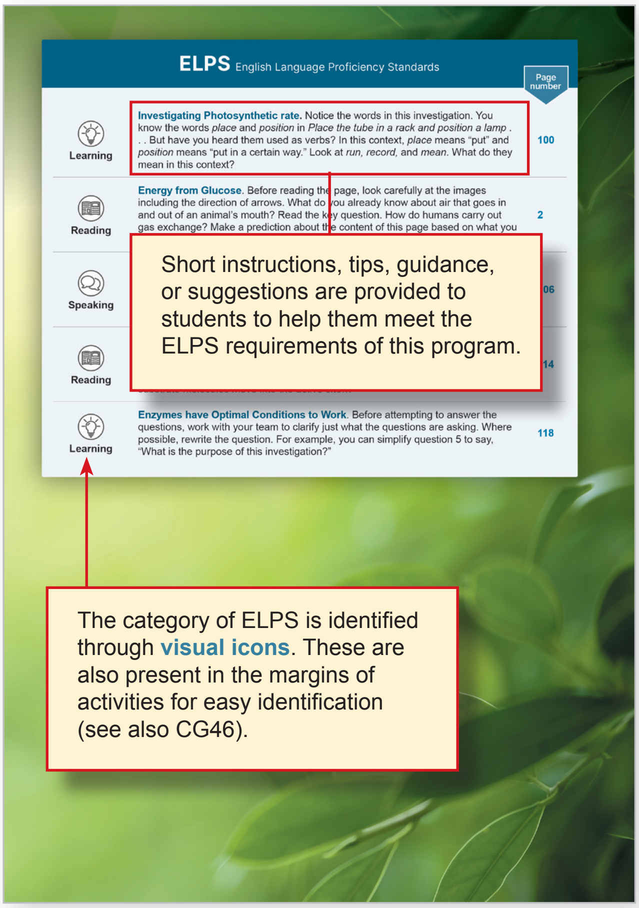
The QR code provides direct access to BIOZONE's **Resource Hub**.



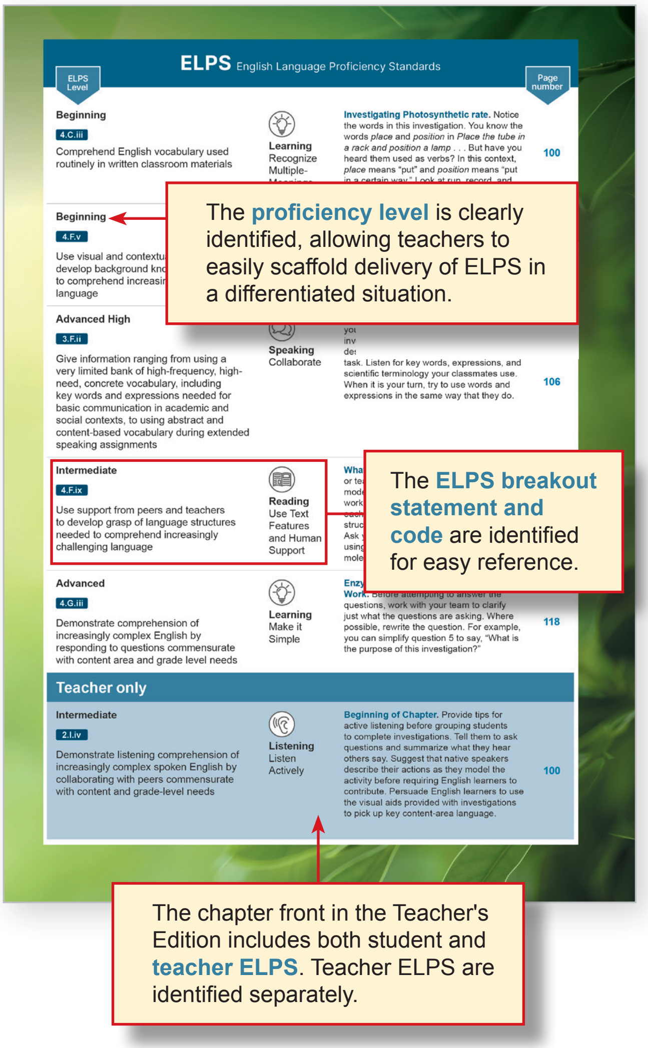
Unpacking the English Language Proficiency Standards (ELPS)

- The second page of the chapter introduction identifies the ELPS covered within the chapter.
- In the Student Edition, prompts, hints, and guidance statements are provided for activities containing ELPS. The statements have been specifically and carefully designed to help students unpack the content, whilst meeting the ELPS requirements for the program. They provide clear direction and instructions to students, and teachers should incorporate these strategies into their classroom instruction, or highlight to students for their own reference. Only student ELPS are identified in the Student Edition.
- For teachers, the ELPS content is expanded, and identifies both student and teacher ELPS. The proficiency level (beginning, intermediate, advanced, advanced high) is identified, allowing for scaffolding the ELPS within a differentiated classroom. The specific ELPS breakout and statement are also provided.
- The features of both pages are shown below. Tables identifying all of the ELPS included in *Biology for Texas* can be found on CG56-CG60.

Student Edition



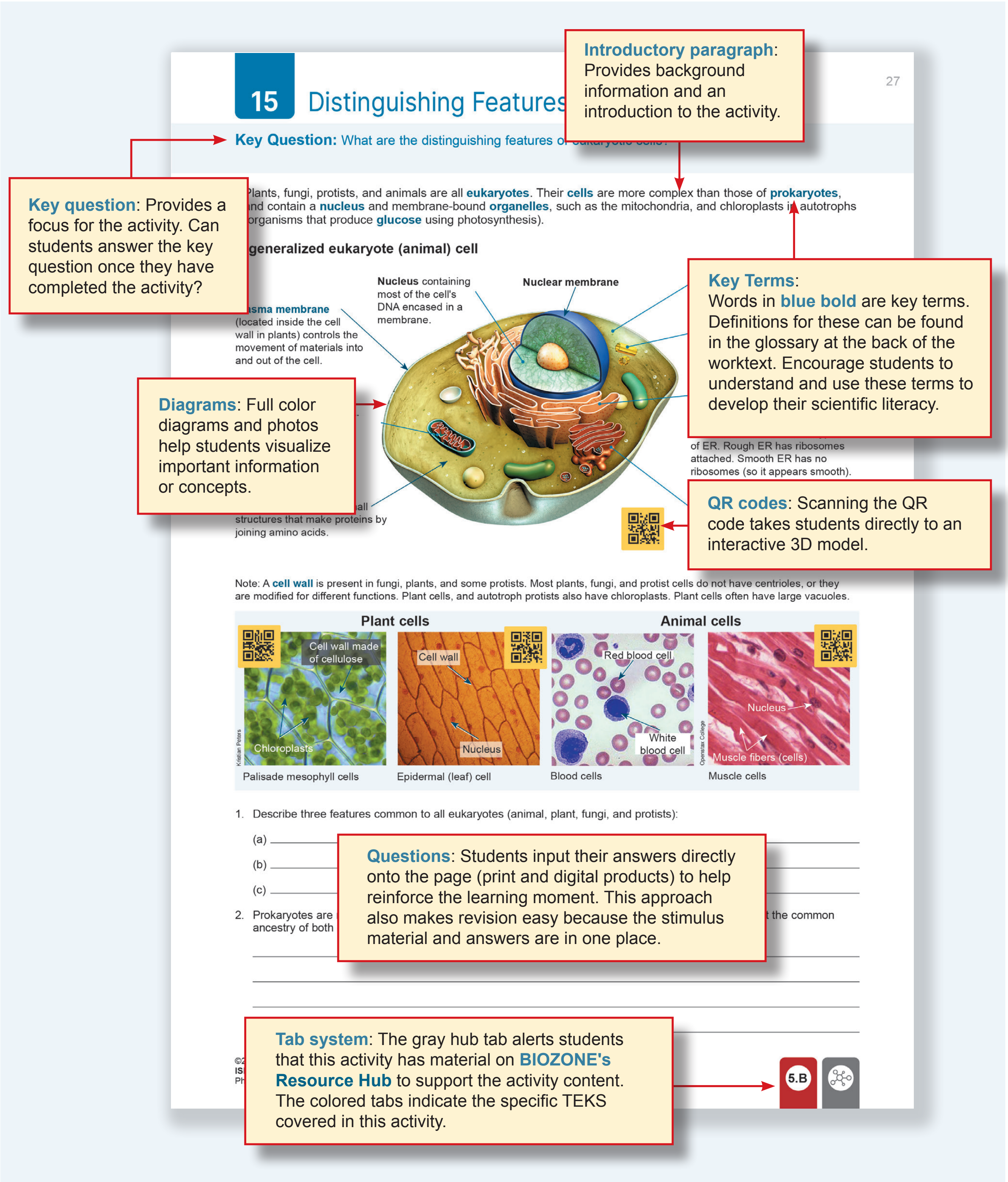
Teacher's Edition

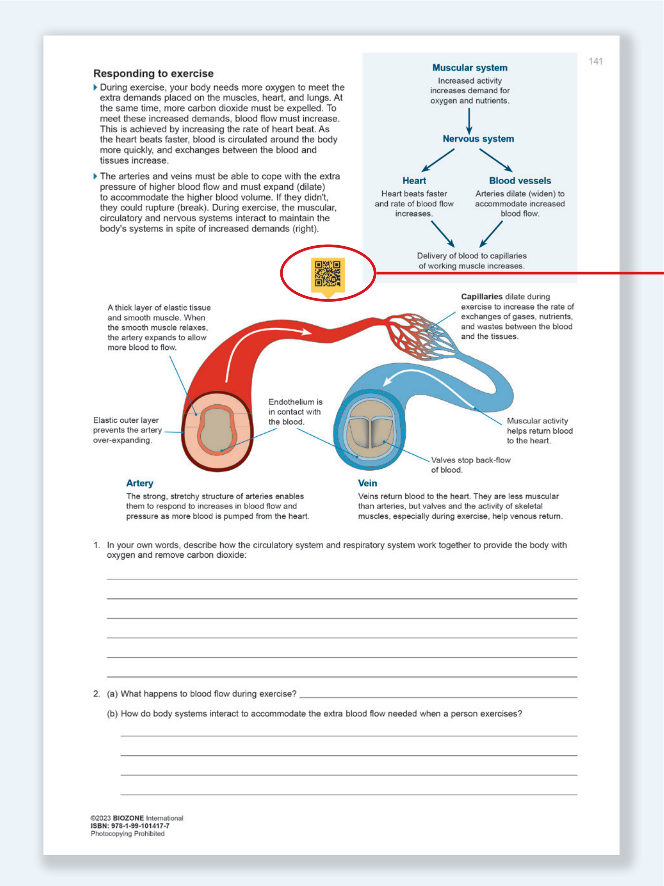


Structure of an Activity Page

The activity pages have been carefully designed to provide high quality information to students in an easily accessible format. They include a number of features designed to engage students and help them unpack and understand the information. Guide students through the features of the activity pages to ensure that they make the most of each activity.
Features include:

- Short blocks of text so that students do not feel overwhelmed with too much reading.
- High quality, informative graphics.
- Links to 3D models (following page). These provide another dimension to student engagement and learning.
- Question and answer sections allow students to demonstrate their understanding of the content. By having the stimulus material and their answers in one place, students can easily revise for assessments.
- The tab system identifies when there is support material on the **Resource Hub**. Tabs also identify the applicable TEKS (see following page).





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Responding to exercise

- During exercise, your body needs more oxygen to meet the extra demands placed on the muscles, heart, and lungs. At the same time, more carbon dioxide must be expelled. To meet these increased demands, blood flow must increase. This is achieved by increasing the rate of heart beat. As the heart beats faster, blood is circulated around the body more quickly, and exchanges between the blood and tissues increase.
- The arteries and veins must be able to cope with the extra pressure of higher blood flow and must expand (dilate) to accommodate the higher blood volume. If they didn't, they could rupture (break). During exercise, the muscular, circulatory and nervous systems interact to maintain the body's systems in spite of increased demands (right).

Artery
The strong, stretchy structure of arteries enables them to respond to increases in blood flow and pressure as more blood is pumped from the heart.

Vein
Veins return blood to the heart. They are less muscular than arteries, but valves and the activity of skeletal muscles, especially during exercise, help venous return.

1. In your own words, describe how the circulatory system and respiratory system work together to provide the body with oxygen and remove carbon dioxide:

2. (a) What happens to blood flow during exercise?

   (b) How do body systems interact to accommodate the extra blood flow needed when a person exercises?

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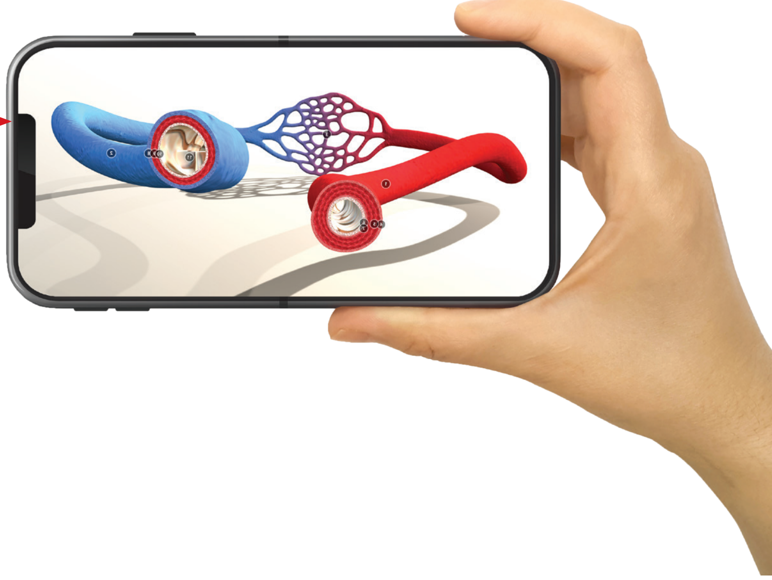
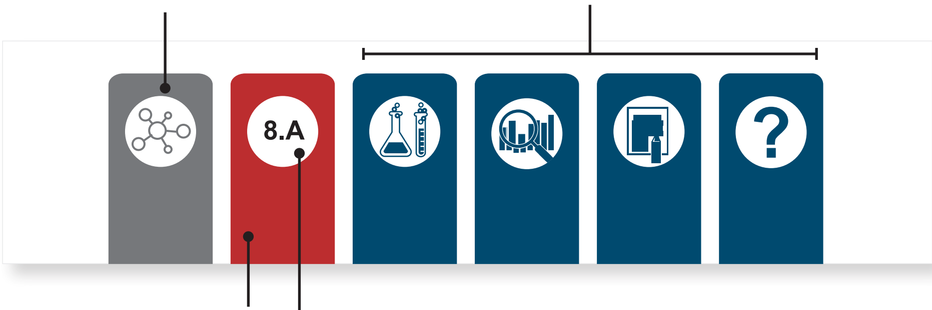
Encourage students to scan the **QR codes** on the activity pages. These link directly to informative and engaging 3D models. All models can be rotated and zoomed, and some contain informative annotations.



Understanding the Tab System

The gray hub tab indicates that the activity has online support via the **BIOZONE RESOURCE HUB**. This may include videos, animations, articles, 3D models, and computer models.

The **blue TEKS** tabs use picture codes to identify the scientific and engineering practices TEKS relevant to the activity. These are detailed in the introduction to each chapter, and linked to appropriate activities.



The **red TEKS** tabs indicate the Science Concepts TEKS covered in the activity. These are detailed in the introduction to each chapter.

The TEKS code refers specifically to the Science Concept TEKS covered in the activity.

Why are the Scientific and Engineering TEKS shown in a different way from the Science Concept TEKS?

The Scientific and Engineering Practices TEKS are identified using a series of picture codes rather than the alphanumerical codes used for the science concept TEKS. This is because there are often too many scientific and engineering TEKS in an activity to display the individual coding. Instead, tabs identifying the four parent TEKS covered are shown. Teachers wanting a more granulated breakdown of the Scientific and Engineering TEKS can find this in the TEKS summary tables (CG48-CG55) and also in the margins of the Teacher's Edition. An explanation of the picture codes is provided below.

B.1 Investigating

B.2 Patterns

B.3 Communicating

B.4 Discovery

Activity Pages are Designed to Scaffold Learning

We have utilized the highly successful **5Es Instructional Model** to scaffold delivery of content. Student understanding is supported and developed through a series of related activities, presented in a logical, consecutive learning sequence. Understanding is developed progressively through exploration and explanation, and opportunities for students to elaborate on their understanding occurs when knowledge is applied to new or more complex situations. This approach is explained in the following pages.

The Five Es

Engage: make connections between past and present learning experiences.

Explore: become actively involved in the activity.

Explain: communicate the learning experience.

Elaborate: expand on the concepts learned.

Evaluate: assess understanding of the concepts.

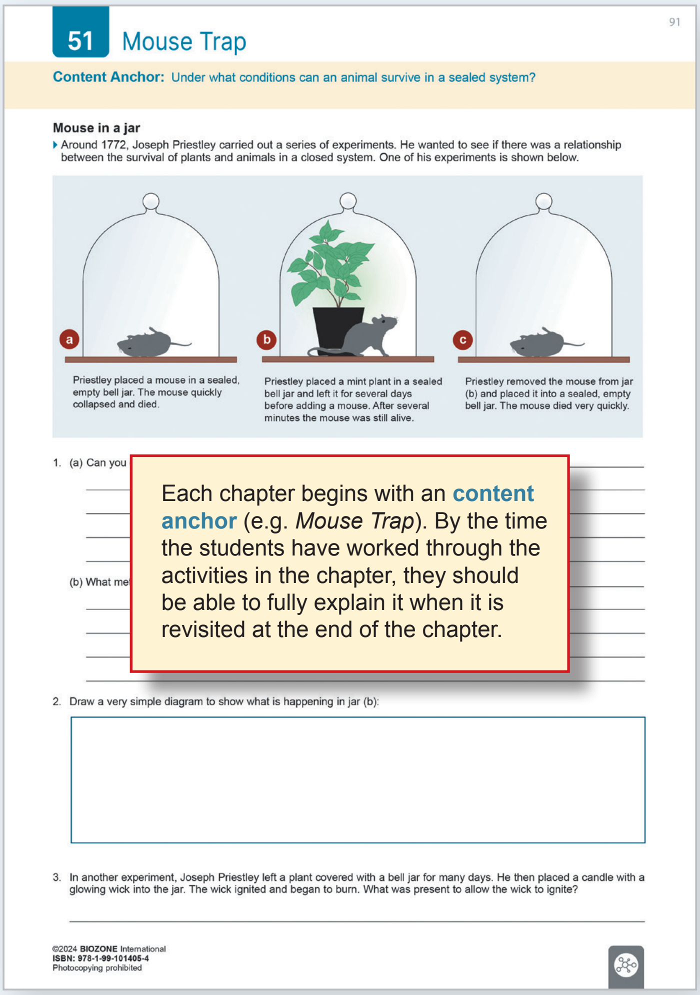
Unpacking a teaching sequence

A typical teaching sequence is explained in a number of steps over the next few pages. Some activities in this sequence are not shown for brevity.

1 Each chapter begins with a **content anchor** (a phenomenon). In each instance, we have chosen an anchor that the student may be familiar with, but which they cannot explain or cannot explain fully. The content anchor activity has three purposes:

- To set the scene and broadly introduce the topic being covered.
- To engage students with the upcoming topic and stimulate curiosity and questions.
- Teachers can use this activity to find out what the students already know, or think they know, before delving into the content more fully.
  Any misconceptions or knowledge gaps can be identified, allowing teachers to ensure these are addressed as they work through the material.

The subsequent activities in a chapter take the students, step by step, through phenomena that explore the ideas inherent in the content anchor.



In most activities, information is conveyed through small blocks of text and annotated diagrams or photo panels. The information provided is scientifically rigorous and appropriate for the grade level, but the format appeals to students because the information is broken down for accessibility. The highly visual approach and small blocks of text prevent students from feeling overwhelmed by the content.

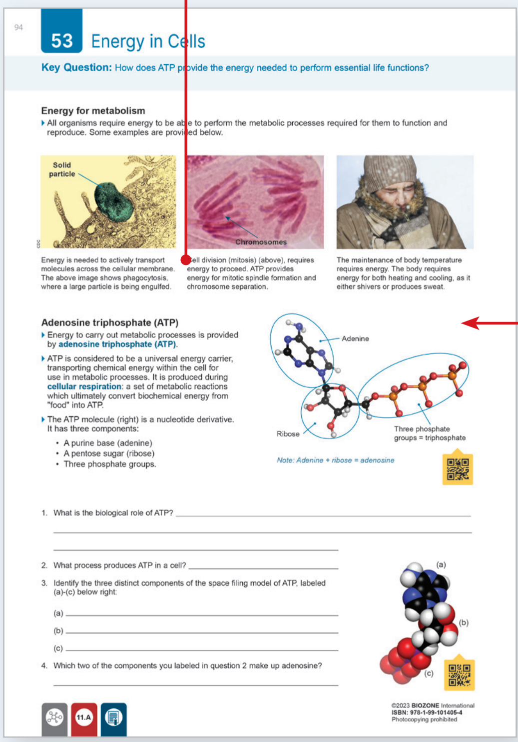
Most activities are supported by online content through **BIOZONE's Resource Hub**. These resources have been chosen to engage as many learners as possible and, in some instances, provide extension for capable students. The gray Resource Hub icon at the bottom of the first page of an activity indicates when material is available.

Questions associated with each activity provide an opportunity for students to demonstrate their understanding of the content. There is no need to grade every response, but reviewing selected activities allows teachers to check in and see how their students are progressing. Strategies for assessment opportunities are provided on CG21-CG22.

The first activity or two in a related sequence is often an introductory type activity providing background information to the topic, or introducing a topic in broad terms.

2 In this activity, students are introduced to the central role ATP plays in providing energy for metabolic processes to occur. As they progress through the content, students will be able to explain specifically the role of ATP in photosynthesis and cellular respiration.

3 Photosynthesis is introduced through an introductory activity. The highly visual overview of photosynthesis allows students to engage with the process, and it provides a foundation for expanding on the information in subsequent activities.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53 Energy in Cells

Key Question: How does ATP provide the energy needed to perform essential life functions?

Energy for metabolism

- All organisms require energy to be able to perform the metabolic processes required for them to function and reproduce. Some examples are provided below.

Energy is needed to actively transport molecules across the cellular membrane. The above image shows phagocytosis, where a large particle is being engulfed.

Cell division (mitosis) (above), requires energy to proceed. ATP provides energy for mitotic spindle formation and chromosome separation.

The maintenance of body temperature requires energy. The body requires energy for both heating and cooling, as it either shivers or produces sweat.

Adenosine triphosphate (ATP)

- Energy to carry out metabolic processes is provided by **adenosine triphosphate (ATP)**.
- ATP is considered to be a universal energy carrier, transporting chemical energy within the cell for use in metabolic processes. It is produced during **cellular respiration**: a set of metabolic reactions which ultimately convert biochemical energy from "food" into ATP.
- The ATP molecule (right) is a nucleotide derivative. It has three components:
  - A purine base (adenine)
  - A pentose sugar (ribose)
  - Three phosphate groups.

1. What is the biological role of ATP?
2. What process produces ATP in a cell?
3. Identify the three distinct components of the space filling model of ATP, labeled (a)-(c) below right:
   (a)
   (b)
   (c)
4. Which two of the components you labeled in question 2 make up adenosine?

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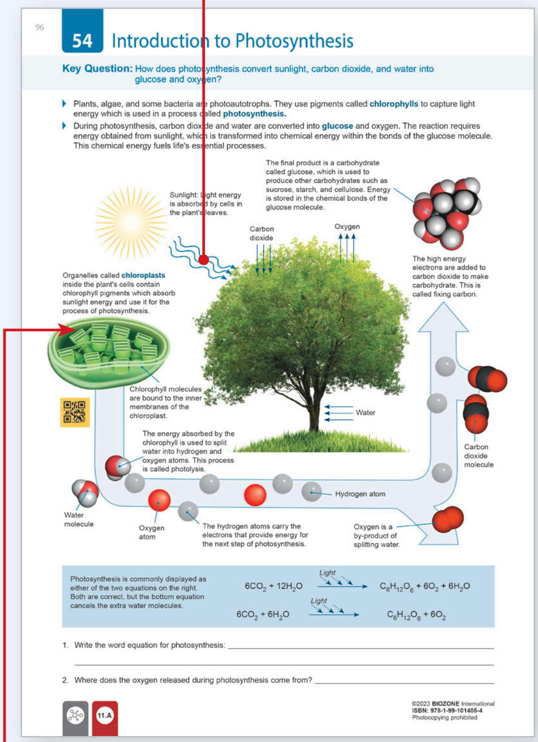
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54 Introduction to Photosynthesis

Key Question: How does photosynthesis convert sunlight, carbon dioxide, and water into glucose and oxygen?

- Plants, algae, and some bacteria are photoautotrophs. They use pigments called **chlorophylls** to capture light energy which is used in a process called **photosynthesis**.
- During photosynthesis, carbon dioxide and water are converted into **glucose** and oxygen. The reaction requires energy obtained from sunlight, which is transformed into chemical energy within the bonds of the glucose molecule. This chemical energy fuels life's essential processes.

Photosynthesis is commonly displayed as either of the two equations on the right. Both are correct, but the bottom equation cancels the extra water molecules.

$$6CO_2 + 12H_2O \xrightarrow{Light} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

$$6CO_2 + 6H_2O \xrightarrow{Light} C_6H_{12}O_6 + 6O_2$$

1. Write the word equation for photosynthesis:
2. Where does the oxygen released during photosynthesis come from?

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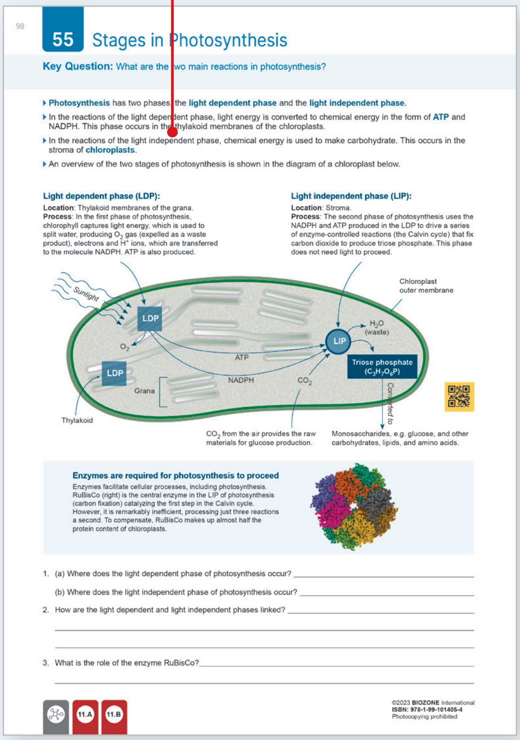
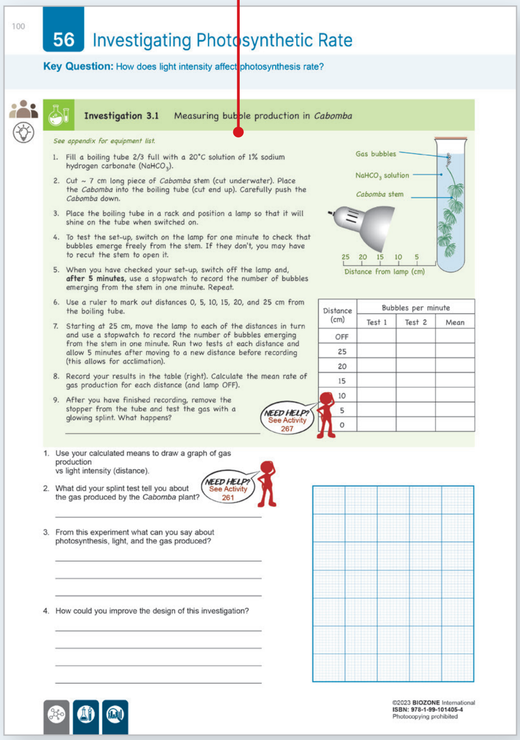
Students are given enough information to complete the activity's questions or tasks.

Information to answer the questions is often on the page, but students may need to analyze data or information and draw conclusions to answer the questions. On occasion, they may be asked to apply their knowledge to answer a more challenging question. Sometimes students are asked to carry out their own research or investigation.

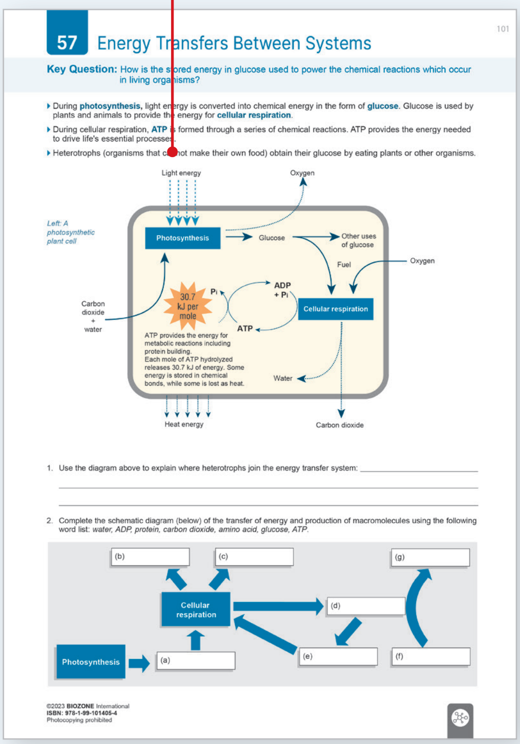
4 This activity allows students to explore photosynthesis in more detail, building on the foundation developed in the previous activity. Students are introduced to the fact that photosynthesis consists of several steps, and these are broadly referred to as the light dependent and light independent stages. The role of ATP (introduced earlier) and how it is transferred during the process is covered.



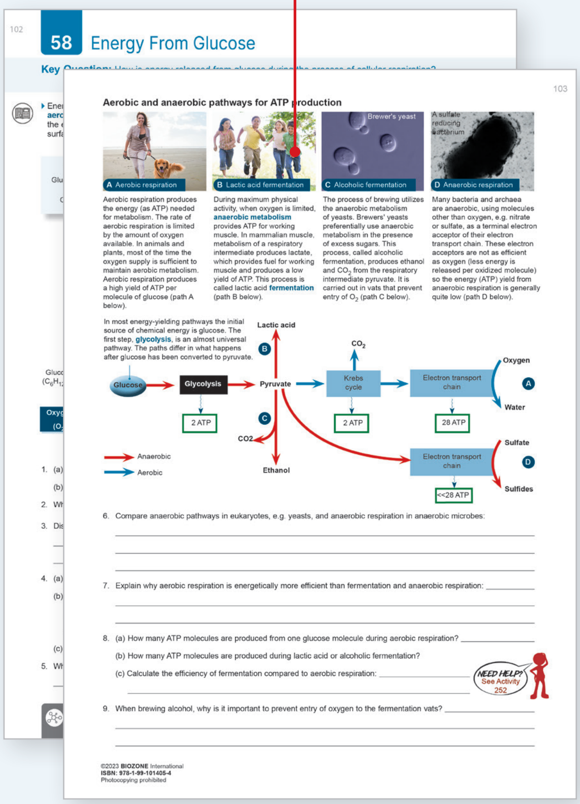
5 Students may have many opportunities to explore through a variety of activities, including practical investigations, creating models, analyzing or using second hand data, or interpreting diagrams. In this example, students explore photosynthesis through a simple practical investigation. With their knowledge of photosynthesis they can explain why bubble production varies with light intensity.



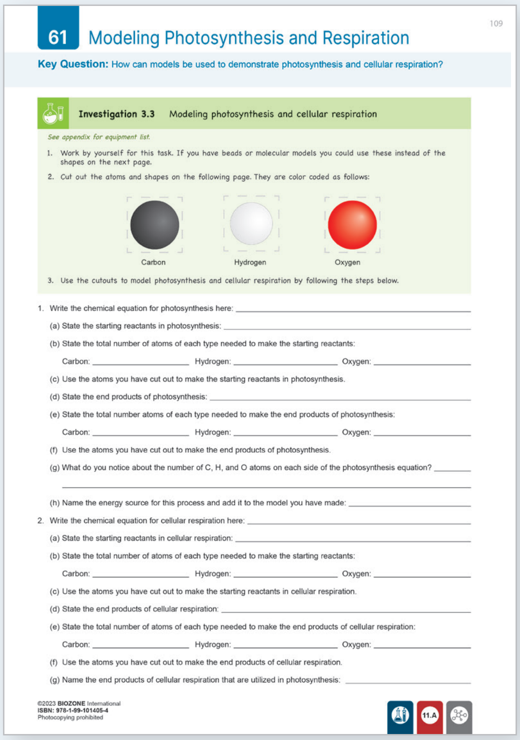
6 After completing the photosynthesis content, the focus moves to the process of cellular respiration. This bridging activity has been designed to show students the link, or connectedness, between photosynthesis and cellular respiration. They should readily observe that the glucose produced in photosynthesis is an essential starting material for cellular respiration.



7 In this activity students can elaborate on why the glucose produced from photosynthesis is so important for energy generation. They have already seen that glucose is utilized in cellular respiration, but is the starting point for several other energy producing pathways.



8 In this activity, students carry out a paper practical to model photosynthesis and cellular respiration. The intention is to provide a hands-on, visual representation of both processes, through which students see the connectedness between the two and reinforce and consolidate their understanding of each process.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61 Modeling Photosynthesis and Respiration

Key Question: How can models be used to demonstrate photosynthesis and cellular respiration?

Investigation 3.3 Modeling photosynthesis and cellular respiration

See appendix for equipment list

1. Work by yourself for this task. If you have beads or molecular models you could use these instead of the shapes on the next page.
2. Cut out the atoms and shapes on the following page. They are color coded as follows:

Carbon Hydrogen Oxygen

3. Use the cutouts to model photosynthesis and cellular respiration by following the steps below.

1. Write the chemical equation for photosynthesis here:
   (a) State the starting reactants in photosynthesis:
   (b) State the total number of atoms of each type needed to make the starting reactants:
   Carbon: Hydrogen: Oxygen:
   (c) Use the atoms you have cut out to make the starting reactants in photosynthesis.
   (d) State the end products of photosynthesis:
   (e) State the total number atoms of each type needed to make the end products of photosynthesis:
   Carbon: Hydrogen: Oxygen:
   (f) Use the atoms you have cut out to make the end products of photosynthesis.
   (g) What do you notice about the number of C, H, and O atoms on each side of the photosynthesis equation?
   (h) Name the energy source for this process and add it to the model you have made:
2. Write the chemical equation for cellular respiration here:
   (a) State the starting reactants in cellular respiration:
   (b) State the total number of atoms of each type needed to make the starting reactants:
   Carbon: Hydrogen: Oxygen:
   (c) Use the atoms you have cut out to make the starting reactants in cellular respiration.
   (d) State the end products of cellular respiration:
   (e) State the total number of atoms of each type needed to make the end products of cellular respiration:
   Carbon: Hydrogen: Oxygen:
   (f) Use the atoms you have cut out to make the end products of cellular respiration.
   (g) Name the end products of cellular respiration that are utilized in photosynthesis:

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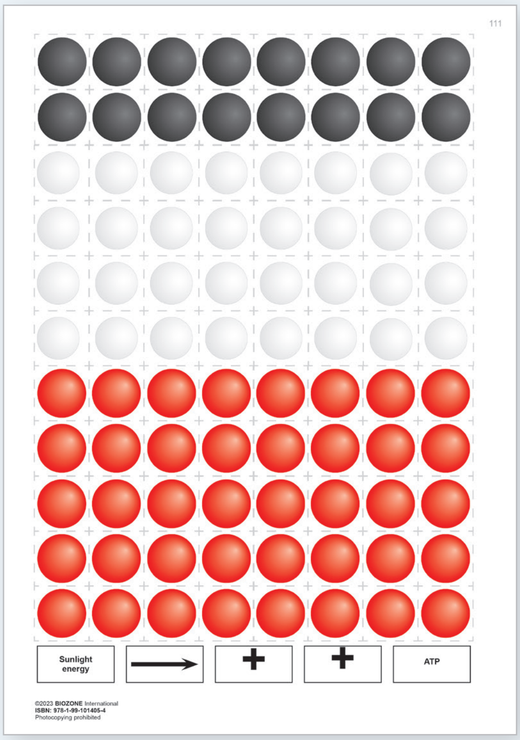
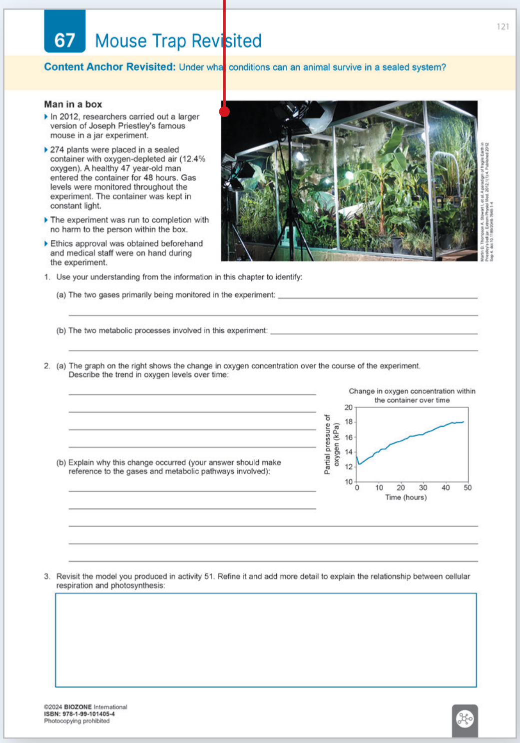


9 Revisiting the content anchor at the end of the chapter provides an opportunity to evaluate student understanding of the material covered. Students should be able to fully explain the content anchor when they revisit it.

10 Evaluate student understanding of the content using the summing up task at the end of the chapter.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67 Mouse Trap Revisited

Content Anchor Revisited: Under what conditions can an animal survive in a sealed system?

Man in a box

- In 2012, researchers carried out a larger version of Joseph Priestley's famous mouse in a jar experiment.
- 274 plants were placed in a sealed container with oxygen-depleted air (12.4% oxygen). A healthy 47 year-old man entered the container for 48 hours. Gas levels were monitored throughout the experiment. The container was kept in constant light.
- The experiment was run to completion with no harm to the person within the box.
- Ethics approval was obtained beforehand and medical staff were on hand during the experiment.

1. Use your understanding from the information in this chapter to identify:
   (a) The two gases primarily being monitored in the experiment:
   (b) The two metabolic processes involved in this experiment:
2. (a) The graph on the right shows the change in oxygen concentration over the course of the experiment. Describe the trend in oxygen levels over time:
   (b) Explain why this change occurred (your answer should make reference to the gases and metabolic pathways involved):

Change in oxygen concentration within the container over time
Partial pressure of oxygen (kPa); Time (hours)

3. Revisit the model you produced in activity 51. Refine it and add more detail to explain the relationship between cellular respiration and photosynthesis:

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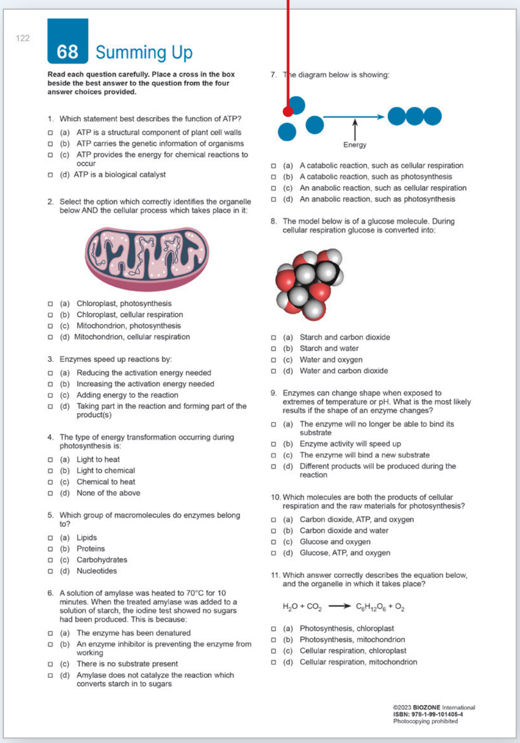
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68 Summing Up

Read each question carefully. Place a cross in the box beside the best answer to the question from the four answer choices provided.

1. Which statement best describes the function of ATP?
   (a) ATP is a structural component of plant cell walls
   (b) ATP carries the genetic information of organisms
   (c) ATP provides the energy for chemical reactions to occur
   (d) ATP is a biological catalyst
2. Select the option which correctly identifies the organelle below AND the cellular process which takes place in it:
   (a) Chloroplast, photosynthesis
   (b) Chloroplast, cellular respiration
   (c) Mitochondrion, photosynthesis
   (d) Mitochondrion, cellular respiration
3. Enzymes speed up reactions by:
   (a) Reducing the activation energy needed
   (b) Increasing the activation energy needed
   (c) Adding energy to the reaction
   (d) Taking part in the reaction and forming part of the product(s)
4. The type of energy transformation occurring during photosynthesis is:
   (a) Light to heat
   (b) Light to chemical
   (c) Chemical to heat
   (d) None of the above
5. Which group of macromolecules do enzymes belong to?
   (a) Lipids
   (b) Proteins
   (c) Carbohydrates
   (d) Nucleotides
6. A solution of amylase was heated to 70°C for 10 minutes. When the treated amylase was added to a solution of starch, the iodine test showed no sugars had been produced. This is because:
   (a) The enzyme has been denatured
   (b) An enzyme inhibitor is preventing the enzyme from working
   (c) There is no substrate present
   (d) Amylase does not catalyze the reaction which converts starch in to sugars
7. The diagram below is showing:
   Energy
   (a) A catabolic reaction, such as cellular respiration
   (b) A catabolic reaction, such as photosynthesis
   (c) An anabolic reaction, such as cellular respiration
   (d) An anabolic reaction, such as photosynthesis
8. The model below is of a glucose molecule. During cellular respiration glucose is converted into:
   (a) Starch and carbon dioxide
   (b) Starch and water
   (c) Water and oxygen
   (d) Water and carbon dioxide
9. Enzymes can change shape when exposed to extremes of temperature or pH. What is the most likely results if the shape of an enzyme changes?
   (a) The enzyme will no longer be able to bind its substrate
   (b) Enzyme activity will speed up
   (c) The enzyme will bind a new substrate
   (d) Different products will be produced during the reaction
10. Which molecules are both the products of cellular respiration and the raw materials for photosynthesis?
   (a) Carbon dioxide, ATP, and oxygen
   (b) Carbon dioxide and water
   (c) Glucose and oxygen
   (d) Glucose, ATP, and oxygen
11. Which answer correctly describes the equation below, and the organelle in which it takes place?
   $H_2O + CO_2 \longrightarrow C_6H_{12}O_6 + O_2$
   (a) Photosynthesis, chloroplast
   (b) Photosynthesis, mitochondrion
   (c) Cellular respiration, chloroplast
   (d) Cellular respiration, mitochondrion

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Practical Investigations

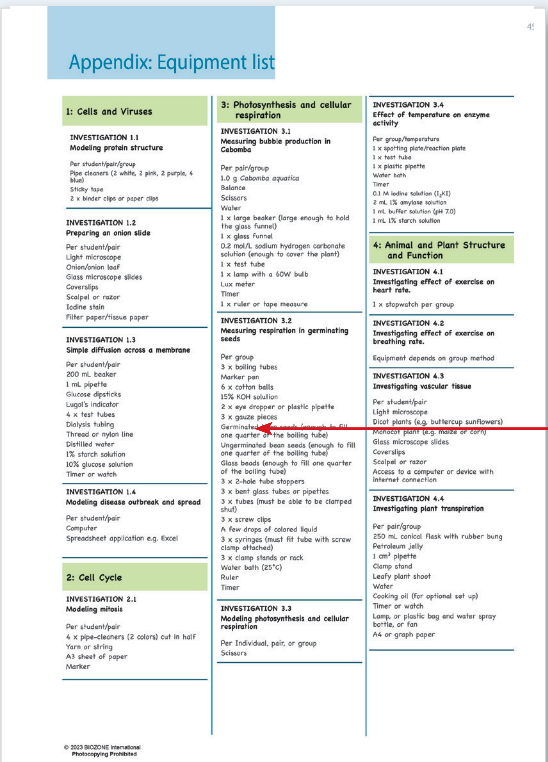
Throughout *Biology for Texas*, students are given opportunities to explore through investigations. These are opportunities for students to develop competency in laboratory procedures, to practice and refine skills in observation and analysis, and to manipulate data. Some investigations act as stimulus material, while others require students to take what they have already learned and apply their knowledge to a more complex scenario. Investigations can take several forms, including paper practicals, modeling activities, and wet lab experiments.

The investigations provide an excellent opportunity for collaborative work and will stimulate discussion and the sharing of ideas. You may wish to pair students of different abilities. Confident students can guide and encourage less able students and, in this relaxed environment, striving students will be encouraged to share their own observations and thoughts. Collaboration through paired practical work provides an excellent opportunity for English language learners to interact in meaningful ways to extend their English language and scientific vocabulary.

Each investigation is clearly numbered sequentially through the chapter.

Where applicable, the investigations provide students with health and safety information at the start of the investigation.

- Ensure the students read through the procedure fully *before beginning* the investigation.
- Highlight any hazardous steps or important steps where extra care may be required.
- Ensure students have all the equipment assembled and know if there are pinch points in the process. If necessary, have the groups allocate specific people to steps, e.g. timing, collecting samples, recording data or observations etc.



No kits are required for the investigations.

The investigations have been designed using everyday materials and equipment easily found in most high school laboratories.

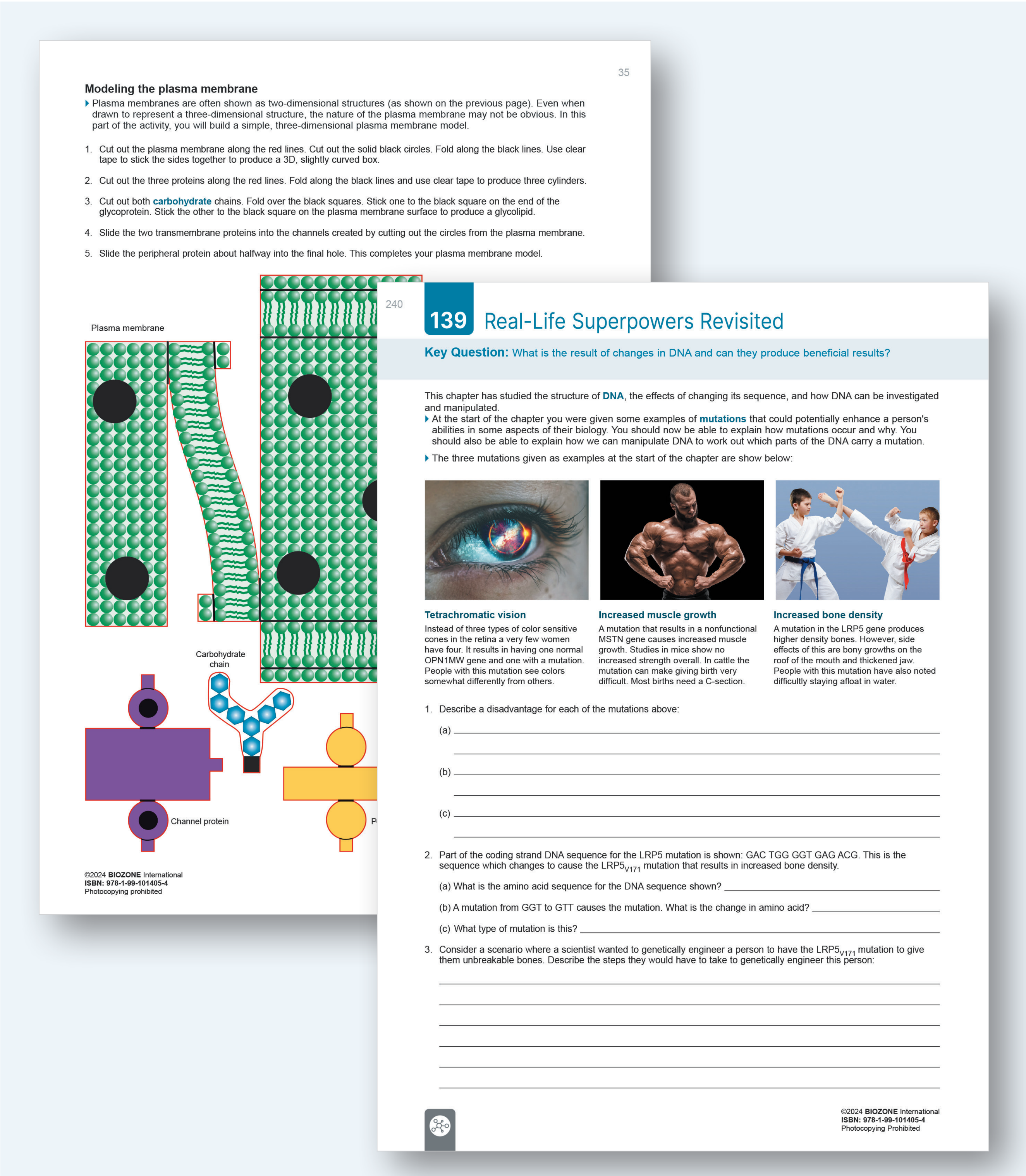
A list of the equipment and chemicals required for each investigation is provided in the back of both Student and Teacher Editions.

Evaluating Student Performance

Biology for Texas provides ample opportunity for students to demonstrate their understanding and proficiency in both the TEKS and ELPS. Opportunities for formative and summative assessment are provided. While most activities require students to record a response, we do not recommend that every question is graded. In most instances, student answers form a record of work for them, allowing them to review their answer within the context of the activity at any time. We recommend teachers are selective about activities, or questions, they choose to review or grade to avoid assessment fatigue. Some suggestions are provided below and on the following page.

FORMATIVE ASSESSMENT

Almost any activity can be chosen as **formative assessment** to determine how a student's knowledge is progressing within a selected topic. However, some activities are more suitable than others for evaluation by grading. We recommend content anchor and revisiting the content anchor activities, and activities with a more complex component, e.g. analyzing data, developing a model, or applying foundation knowledge to a more complex situation, as suitable formative tasks for grading. Teachers can revise instruction, revisit material, or set further tasks if a student is having difficulty with the material.



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Modeling the plasma membrane

- Plasma membranes are often shown as two-dimensional structures (as shown on the previous page). Even when drawn to represent a three-dimensional structure, the nature of the plasma membrane may not be obvious. In this part of the activity, you will build a simple, three-dimensional plasma membrane model.

1. Cut out the plasma membrane along the red lines. Cut out the solid black circles. Fold along the black lines. Use clear tape to stick the sides together to produce a 3D, slightly curved box.
2. Cut out the three proteins along the red lines. Fold along the black lines and use clear tape to produce three cylinders.
3. Cut out both **carbohydrate** chains. Fold over the black squares. Stick one to the black square on the end of the glycoprotein. Stick the other to the black square on the plasma membrane surface to produce a glycolipid.
4. Slide the two transmembrane proteins into the channels created by cutting out the circles from the plasma membrane.
5. Slide the peripheral protein about halfway into the final hole. This completes your plasma membrane model.

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139 Real-Life Superpowers Revisited

Key Question: What is the result of changes in DNA and can they produce beneficial results?

This chapter has studied the structure of **DNA**, the effects of changing its sequence, and how DNA can be investigated and manipulated.

- At the start of the chapter you were given some examples of **mutations** that could potentially enhance a person's abilities in some aspects of their biology. You should now be able to explain how mutations occur and why. You should also be able to explain how we can manipulate DNA to work out which parts of the DNA carry a mutation.
- The three mutations given as examples at the start of the chapter are show below:

Tetrachromatic vision
Instead of three types of color sensitive cones in the retina a very few women have four. It results in having one normal OPN1MW gene and one with a mutation. People with this mutation see colors somewhat differently from others.

Increased muscle growth
A mutation that results in a nonfunctional MSTN gene causes increased muscle growth. Studies in mice show no increased strength overall. In cattle the mutation can make giving birth very difficult. Most births need a C-section.

Increased bone density
A mutation in the LRP5 gene produces higher density bones. However, side effects of this are bony growths on the roof of the mouth and thickened jaw. People with this mutation have also noted difficultly staying afloat in water.

1. Describe a disadvantage for each of the mutations above:

(a) ______

(b) ______

(c) ______

2. Part of the coding strand DNA sequence for the LRP5 mutation is shown: GAC TGG GGT GAG ACG. This is the sequence which changes to cause the $LRP5_{V171}$ mutation that results in increased bone density.

(a) What is the amino acid sequence for the DNA sequence shown? ______

(b) A mutation from GGT to GTT causes the mutation. What is the change in amino acid? ______

(c) What type of mutation is this? ______

3. Consider a scenario where a scientist wanted to genetically engineer a person to have the $LRP5_{V171}$ mutation to give them unbreakable bones. Describe the steps they would have to take to genetically engineer this person:

______

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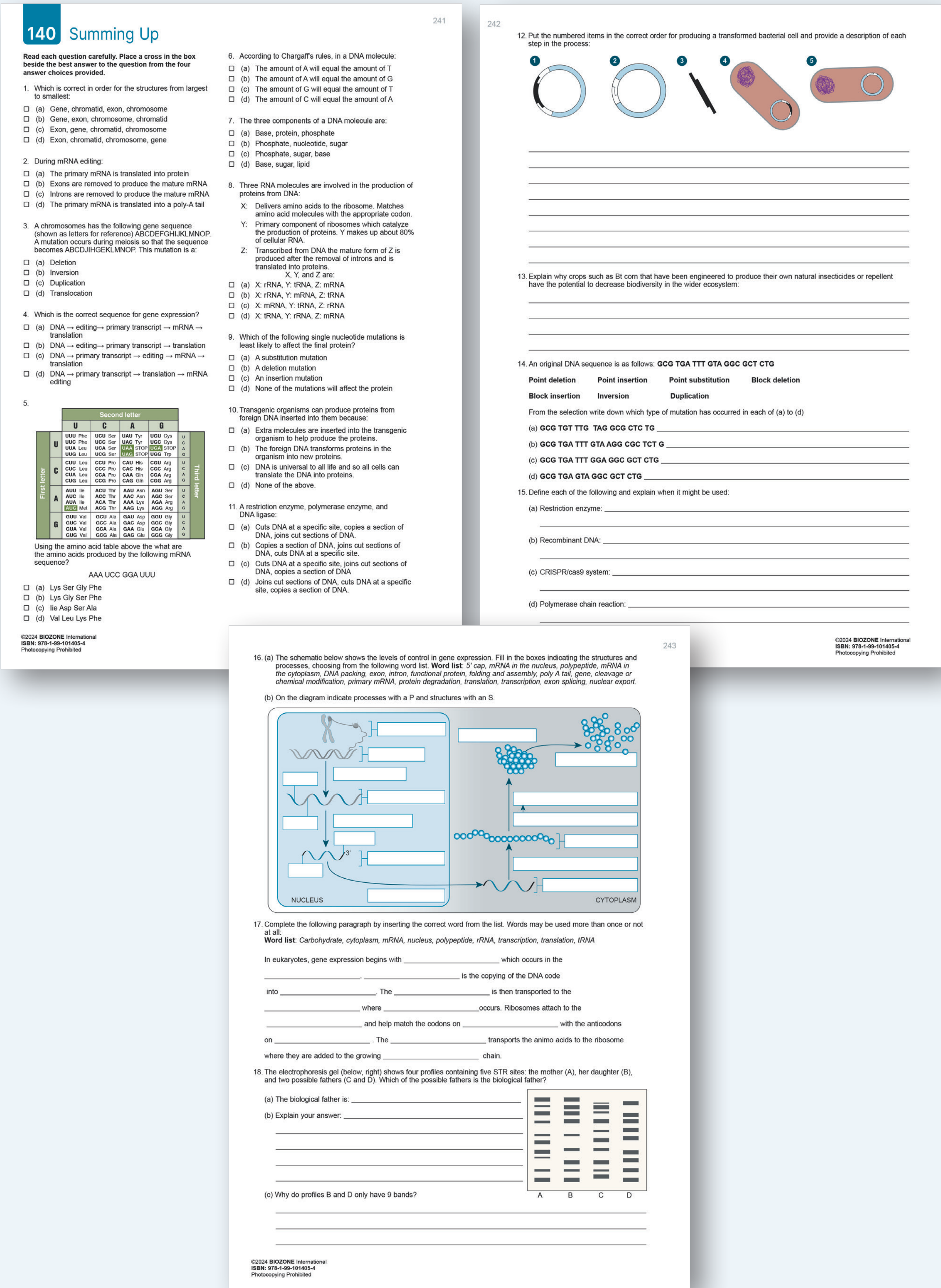
SUMMATIVE ASSESSMENT

Summing up tasks conclude chapters 1-9. They can be used as a formal summative testing moment to evaluate student understanding of the TEKS.



140 Summing Up

Read each question carefully. Place a cross in the box beside the best answer to the question from the four answer choices provided.

1. Which is correct in order for the structures from largest to smallest:
- ☐ (a) Gene, chromatid, exon, chromosome
- ☐ (b) Gene, exon, chromosome, chromatid
- ☐ (c) Exon, gene, chromatid, chromosome
- ☐ (d) Exon, chromatid, chromosome, gene

2. During mRNA editing:
- ☐ (a) The primary mRNA is translated into protein
- ☐ (b) Exons are removed to produce the mature mRNA
- ☐ (c) Introns are removed to produce the mature mRNA
- ☐ (d) The primary mRNA is translated into a poly-A tail

3. A chromosomes has the following gene sequence (shown as letters for reference) ABCDEFGHIJKLMNOP. A mutation occurs during meiosis so that the sequence becomes ABCDJIHGEKLMNOP. This mutation is a:
- ☐ (a) Deletion
- ☐ (b) Inversion
- ☐ (c) Duplication
- ☐ (d) Translocation

4. Which is the correct sequence for gene expression?
- ☐ (a) DNA → editing→ primary transcript → mRNA → translation
- ☐ (b) DNA → editing→ primary transcript → translation
- ☐ (c) DNA → primary transcript → editing → mRNA → translation
- ☐ (d) DNA → primary transcript → translation → mRNA editing

5.

First letter	Second letter: U	C	A	G	Third letter
U	UUU Phe UUC Phe UUA Leu UUG Leu	UCU Ser UCC Ser UCA Ser UCG Ser	UAU Tyr UAC Tyr UAA STOP UAG STOP	UGU Cys UGC Cys UGA STOP UGG Trp	U C A G
C	CUU Leu CUC Leu CUA Leu CUG Leu	CCU Pro CCC Pro CCA Pro CCG Pro	CAU His CAC His CAA Gln CAG Gln	CGU Arg CGC Arg CGA Arg CGG Arg	U C A G
A	AUU Ile AUC Ile AUA Ile AUG Met	ACU Thr ACC Thr ACA Thr ACG Thr	AAU Asn AAC Asn AAA Lys AAG Lys	AGU Ser AGC Ser AGA Arg AGG Arg	U C A G
G	GUU Val GUC Val GUA Val GUG Val	GCU Ala GCC Ala GCA Ala GCG Ala	GAU Asp GAC Asp GAA Glu GAG Glu	GGU Gly GGC Gly GGA Gly GGG Gly	U C A G

Using the amino acid table above the what are the amino acids produced by the following mRNA sequence?

AAA UCC GGA UUU

- ☐ (a) Lys Ser Gly Phe
- ☐ (b) Lys Gly Ser Phe
- ☐ (c) Ile Asp Ser Ala
- ☐ (d) Val Leu Lys Phe

6. According to Chargaff's rules, in a DNA molecule:
- ☐ (a) The amount of A will equal the amount of T
- ☐ (b) The amount of A will equal the amount of G
- ☐ (c) The amount of G will equal the amount of T
- ☐ (d) The amount of C will equal the amount of A

7. The three components of a DNA molecule are:
- ☐ (a) Base, protein, phosphate
- ☐ (b) Phosphate, nucleotide, sugar
- ☐ (c) Phosphate, sugar, base
- ☐ (d) Base, sugar, lipid

8. Three RNA molecules are involved in the production of proteins from DNA:

X: Delivers amino acids to the ribosome. Matches amino acid molecules with the appropriate codon.

Y: Primary component of ribosomes which catalyze the production of proteins. Y makes up about 80% of cellular RNA.

Z: Transcribed from DNA the mature form of Z is produced after the removal of introns and is translated into proteins.

X, Y, and Z are:
- ☐ (a) X: rRNA, Y: tRNA, Z: mRNA
- ☐ (b) X: rRNA, Y: mRNA, Z: tRNA
- ☐ (c) X: mRNA, Y: tRNA, Z: rRNA
- ☐ (d) X: tRNA, Y: rRNA, Z: mRNA

9. Which of the following single nucleotide mutations is least likely to affect the final protein?
- ☐ (a) A substitution mutation
- ☐ (b) A deletion mutation
- ☐ (c) An insertion mutation
- ☐ (d) None of the mutations will affect the protein

10. Transgenic organisms can produce proteins from foreign DNA inserted into them because:
- ☐ (a) Extra molecules are inserted into the transgenic organism to help produce the proteins.
- ☐ (b) The foreign DNA transforms proteins in the organism into new proteins.
- ☐ (c) DNA is universal to all life and so all cells can translate the DNA into proteins.
- ☐ (d) None of the above.

11. A restriction enzyme, polymerase enzyme, and DNA ligase:
- ☐ (a) Cuts DNA at a specific site, copies a section of DNA, joins cut sections of DNA.
- ☐ (b) Copies a section of DNA, joins cut sections of DNA, cuts DNA at a specific site.
- ☐ (c) Cuts DNA at a specific site, joins cut sections of DNA, copies a section of DNA
- ☐ (d) Joins cut sections of DNA, cuts DNA at a specific site, copies a section of DNA.

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12. Put the numbered items in the correct order for producing a transformed bacterial cell and provide a description of each step in the process:

13. Explain why crops such as Bt corn that have been engineered to produce their own natural insecticides or repellent have the potential to decrease biodiversity in the wider ecosystem:

14. An original DNA sequence is as follows: **GCG TGA TTT GTA GGC GCT CTG**

Point deletion **Point insertion** **Point substitution** **Block deletion**

Block insertion **Inversion** **Duplication**

From the selection write down which type of mutation has occurred in each of (a) to (d)

(a) **GCG TGT TTG TAG GCG CTC TG** ______

(b) **GCG TGA TTT GTA AGG CGC TCT G** ______

(c) **GCG TGA TTT GGA GGC GCT CTG** ______

(d) **GCG TGA GTA GGC GCT CTG** ______

15. Define each of the following and explain when it might be used:

(a) Restriction enzyme: ______

(b) Recombinant DNA: ______

(c) CRISPR/cas9 system: ______

(d) Polymerase chain reaction: ______

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16. (a) The schematic below shows the levels of control in gene expression. Fill in the boxes indicating the structures and processes, choosing from the following word list. **Word list**: *5' cap, mRNA in the nucleus, polypeptide, mRNA in the cytoplasm, DNA packing, exon, intron, functional protein, folding and assembly, poly A tail, gene, cleavage or chemical modification, primary mRNA, protein degradation, translation, transcription, exon splicing, nuclear export.*

(b) On the diagram indicate processes with a P and structures with an S.

17. Complete the following paragraph by inserting the correct word from the list. Words may be used more than once or not at all:
Word list: *Carbohydrate, cytoplasm, mRNA, nucleus, polypeptide, rRNA, transcription, translation, tRNA*

In eukaryotes, gene expression begins with ______ which occurs in the ______. ______ is the copying of the DNA code into ______. The ______ is then transported to the ______ where ______ occurs. Ribosomes attach to the ______ and help match the codons on ______ with the anticodons on ______. The ______ transports the animo acids to the ribosome where they are added to the growing ______ chain.

18. The electrophoresis gel (below, right) shows four profiles containing five STR sites: the mother (A), her daughter (B), and two possible fathers (C and D). Which of the possible fathers is the biological father?

(a) The biological father is: ______

(b) Explain your answer: ______

(c) Why do profiles B and D only have 9 bands?

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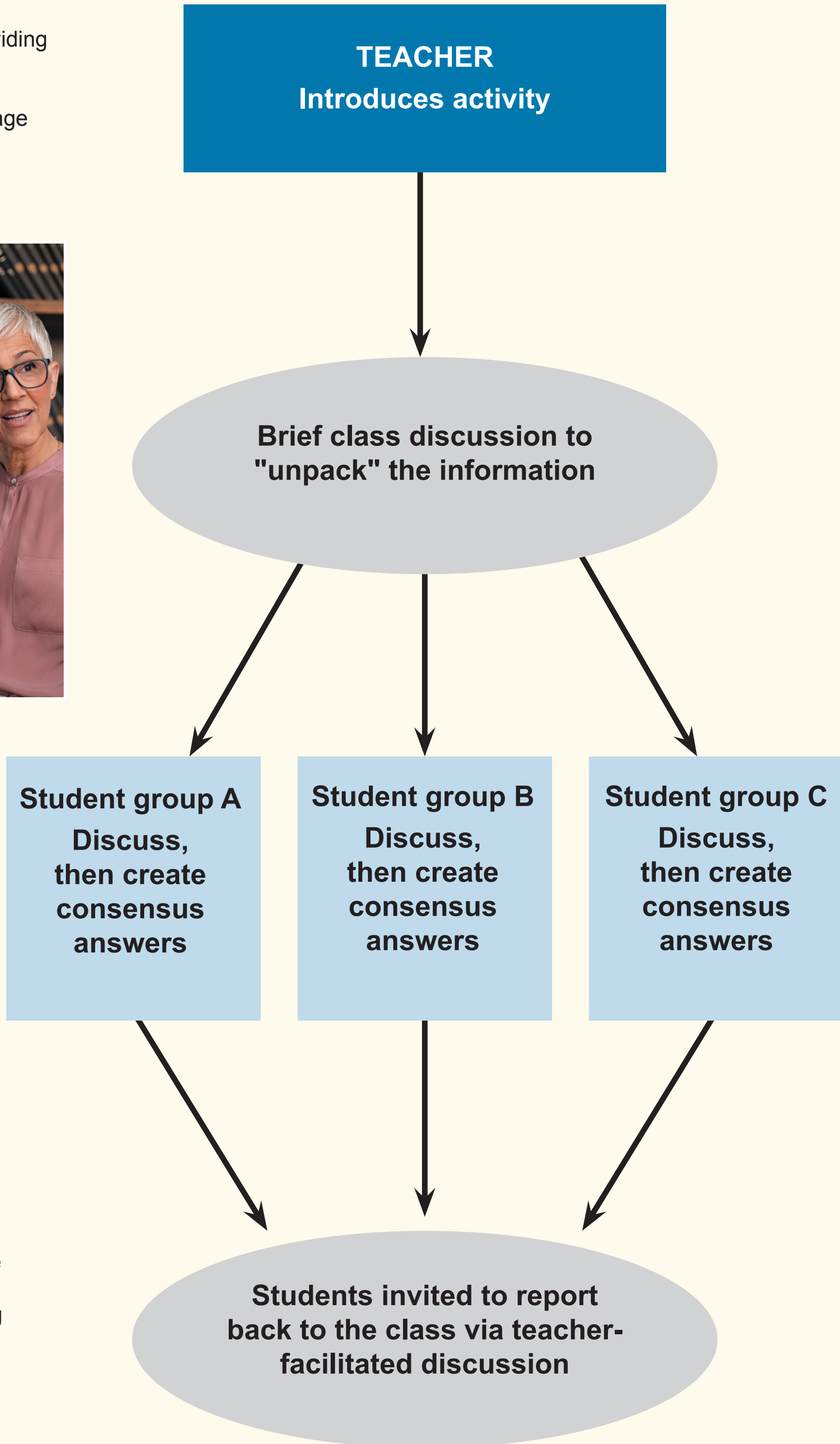
Teaching Strategies for Classroom Use

Achieving effective differential instruction in classes is a teaching challenge. Students naturally have mixed abilities, varying backgrounds in the subject, and different language skills. Used effectively, BIOZONE's student worktexts and supporting resources can make teaching a mixed ability class easier. Here, we suggest some approaches for differential instruction.

Making a start

Regardless of which activity you might be attempting in class, a short introduction to the task by the teacher is a useful orientation for all students. For collaborative work, the teacher can then divide the class into appropriate groups, each with a balance of able and less able students. Depending on the activity, the class may regroup at the end of the lesson for discussion or to present their findings.

The teacher introduces the topic. They provide structure to the session by providing background information and setting up discussion points and clear objectives. Collaboration is emphasized to encourage participation from the entire group. If necessary, students in a group can be assigned specific tasks.



Students work in small groups so that everyone's contribution is heard. They collaborate, share ideas, and engage in discourse. The emphasis is on discussing questions and formulating a consensus answer (or not), not just sharing ideas.

At the end of the session, students report back on their findings. Each student should have enough knowledge to report back on the group's findings. Reporting consists primarily of providing answers to questions, but may involve presenting a report, model, or slide show, or contributing to a debate.

Using collaboration to maximize learning outcomes

- The structure of *Biology for Texas* allows for a flexible approach to unpacking the content with your students.
- The content can be delivered in a way to support collaboration, where students work in small groups to share ideas and information to answer and gain a better understanding of a topic, or design a solution to a problem.
- By working together to ask questions and evaluate each other's ideas, students maximize their own and each other's learning opportunities. They are exposed to ideas and perspectives they may not have come up with on their own.
- Collaboration, listening to others, and voicing their own ideas is valuable for supporting English language learners and developing their English and scientific vocabularies.
- Use a short, informal, collaborative learning session to encourage students to exchange ideas about the answer to a question. Alternatively, collaboration may take a more formal role that lasts for a longer period of time, e.g. assign groups to work together for a practical activity, to research an extension question, or design a solution to a problem.

Peer to peer collaboration and support

- Peer-to-peer learning is emphasized throughout the worktext, and is particularly valuable for more challenging activities in which the content is more complex or the questions require students to draw on several areas of their knowledge to solve a problem.
- Stronger students can assist their peers and both groups benefit from verbalizing their ideas. Students for whom English is an additional language can ask their classmates to explain unfamiliar terms and this benefits the understanding of both parties.
- BIOZONE's *Biology for Texas* uses the TEKS framework to develop student understanding by providing a range of activities. These include encouraging students to think about and share what they already know and then build on this knowledge by exploring and explaining phenomena in a more formal role that lasts for a longer period of time, e.g. assign groups to work together for a practical activity, to research an extension question, or design a solution to a problem.

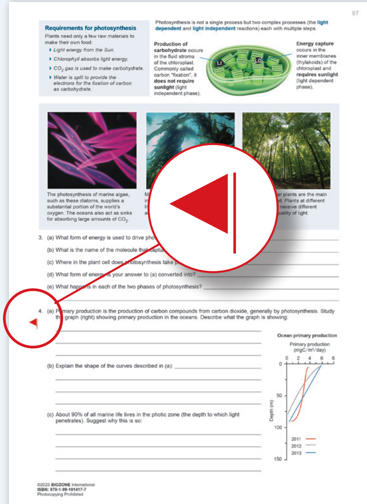
Student A is capable. He helps to lead the discussion and records the discussion in a structured way.

Students B and C are also capable but less willing to lead discussion. They will add ideas to the discussion but need a little direction from A to do so.

Student D is less able but gains ideas and understanding from the discussion of students A, B, and C. She may add to the discussion as she gains confidence in the material being studied.

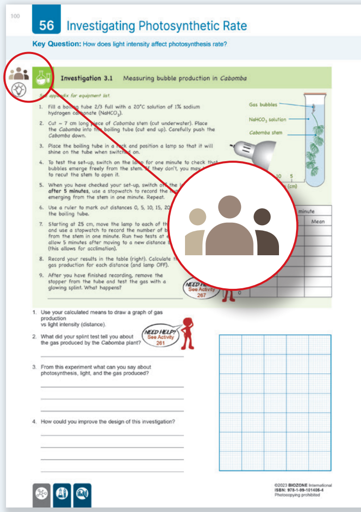
Differentiated Learning

The structure of *Biology for Texas* promotes differentiated instruction and has been designed to cater for students of all abilities. BIOZONE's collaborative approach to science inquiry encourages students of all abilities to share ideas and knowledge with their peers while, at the same time, broadening their own understanding. There are several ways you can utilize the tools in *Biology for Texas* to support differential instruction in your classroom:

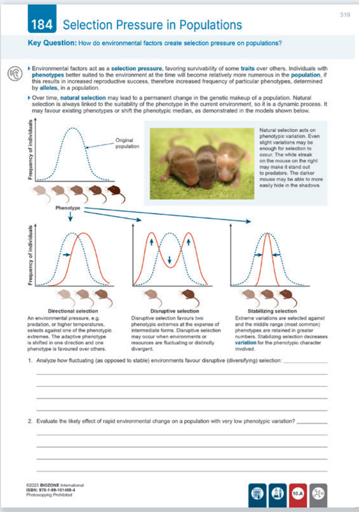


Extension Questions: Red flag icons beside a section or question (on the Teacher's Edition) indicate that the material is suitable for extending more able students. Other students can attempt the material too, but they may need extra guidance from the teacher. **Resource Hub extension**: Some material on the **Resource Hub** is tagged as extension material.

Need Help? Icon: The red NEED HELP? icon identifies where material is available in the Science Practices chapter to support a particular Scientific and Engineering Practice. Set these activities as a refresher before the students attempt the activity that requires the skill. Encourage students to refer to the Science Practices chapter often.

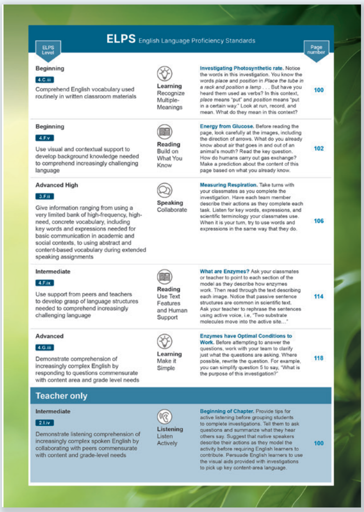


Collaboration Icon: A group symbol indicates where students can work together. Group work provides opportunities for student collaboration and peer-to-peer support to explore or develop Scientific and Engineering Practices. Working in groups, students benefit from collaboration. By speaking and listening to each other, communication skills and scientific vocabulary are extended.



Resource Hub: BIOZONE's **Resource Hub** supports learners of all abilities and also provides teacher support materials (CG5). Use the videos, games, and animations to help striving learners with their understanding of content. Some material is specifically tagged for students needing extension, or for teachers.

Glossary: Glossaries have been provided to help improve scientific literacy. Encourage students to refer to the glossary whenever they are unsure about the meaning of a key term. Key terms are identified by **bold blue text**. The glossary is provided in both English and Spanish (CG26).

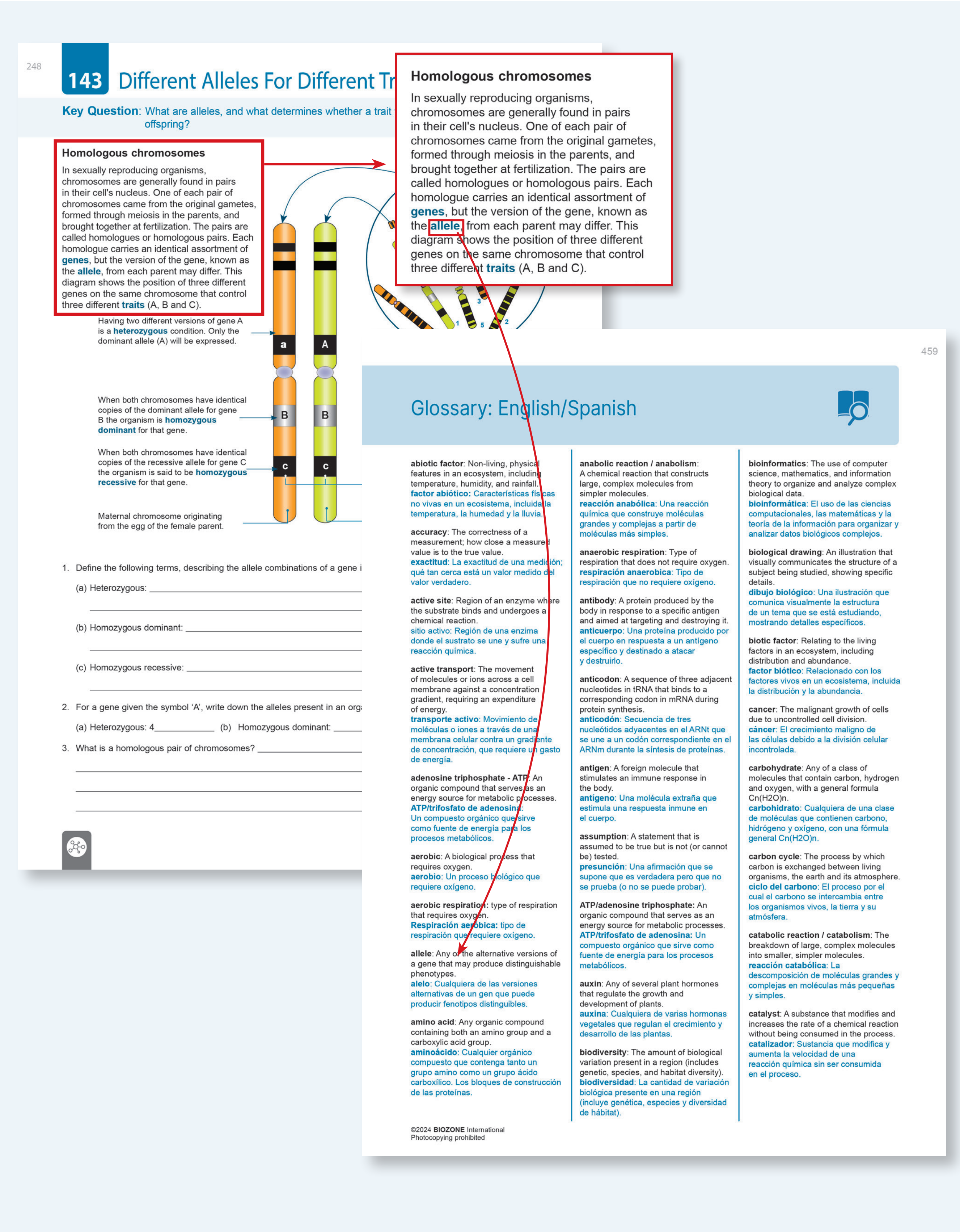


ELPS: Four levels of ELPS differentiation are provided to support learners with differing backgrounds and levels of English language proficiency. Select the level (beginning, intermediate, advanced, or advanced high) to support students to connect with, and successfully use this resource, whilst building confidence in their English language skills.

Glossary

BIOZONE has several support mechanisms in place to support the development of language skills, including support for English Language Learners (ELLs) in your classroom. A **glossary** of important key terms is provided in English and Spanish. In the digital versions of the worktext, **text to speech** (read aloud) and **translation** functions will be available to support ELLs in their learning journey. More information on these features is provided below.

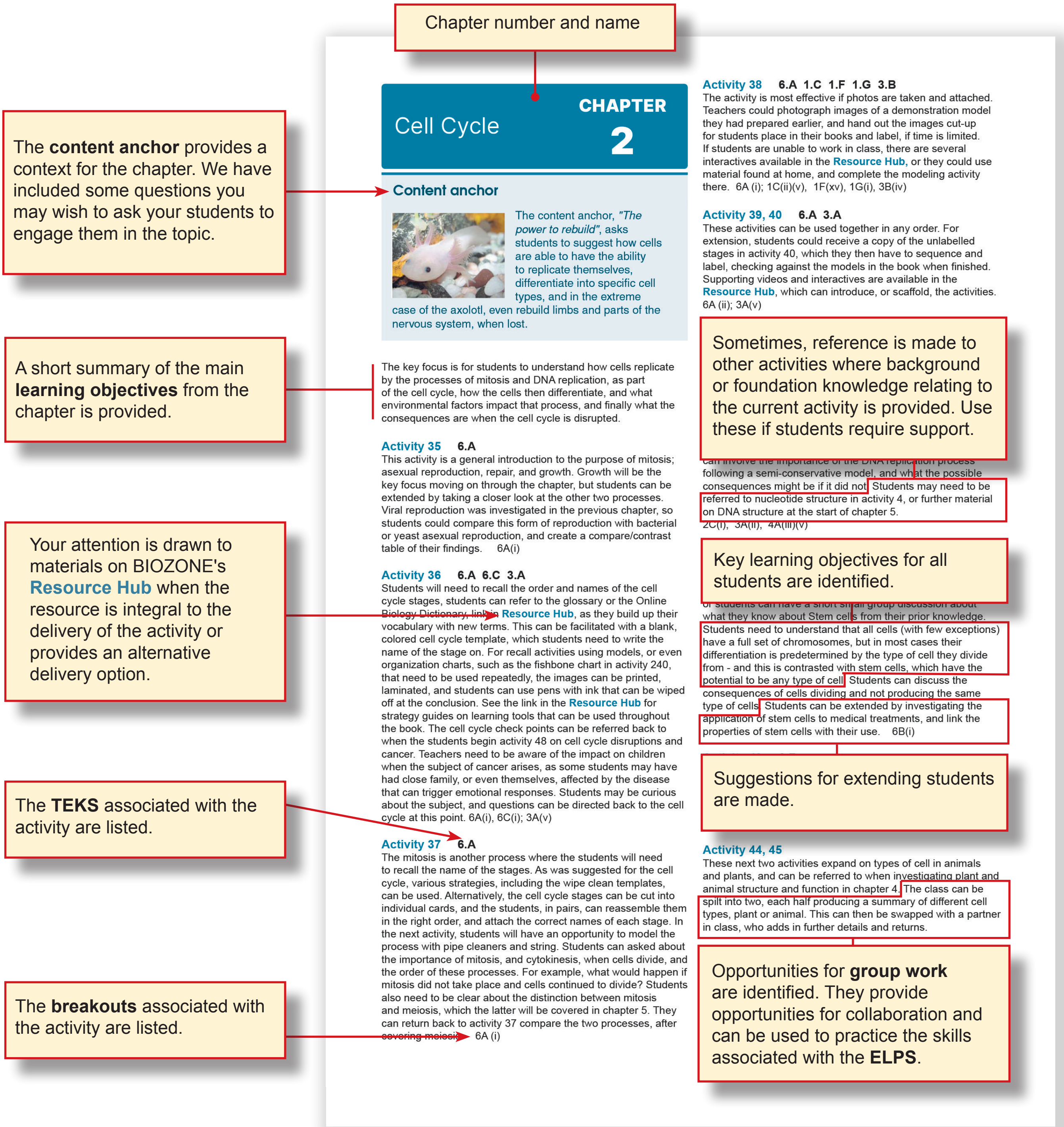
Encourage all students to use the **glossary** to build scientific literacy and become comfortable with using the terms appropriately. Key terms, which have been **blue bolded** within an activity, are included in the glossary. Key terms are only bolded the first time they appear within an activity.



An Introduction to the Teacher's Notes

Extended teacher's notes are found on pages (CG28-CG45) of the Teacher's Edition and Digital Teacher's Edition of *Biology for Texas*. The learning points of the teacher's notes match point for point those in the student edition for easy use. These notes provide context for the material and additional detail for the learning points. Where appropriate, opportunities to incorporate group work or practical activities are explained. Suggestions for differentiated instruction are provided, including ways to support striving learners and to extend able students. The TEKS associated with each activity are clearly identified within the teacher notes for quick and easy reference.

Most activities are supported by material on **BIOZONE's Resource Hub**. The **Resource Hub** provides access to a large collection of free resources to supplement your teaching. They are identified with a hub icon on the first page of an activity in both the Student Edition and Teacher's Edition. Where the resource is integral to the delivery of the activity, e.g. online data sets, computer simulations, or spreadsheets, we have indicated this in the teacher's notes.



Cell Cycle CHAPTER 2

Content anchor

The content anchor, *"The power to rebuild"*, asks students to suggest how cells are able to have the ability to replicate themselves, differentiate into specific cell types, and in the extreme case of the axolotl, even rebuild limbs and parts of the nervous system, when lost.

The key focus is for students to understand how cells replicate by the processes of mitosis and DNA replication, as part of the cell cycle, how the cells then differentiate, and what environmental factors impact that process, and finally what the consequences are when the cell cycle is disrupted.

Activity 35 6.A
This activity is a general introduction to the purpose of mitosis; asexual reproduction, repair, and growth. Growth will be the key focus moving on through the chapter, but students can be extended by taking a closer look at the other two processes. Viral reproduction was investigated in the previous chapter, so students could compare this form of reproduction with bacterial or yeast asexual reproduction, and create a compare/contrast table of their findings. 6A(i)

Activity 36 6.A 6.C 3.A
Students will need to recall the order and names of the cell cycle stages, students can refer to the glossary or the Online Biology Dictionary, link in **Resource Hub**, as they build up their vocabulary with new terms. This can be facilitated with a blank, colored cell cycle template, which students need to write the name of the stage on. For recall activities using models, or even organization charts, such as the fishbone chart in activity 240, that need to be used repeatedly, the images can be printed, laminated, and students can use pens with ink that can be wiped off at the conclusion. See the link in the **Resource Hub** for strategy guides on learning tools that can be used throughout the book. The cell cycle check points can be referred back to when the students begin activity 48 on cell cycle disruptions and cancer. Teachers need to be aware of the impact on children when the subject of cancer arises, as some students may have had close family, or even themselves, affected by the disease that can trigger emotional responses. Students may be curious about the subject, and questions can be directed back to the cell cycle at this point. 6A(i), 6C(i); 3A(v)

Activity 37 6.A
The mitosis is another process where the students will need to recall the name of the stages. As was suggested for the cell cycle, various strategies, including the wipe clean templates, can be used. Alternatively, the cell cycle stages can be cut into individual cards, and the students, in pairs, can reassemble them in the right order, and attach the correct names of each stage. In the next activity, students will have an opportunity to model the process with pipe cleaners and string. Students can asked about the importance of mitosis, and cytokinesis, when cells divide, and the order of these processes. For example, what would happen if mitosis did not take place and cells continued to divide? Students also need to be clear about the distinction between mitosis and meiosis, which the latter will be covered in chapter 5. They can return back to activity 37 compare the two processes, after covering meiosis. 6A (i)

Activity 38 6.A 1.C 1.F 1.G 3.B
The activity is most effective if photos are taken and attached. Teachers could photograph images of a demonstration model they had prepared earlier, and hand out the images cut-up for students place in their books and label, if time is limited. If students are unable to work in class, there are several interactives available in the **Resource Hub**, or they could use material found at home, and complete the modeling activity there. 6A (i); 1C(ii)(v), 1F(xv), 1G(i), 3B(iv)

Activity 39, 40 6.A 3.A
These activities can be used together in any order. For extension, students could receive a copy of the unlabelled stages in activity 40, which they then have to sequence and label, checking against the models in the book when finished. Supporting videos and interactives are available in the **Resource Hub**, which can introduce, or scaffold, the activities. 6A (ii); 3A(v)

... following a semi-conservative model, and what the possible consequences might be if it did not. Students may need to be referred to nucleotide structure in activity 4, or further material on DNA structure at the start of chapter 5.
2C(i), 3A(ii), 4A(iii)(v)

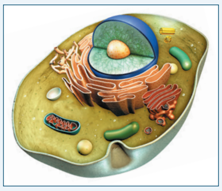
... what they know about Stem cells from their prior knowledge. Students need to understand that all cells (with few exceptions) have a full set of chromosomes, but in most cases their differentiation is predetermined by the type of cell they divide from - and this is contrasted with stem cells, which have the potential to be any type of cell. Students can discuss the consequences of cells dividing and not producing the same type of cells. Students can be extended by investigating the application of stem cells to medical treatments, and link the properties of stem cells with their use. 6B(i)

Activity 44, 45
These next two activities expand on types of cell in animals and plants, and can be referred to when investigating plant and animal structure and function in chapter 4. The class can be split into two, each half producing a summary of different cell types, plant or animal. This can then be swapped with a partner in class, who adds in further details and returns.

Teacher's Notes

Cells and Viruses — CHAPTER 1

Content anchor



The content anchor, *"Are sponges animals?"*, asks students to consider what evidence might be found at a cellular level to classify organisms? In revisiting this activity, students apply their learning about the structure of viruses, and prokaryote and eukaryote cells, to answer the question.

In this chapter, the key focus is for students to understand the key structural and functional differences of cells and viruses. Students' prior knowledge of basic cell structure from earlier grades can now be applied to understand cellular biomolecules, and explain eukaryote complexity, cellular transport, and comparisons with viruses.

Activity 2 5.A

This activity can be used as a reference page for summarizing biomolecules. Students should take away an understanding of the importance of key biomolecules in cellular structure and function. Prior knowledge of atomic and molecular structure would be an advantage, and teachers could provide background information and definitions if required. For interested students, use a periodic table to locate the key elements in biomolecules. 5A(i)(ii)(iii)(iv)(v)(vi)(vii)(viii)

Activity 3 5.A

This activity could be considered information heavy by some students. Students could work in small 'expert groups' to research one of the polysaccharides in more detail, then return to a larger group to share their findings. Emphasis should be on how the biomolecule contributes to the structure and function of the cell, rather than just the structure and function of the biomolecule. Students can be extended by taking a deeper look at how different organisms work together symbiotically to break down the cellulose in plant cell walls.
5A(i)(v)

Activity 4 5.A

This activity provides a brief introduction to nucleic acids, and is unpacked further in chapter 5. Encourage students to refer back to this introductory activity when needed. For extension, students can compare and contrast DNA and RNA, and explore the different cells and organisms that contain each type of nucleic acid. Although the ATP molecule (another type of nucleic acid) is covered in activity 53, it could be introduced here at the teacher's discretion.
5A(iv)(viii)

Activity 5,6 5.A 1.G 3.A

This introductory activity requires students to identify that amino acids link together to form proteins. Students should understand that globular and fibrous proteins have different functions. The role of proteins is explored further in the following activities. Teachers could make amino acid cards, which the students can link together to make particular proteins or, more correctly, polypeptide chains, the precursor to proteins. Provide the name of the amino acid, and a 'recipe' for particular chains, that the students need to construct. For extension, chemistry minded students can take a closer look at the condensation reaction that links the amino acids. The investigation in activity 6 provides a hands-on opportunity to model how polypeptide chains fold into functional proteins. Students can annotate the notes with examples of the different protein structure types.
5A (iii)(vii); 1G(i)(ii), 3A(iv)(v)(xi)

Activity 7 5.A 1.G

This cut and match activity uses specific protein examples to reinforce that different proteins have different functions. In an alternative use of the activity, students can cut and glue correct squares back-to-back to create a flip card set for revision, or to test each other in pairs. For any card type resources made by students, a zip-lock type plastic bag can be stapled to the back cover of the worktext, and cards placed inside for storage.
5A(iii)(vii); 1G(ii)

Activity 8 5.A 3.A

Lipids are discussed more fully in the context of the cell membrane later in the chapter. Students may need some support interpreting the organic chemical drawing to understand the shorthand used for the carbon-hydrogen chain and the atoms involved in the ester bond. Like the condensation reaction for polypeptide chain reaction (activity 6), some students can be extended by looking further into the hydrolysis reaction that breaks apart the ester bonds in the triglycerides. Soap making is an engaging activity that could be carried out, if time permits.
5A(ii)(vi); 3A(iv)

Activity 9 4.B

The next section on cell structure is introduced with historical developments of the microscope. A number of supporting materials, including short videos and an interactive on van Leeuwenhoek, can be found in the **Resource Hub**. Protists are also introduced in this activity. An extension activity could involve researching one or more examples and comparing/contrasting the cellular features of each.
For extension, students can build on their prior knowledge of cell theory, in particular researching the contributions of Schleiden, Schwann, and Virchow. Individually or in pairs, students can research the work of the scientists involved in furthering our understanding of cell theory and microscopes, and could include reference to who influenced their work. Alternatively, they can collate the information from the class and create a timeline using an online programme. 4B(iii)(iv)(vi)

Activity 10 2.C

Most students will have previous experience in using microscopes but they will all still benefit from a demonstration of correct use. This activity can include a practical component where students look at hair strands, pre-prepared slides, or even small living protists (if teachers have access to samples of pond or drain water). Some students may need support with magnification calculations: the teacher could project the first example onto the board, and work through it step-by-step. There is a link to a virtual microscope lab in the **Resource Hub** for those students unable to access a lab.
2C(i)

Activity 11 1.B 1.C 1.D 1.F

For best results, the teacher could demonstrate the onion slide investigation step-by-step before students begin. Alternatively, a video in the **Resource Hub** shows the procedure. Pre-prepared slides of animal cells can be provided so that students can compare the two types of cells. The lesson can be extended by asking students to make a scientific drawing on a piece of paper, labeling any key structures and including a scale and magnification value for their onion cell sample. Refer to ch10, p449, for guidance on biological drawings.
1B(iv), 1C(i)(iv), 1D(i), 1F(xiv)

Activity 12 4.B

Students return to the history of science and explore the work of Louis Pasteur and Robert Koch in the role of advancing microbiology and germ theory. Students have been asked to research both further, but this could be scaffolded by the teacher preparing an exemplar for one of the scientists, or creating template sheets for students to complete. These methods can apply to all areas of this worktext that require 'essay-type' answers. The range of literacy abilities and level of English language proficiency will vary: advanced learners can plan and write their own essays independently, whereas fill-in-the-blank cloze essays are more suitable for beginners. For those in between, you can supply a list of keywords, an exemplar, or provide an outline template.
4B(ii)(iii)(iv)(v)(vi)(vii)(ix)(xi)(xii)

Activity 13 5.B 5.D

The reference schematic encourages students to start thinking about how different cell types are related to each other, and how they are classified. Alternatively, supply small groups with a set of cards, each with a different type of cell or virus on. Students can arrange them on a large, blank piece of paper, adding connections between them for classification. Ask the groups to provide a justification for their choices. For cellular requirements, teachers can provide the three headings to students and they can work in groups to share ideas, which can then be collated as a class, before checking against the list in the activity.
5B(i)(ii), 5D(i)

Activity 14,15, 16 5.B 3.A

The order of these activities is flexible. You may wish to complete the general comparison (activity 16) first, followed by the more detailed activities (14 and 15). An alternative approach is to split the class so that half researches prokaryotes, while the other half researches eukaryotes. The students can then be placed into pairs, one from each group, and can share their expertise, completing the comparison activity together.
5B(i)(ii); 3A(iv)

Activity 17 5.B 5.D 2.B 2.C

Students may need some support with the conversions. We suggest completing a worked example on the board first. The scale lines can be drawn on the edge of a piece of paper and held up against the specimen to make measuring easier. The log scale may need some explanation to students, asking what the advantages might be in its use. You can refer to activity 254, p432, in ch10 as background. You could project a log scale on the board, and encourage students to come up and write on where their measurements and specimens fit onto it.
5B(ii), 5D(i); 2B(ii), 2C(i)

Activity 18 5.B

The lesson could start with an engagement video from the **Resource Hub**. Deeper investigation of cyanobacteria or slime mold life cycles is also possible. Like many questions in the worktext, these can be completed individually, or in small groups and shared or reviewed with the class. As this is the final activity on comparing cells, students could make a summary poster or chart for revision.
5B(i)

Activity 19 5.B 1.G 1.H 3A 4.A

The activity is information rich, and can be broken up with **Resource Hub** videos, or group discussions. The sequencing on the first page can be broken down into a series by making cards that small groups of students can place in sequential order of occurrence, with justification. When answering question 3, focus the students on the skills of paraphrasing and outlining/summarizing, helping them understand that first they must read the information provided, then rewrite in words they would typically use, not just copy the text provided. Ideally, teachers could have posters of common scientific terminology, such as theory, hypothesis, and scientific law, on the classroom walls, that students can refer back to when needed. Chloroplast and mitochondria structure are covered in activity 52.
5B(iii); 1G(ii), 1H(i), 3A(iv), 4A(ii)(vi)

Activity 20 5.C 1.G 4.A

Students can use multiple means of demonstrating membrane structure, including the cut-out model provided and the 3D images and videos in the **Resource Hub**. You may wish to assign the freeze-fracture comprehension activity to more capable students. For delivery to the whole class, each step could be assigned to a small group, to simplify into their own words, then share with the class. Students may need to use the glossary, or an online search to decipher the language. Students could use a thesaurus to select alternative terms. These guidelines can be used in any activity with dense and complex literacy challenges.
5C(i); 1G(i), 4A(viii)

Activity 21, 22 5C 1.B 1.C 1.D 1.E 1.F 2.D 3.A 4.A

These two activities are interchangeable in order. The demonstration in activity 22 can be performed alongside the diffusion lab. Videos demonstrating osmosis and diffusion are in the **Resource Hub**. After completing the practicals, students should explain the process. Emphasis should be on the movement from high to low concentration, and the passive nature of the process. Some students may include selective permeability.
5C(i); 1B(iv), 1C(i)(iv), 1D(i), 1E(ii), 1F(xv), 2D(i), 3A(i)(iv), 4A(iv)

Activity 23, 24, 25 5.A 5.C 3.A

Activity 23 provides a generalized description of active transport. Activity 24 details ion pumps. Students could be extended by looking into the importance of the sodium-ion pump for cellular function. Cellular transport is concluded with an investigation into the process of cytosis. Reference this when students investigate how some viruses enter the cell by endocytosis. Students may want to return to the model of eukaryotic organelles in activity 15 to remind themselves about terminology. A QR code links to a 3D model of the cell.
5A(v), 5C(i); 3A(iv)

Activity 26, 27 5.D 3.A 4.B

Students compare virus types. Viral classification is provided for interest, but students do not need to recall it. Students could construct a chart to compare cells and viruses. Modes of viral replication are provided in activity 27. Teachers can add a sequencing card activity for both the lytic/lysogenic cycles and endocytosis entry.
5D(i)(iii); 3A(v)(iv), 4B(iii)(iv)

Activity 28 - 31 5.D 1.B 1.E 1.F 1.G 2.B 2.D 3.A

Viral disease, transmission, and spread are covered in activities 28-31. Teachers could use the context of COVID-19, provided as a detailed case study in activity 31 for this section. Alternatively, students could apply their own experience with other viral diseases, such as flu, as they work through this material. The spreadsheet modeling disease spread in activity 30 has flexible delivery options. Students can build their own model, or use the pre-made spreadsheet provided in the **Resource Hub** if teachers are short on time.
5D(ii)(iii);1B(iv),1E(i),1F(ii)(vi)(xiii)(xv),1G(i), 2B(ii), 2D(ii),3A(iv)

Cell Cycle

CHAPTER **2**

Content anchor

The content anchor, *"The power to rebuild"*, asks students how cells are able to replicate, differentiate and, in the extreme case of the axolotl, even rebuild limbs and parts of the nervous system.

A key focus is for students to understand the importance of cell replication and the role of the cell cycle in this process. When the checks of this highly regulated process fail, cancerous cells can form. Students should be able to explain cellular differentiation and its ability to lead to many cell types.

Activity 35 6.A

This activity introduces the purpose of mitosis; asexual reproduction, repair, and growth. Growth will be the key focus moving on through the chapter. Extend students by taking a closer look at the other two processes. Viral reproduction was investigated in the previous chapter, so students could compare viral reproduction with bacterial or yeast asexual reproduction, and create a compare/contrast table to show their findings.
6A(i)

Activity 36 6.A 6.C 3.A

Students need to recall the order and names of the stages of the cell cycle. They can refer to the glossary or the Online Biology Dictionary link in the **Resource Hub** as they build their vocabulary with these terms. This can be facilitated with a colored cell cycle template, which students annotate with the stages. Refer back to the cell cycle checkpoints when you cover activity 48, cell cycle disruptions and cancer. Teachers need to be aware of the impact on children when the subject of cancer arises. It could trigger emotional responses if students have had close family, or even themselves, affected by cancer. Students may be curious about the subject, and questions can be directed back to the cell cycle at this point.
Tip: for recall activities using templates or even organization charts, such as the fishbone chart in activity 240, the images can be printed and laminated. Have students use non-permanent markers with ink that can be wiped off so they can be reused. The **Resource Hub** provides strategy guides on learning tools that can be used throughout the worktext.
6A(i), 6C(i); 3A(v)

Activity 37 6.A

Students will need to sequence and name the stages of mitosis. Wipe-clean templates could be used to aid recall. Alternatively, the mitosis stages can be cut into individual cards, and the students can reassemble them in the right order, and name the stage. In activity 38, students use a model which will help with sequencing. Students can ask about the importance of mitosis, and cytokinesis when cells divide, and the order of these processes. For example, what would happen if mitosis did not take place and cells continued to divide? Students also need to be clear about the distinction between mitosis and meiosis; the latter is covered in chapter 5. They can return to activity 37 to compare the two processes after covering meiosis.
6A (i)

Activity 38 6.A 1.C 1.F 1.G 3.B

This model uses pipecleaners and string to reinforce the stages of mitosis. The activity is most effective if photos are taken and attached for recall. If short on time, teachers could photograph images of a demonstration model they prepared earlier, and hand out the individual images for students to place in their books and label. If assigning as homework, provide the material to take home, or there are interactives on the **Resource Hub**.
6A (i); 1C(ii)(v), 1F(xv), 1G(i), 3B(iv)

Activity 39, 40 6.A 3.A

Activity 39 provides an overview of DNA replication and more detail is provided in activity 40. For extension, provide students with an unlabelled copy of stages shown in activity 40. Ask them to sequence and label it, then check it against the models in the worktext. Supporting videos and interactives in the **Resource Hub** can be used to introduce or scaffold the activities.
6A (ii); 3A(v)

Activity 41 2.C 3.A 4.A 4.B

Students simulate Meselson and Stahl's experiment which proved DNA replication is semi-conservative. Use videos in the **Resource Hub** to engage students and set the context of the experiment. Some students may need scaffolding. Project the activity on a board with the first generation completed as a class activity before students attempt the second generation themselves. Extend question 3 by asking students to provide bullet points for their question outline, then attach their full answer to the page. A class discussion can involve the importance of the semi-conservative DNA replication process and what the possible consequences might be if it did not follow this model. Refer students to activity 4 (nucleotide structure), or the DNA structure material in chapter 5 if necessary.
2C(i), 3A(i), 4A(v), 4B(iii)

Activity 42 6.B

Activity 42 covers cell differentiation and environmental influences. Stem cells can be introduced with a short video from the **Resource Hub**, or students can discuss in groups what they already know about stem cells. Students need to understand that all cells (with few exceptions) have a full set of chromosomes, but in most cases their differentiation is predetermined by the type of cell they divide from. Contrast this with stem cells, which have the potential to differentiate into almost any type of cell. Ask students why differentiation is important. Extension could involve students investigating the application of stem cells to medical treatments.
6B(i)

Activity 43 6.B

This activity looks at a specific type of cell differentiation: blood cells. Students can understand the terms totipotent, pluripotent, and multipotent, but do not have to recall the names for various types of blood cells. For extension, these types and their roles in immunity could be investigated further.
6B(i)

Activity 44, 45

These two activities explore the specialization of animal and plant cells. Refer back to these when investigating plant and animal structure and function in chapter 4. The class can be split into two, each summarizing specialization in plants and animal cells. A research component could be included. Summaries can be swapped with a partner in class, who adds further detail and returns it to the original author.

Activity 46 6.B

This activity explores the role of the environment in phenotype. A range of introductory videos are available in the **Resource Hub**, and teachers may choose to focus deeper on one of the case studies in the activity, or cover all for a broad comparison. Note: differentiation here is seen as changes in phenotype NOT genotype. Epigenetics is introduced at a basic level, with its effect on gene expression described in activity 121. The specific mechanism of epigenetics is not required, but extension students may be interested to investigate further.
6B(i)

Activity 47 6.B 1.F 2.B 3.A

Activity 47 uses a case study to observe how environmental influences can affect the genetic material, and how these changes can be passed on to subsequent generations. The data requires 3 plots of line graphs. Refer students to activity 261 in the Science Practices chapter for a refresher on the features of a line graph.
6B(i); 1F(ii), 2B(ii), 3A(ii)

Activity 48 6.C

This activity revisits the checkpoints of the cell cycle, in context of disruptions. The technical terms used in this activity will need to be unpacked. Two key terms all students should be familiar with are tumor suppressor genes (genes that stop cell division), and proto-oncogenes (genes that switch cell division on). Students need to know that mutations to these genes can result in uncontrolled cell division because the cell cycle runs unchecked. Mutation is covered in more detail in activities 128 -130. Be mindful of students who have been impacted by this disease. Apoptosis (programmed cell death) is examined as another process that, if disrupted, leads to uncontrolled cell growth. Students can examine the role of carcinogenic virus examples provided in cancer formation if they want extension.
6C(i)

Photosynthesis and Cellular Respiration

CHAPTER 3

Content anchor

The content anchor, *"Mouse Trap"*, uses the context of a historical experiment, placing a mouse and plant in a bell jar, to unpack the students' prior knowledge of the processes of photosynthesis and cellular respiration.

The key focus is for students to explain how matter is conserved and energy is transferred during the cellular processes of photosynthesis and cellular respiration. This should be demonstrated through chemical equations and models. The role of enzymes in cellular processes are investigated and explained.

Activity 52 11.B

Mitochondria and chloroplasts are integral to cellular respiration and photosynthesis. The information expands on that provided in chapter 1. This activity could be used with activity 19 when covering the endosymbiosis theory if you wish. Models are shown in the book and **Resource Hub**, but it is also useful for the teacher to project images of the structures onto the board, and annotate the features. Some students could be extended by investigating cellular respiration and photosynthesis in prokaryotic cells, again linking to the endosymbiosis theory.
11B(ii)

Activity 53 11.A 3.A

Remind students that ATP is a type of nucleic acid. If you have taught this alongside activity 4, then review ATP now. Classes may have access to molymods (plastic molecular models) that can be useful to build an ATP model and show the reaction to form ADP. Colored blocks, with each color representing a different type of atom can also be used. The convention for atom model colors are: Hydrogen = White, Oxygen = Red, Chlorine = Green, Nitrogen = Blue, Carbon = Black, Sulphur = Yellow, Phosphorus = Orange. The models are a useful way of emphasizing the conservation of matter - where the same number and type of atoms need to be present as both the reactants and products. The **Resource Hub** has material for students wanting to understand the law of conservation at a deeper level
11A(iv); 3A(iv)

Activity 54 11.A

The central graphic provides a visual overview of photosynthesis. Using colored beads or plastic bricks to mimic the equation can help students in their understanding. Pulling apart represents bonds breaking, and joining together represents bonds forming. A wikihow link on the **Resource Hub** can scaffold understanding for students with limited chemistry. If time permits, the activity can be contextualized with the history of photosynthetic scientific discoveries, such as Van Helmont and the conservation of mass experiments. A video is provided on the **Resource Hub**. Question 4(a) is marked as extension.
11A(i)(iii)

Activity 55 11.A, 11.B

The photosynthetic process is divided into the light dependent and light independent phases. Each stage involved in the photosynthesis reactions could be written onto a card, with the molecules involved clearly drawn or named, and then small groups of students can sequence the steps, before completing the activity. The role of the enzyme RuBisCo in the photosynthesis process should be highlighted here
11A(i), 11B(ii)

Activity 56 1.B 1.D 1.F 2.B 2.C

Photosynthetic rate is measured by students counting gas bubbles produced from a *Cabomba* cutting exposed to different light intensities. Other methods of measuring photosynthetic rate are included on the **Resource Hub**. Teachers could alter the investigation and ask students to plan their own method for measuring photosyntheses, or provide the equipment and ask them to select a variable to change, such as temperature and light color. Using LED bulbs controls the temperature. *Cabomba* is also used in chapter 9, for modeling the carbon cycle. Teachers could keep a small tank or jar of the plant so they have a ready supply at hand.
1B(vi), 1D(i), 1F(ii)(v), 2B(ii), 2C(i)

Activity 57

Use the diagram to illustrate the connectedness between photosynthesis and cellular respiration. To reinforce the concept of matter conservation, students could annotate the diagram with molecular models (small colored circles or molymods) for the reactants and product of photosynthesis. The schematic drawing in question 2 can be sketched onto a larger piece of paper, and students can work in small groups to complete it, before they transfer the information to their own page. The activity is well supported by content on the **Resource Hub**.

Activity 58 11.A 2.C

Start by comparing the two equations for photosynthesis and cellular respiration. Ask the students to explain how these processes together show the conservation of matter and the transfer of energy. Ask where and in what form does the energy originate? Where and in what form does the energy end up after the reaction? The four pathways shown for ATP production can be used as an expert group activity. Divide the class into four groups (or eight if a large class) where each group discusses and writes down summary points about their pathway. The groups split to form new groups of four, and each person explains their 'expert' pathway knowledge to the others. Question 9 is tagged as an extension question.
11A(ii); 2C(i)

Activity 59 11.A 2.C

Students should use the diagram to note the main steps and their location. Emphasize the equation for cellular respiration; use strategies previously discussed if required. If students require support with the percentage calculations in this question, complete a worked example with the class or refer to activity 252 in the Science Practices chapter. Explain that a mole is a specific unit of measurement. More able students may want to know that a molecule and a mole (6.02×10^{23} particles) are

different, and a standard measure for reactants or products. This activity is well supported with explanatory videos on the **Resource Hub**.
11A(ii); 2C(i)

Activity 60 **1.B 1.C 1.D 1.E 1.F 2.B 2.C**
Components of the investigation will need to be prepared ahead of time. To prepare four day old germinated seeds, place mung bean seeds onto damp tissue in a petri dish. Place in a warm area and do not let the tissue dry out. Mung beans are large enough for the students to handle easily. Make sure all connections are secure when setting up the equipment to ensure the experiment runs well. This investigation could be completed in conjunction with activity 102, which investigates the germination of seeds. The investigation could then be referred back to when covering cellular respiration.
1B(vi), 1C(i), 1D(i), 1E(i), 1F(ii)(v), 2B(ii), 2C(i)

Activity 61 **11.A 1.G**
The components could be cut up and laminated for multiple uses (e.g. modeling the photosynthesis and cellular respiration equations). Students keep them for revision. Molymods could also be used. Pair students up for this investigation, one manipulates the models and the other writes down the answers. Students can switch roles for question 2. Students can be referred back to activities 55 and 58 if they need a reminder about the processes.
11A(i)(ii); 1G(ii)

Activity 62 **11.B**
The focus now moves to the role of enzymes in cellular processes. The lesson could start with an introductory video from the **Resource Hub**. Students can be extended with a compare and contrast table of anabolic and catabolic reactions, linked to photosynthesis and cellular respiration, before they interact with the content in the activity. For terms such as endergonic and exergonic, the prefixes can be elaborated on. Ask students to think of any similar words in science, so they can associate the terms with 'in' and 'out' (**en**trance and **ex**it). Provide examples if necessary, e.g. endotherm and exotherm.
11B(ii)

Activity 63 **11.B**
Encourage students to recall the types of biomolecules they encountered in chapter 1. They should recall from activity 7 that enzymes are proteins. They should understand the key features of enzymes. For extension, compare the redundant 'lock and key' model with the induced fit model of enzyme activity. Discuss why models (and hypotheses) can be superseded when new findings come along. Apply the information about enzymes and metabolic rate to activity 65. Without enzymes, metabolic reactions would proceed slowly because of our relatively low body temperature. Question 1(b) is tagged as extension.
11B(ii)

Activity 64 **11.B**
Demonstrate activation energy by striking a match. Ask students what is the purpose of the friction against the box. They can sketch an energy diagram showing the energy levels contained in the match-head chemicals before, during, and after. Remind students of the conservation of energy law, asking where has the energy 'gone'. Use the energy diagram to show how enzymes lower the activation energy required for a reaction to proceed. Encourage students to use the glossary to define the terms enzyme, catalyst, and denaturation.
11B(ii)

Activity 65 **11.B 1.C 1.D 1.E 1.F 2.B 3.A 3.B**
Students investigate the role of the amylase enzyme on starch. Students will need to be very organized and have assigned roles to record the results. You could perform an iodine test to demonstrate a positive and negative result. Ensure students use appropriate vocabulary in question 4 (enzyme, product, substrate). You can ask students to plan another experiment to test enzyme activity if you wish, e.g. effect of enzyme concentration. They can consider the variables involved, repeatability, and data collection and this can be used to prepare for activity 66. Refer them to the Science Practices chapter for help in planning.
11B(i); 1C(i), 1D(i), 1E(ii), 1F(ii)(v), 2B(ii), 3A(ii), 3B(ii)

Activity 66 **11.B 1.A 1.B 1.C 1.F 2.B 2.D**
Students apply their understanding of enzyme activity to design an investigation into catalase activity. If needed, use the 'fair test' template on the **Resource Hub** for planning; this allows students to consider all of the variables before writing a full plan. Direct students to the equation provided, highlighting that oxygen is one of the products, the amount produced is the dependent variable. If students are considering using the amount or concentration of H_2O_2 as the independent variable, remind them that a fair test has only one variable changed, and there are already different gemination ages for the mung beans.
11B(i); 1A(i)(ii), 1B(ii), 1C(ii), 1F(v), 2B(iii), 2D(i)

Animal and Plant Structure and Function

CHAPTER 4

Content anchor

The content anchor, *"Complex interactions"* asks students to consider how living organisms can regulate their internal systems and co-ordinate numerous organ systems. Students use their prior knowledge to suggest how multiple organ systems work together to enable a life function to occur in both plants and animals.

The key focus for students in this chapter is that interactions occur between systems, allowing plants and animals to perform a multitude of functions. Students' prior knowledge of different body systems and some plant systems from previous grades is developed to build a deeper understanding of the co-ordination occurring between systems.

Activity 70, 71 **4.A**
Activity 70 provides an overview to the hierarchy of life, and demonstrates how complexity builds at each level. Activity 71 recaps the 11 different body systems. These activities can be used for reference as students work through the chapter. The **Resource Hub** provides material to extend interested students and support those with gaps in their knowledge.
4A(i)

Activity 72, 73 **12.A 3.A**
The concepts of homeostasis and system interactions are introduced. Teachers may choose to swap the order of teaching activities 72 and 73, so that students are armed with more knowledge about the homeostasis process first. The lesson could start with groups of students brainstorming what they understand about homeostasis and the structures in the human body that are involved. Finish with a classroom discussion when reviewing answers. Students should then be able to alter their answers to align with the model answer.
12A(i); 3A(iv)(v)(vi)

Activity 74 **12.A 3.A**
Negative feedback is the most common homeostatic control method. Several models are used to illustrate negative feedback loops. Any of the examples: blood pH, stomach emptying, or thermoregulation, can be explored at a greater depth by students as an extension opportunity.
12A(i); 3A(iv)(vi)

Activity 75, 76, 77 **12.A 3.A**

The basics of the nervous regulatory system and hormonal (endocrine) system are explored individually, before their interaction is explored in activity 77. The focus is on how these systems interact to maintain homeostasis. Students can work in small groups or pairs to read the material and answer questions. Use mixed ability groups, including student mentors who have a more comprehensive understanding of the concepts covered in each group. This provides capable students with learning opportunities as they mentor and explain concepts; other students receive scaffolding.
12A(i); 3A(iv)(v)(vi)

Activity 78, 79 **12.A 2.B 4.A**

These activities explore the regulation of the blood and regulation of respiratory gases through system interactions. Ask students to carefully study the models (diagrams) and help them understand the information by projecting the image onto the whiteboard. Annotate the diagram with notes or direction arrows during class discussion. Students can add their own notes and annotations in the worktext.
12A(i); 2B(ii), 4A(i)

Activity 80 **12.A 1.B 1.F 2.B 2.D 3.A**

A simple experiment investigating the effect of exercise on heart rate provides context and background for students to plan their own investigation into the effect of exercise on breathing rate. The amount and type of physical exercise can be adjusted, depending on the health status of the students in the class. Members of a sports team could volunteer to perform the exercise, so that other students can collect data.
12A(i); 1B(iii)(vi), 1F(ii)(vi), 2B(iii)(vi), 2D(i), 3A(i)

Activity 81 **12.A 3.A**

This activity highlights interactions between the circulatory and digestive system to enable nutrient absorption. Students could record their understanding of the key interactions by developing their own summary tables. It can also be used for other interactions in the chapter (regulation, reproduction, and defense from injury and illness).This could also be in the form of a body outline, where each page has one of the headings above, and students indicate the systems involved by annotating the sheet.
12A(ii); 3A(i)

Activity 82 **12.A 2.B**

Diabetes is a fairly common disease in western countries. A person with this condition may wish to share their story of diabetes with the class as a way to introduce this topic. Alternatively, videos on the **Resource Hub** can be used as engagement. For extension, students can distinguish between type I and type II diabetes, comparing the malfunctioning mechanism for both. Refer students to the **Resource Hub** if they need background on the body systems and organs involved.
12A(i)(ii); 2B(ii)

Activity 83 **12.A**

This is a complex topic. To deepen understanding of the interactions, you may want students to combine the information, including ovarian cycle, menstrual cycle, and timing of hormones, on a circular chart representing the 28 day month. Approach the topic of menstruation in an open way, but be aware that, for some female students, it may be a subject that is discussed very little at home, and especially not around males.
12A(iii)

Activity 84 **12.A**

The complex hormonal regulation model could be scaffolded by drawing and annotating a diagram showing a series of the stages of birth. This would help students to comprehend the sequence of hormones released, and the function they serve. Students need to understand that, although the circulatory system of the baby and the mother are separate, there is a constant flow of substances shared between.
12A(iii)

Activity 85, 86 **12.A**

Ensure students have a good understanding of the complexity of the immune system and the multiple layers of defense. An infectious disease can be used to give more context for the students. Alternatively, students could be extended by researching a selected disease and detailing the specific immune system response triggered by it.
12A(iv)

Activity 87, 88 **12.A**

Students can be asked to share their experiences of what happens after they get a small cut, to relate their own experience to the blood clotting process. Likewise, students can discuss what they notice after they get a skin infection, and be asked why they think those responses may occur. Use the activities to explore the mechanisms and systems involved in responding to injury or illness. Some students may be interested to know that fever is an example of positive feedback. These types of control are rare in humans because they can be dangerous if unresolved.
12A(iv)

Activity 89 **12.B**

This activity serves as a refresher for students, covering the key structures and functions in a plant. Teachers can provide a few plant examples, or provide images of different plants so that students can identify the same structures on each. Refer students to chapter 3 to link the structures to the process of photosynthesis. For extension, students can research how different plant structures are modified to allow plants to survive in extreme environments 12B(i)

Activity 90 **12.B 1.C 1.D 1.E 1.F 3.A 4.A**

Students use the microscopic techniques introduced in chapter 1 to view the internal structures of plants involved in water balance and transport. If plant specimens are difficult to obtain, the images can be printed onto clear acetate at a high resolution and enlarged for students to see features clearly, then cut and glued onto glass slides. Images provided in the **Resource Hub** can be projected onto the board and annotated to scaffold student understanding.
12B(i); 1C(i), 1D(i), 1E(ii), 1F(xiii)(xiv), 3A(iv), 4A(iv)

Activity 91, 92, 93 **12.B 3.A**

The structures of the xylem and phloem are examined individually, then in the context of the roots and stems. Finally, the role of these structures in transport, along with the role of stomata, are combined to demonstrate how water is transported through the plant. Visualization of the transpiration process can be supported by videos and animations on the **Resource Hub**.
12B(i); 3A(v)(vi)

Activity 94 **12.B 1.A 1.B 1.E 1.F 2.B 3.A 4.A**

For students unable to access the laboratory, two levels of transpiration investigation simulations are provided in the **Resource Hub**, with most questions in the activity still able to be answered. Teachers could prepare a demonstration of the equipment setup to assist students with a successful set up of their own. Use the activities in the Science Practices chapter to help students with graphing, and identifying variables. Extend the investigation by asking students to plan and write the method out in full, adding all the other variables that are controlled, and how they are controlled.
12B(i); 1A(i), 1B(iii), 1E(i), 1F(i)(v), 2B(ii), 3A(i), 4A(iii)(viii)

Activity 95 **12.B**

Students could view cross sections of the roots using a microscope, or they could be projected onto a board. Although models in the book help to explain the process, it is important that students can also relate these models to actual structures in the plant. The process of osmosis is covered in more detail in chapter 1, if teachers wish to recover this material briefly as an introduction. Teachers could scaffold question 5 by listing the structures on the board, for students to use in their answer.
12B(i)

Activity 96 **12.B**
Refer to activity 22, Osmosis in Cells, to help students understand the osmotic process involved in translocation. An animated video showing translocation is on the **Resource Hub**, and can help to clarify this dynamic process for the students.
2B(i)

Activity 97 **12.B**
Students move onto plant reproduction processes in this activity, and many will bring a base of knowledge that has been covered in previous grades. Teachers could provide the class with a range of asexual plant examples, as shown in the photos. Some classes may have access to school or local gardens to view the plants. For extension, students could be asked to discuss advantages of asexual vs sexual reproduction in plants.
12B(ii)

Activity 98 **12.B 1.B 2.B**
This investigation could take place in the class or an outdoor glasshouse, or even at students' homes (for a home task). Activity 267 in the Science Practices chapter provides support for calculating medians.
12B(ii); 1B(vi)(iv), 2B(ii)

Activity 99, 100 **12.B**
Students can complete a simple insect pollinated flower dissection in groups, using a scalpel and magnifying glass to observe the structures. They could dissect a wind pollinated flower for comparison (although these are likely to be smaller and require more precision). Students can be extended by making a scientific drawing of the dissected flowers. Further extension can be offered for students to research the shape and color of the flowers, linked to the type of pollinator they attract.
12B(ii)

Activity 101 **12.B**
Agapanthus flowers, if available, are suitable to dissect and observe the ovary structure of a flower. This could be completed in conjunction with activities 99 and 100. Making a flow chart of the steps involved in fertilization will help scaffold question 1.
12B(ii)

Activity 102 **12.B 1.B 2.B**
The germination investigation can be extended by students planning a second experiment, where another variable was changed, such as light, warmth, or oxygen. They will need to develop a hypothesis, identify all variables and the control, as well as write a complete method showing how they have controlled all other variables. On completion of the investigation, students could dissect both germinated and non-germinated seeds to observe, and possibly draw, the internal structures. Activities in the Science Practices chapter support this activity.
12B(ii); 1B(vi), 2B(ii)(iii)

Activity 103 **12.B**
The final activity involved with plant reproduction involves methods of seed dispersal. Clarify the distinction between pollination and seed dispersal, as these separate processes can be confused by students. Students can be extended by researching unusual methods of seed dispersal.
12B(ii)

Activity 104 **12.B**
The third function of plants: responses, is introduced in this activity. Students can begin the activity in a small group, brainstorming and sharing ideas for how plants may respond to their environments. Further engagement can be provided by a selection of introductory videos on the **Resource Hub**.
12B(iii)

Activity 105 **12.B**
To scaffold students, the seedling image can be projected onto the board and the different tropisms written up, and crossed off when used. Students can be extended by finding other words that begin with the tropism prefixes, which will also help them remember the original tropism term. Like all new words introduced in this chapter and book, flash cards can be made of meaning and word, obtained from the glossary, to be used as an additional revision tool.
12B(iii)

Activity 106 **12.B**
Many students associate hormones with animals only. They can be reminded that plant hormones provoke a response in certain plant cells, just as they do in animals. Videos are available on the **Resource Hub** that cover tropisms and plant hormones, to provide another type of media for learning.
12B(iii)

Activity 107 **12.B**
Talk students through the results and encourage them to relate them to the effects of auxin. The auxin investigation could be completed in class as a practical component if time and resources are available. As with many plant investigations, an extended preparation period is required prior to running the experiments. Radish seeds and seedlings especially produced for fast growth can be used for the responses segment if quicker results are needed.
12B(iii)

Activity 108 **12.B 1.G**
Refer students to activity 106 for information about plant hormones involved in phototropism. To scaffold the drawing of cells, teachers can project the link, or direct the students, from the Biology Dictionary found on the **Resource Hub**.
12B(iii); 1G(i)(ii)

Activity 109 **12.B 1.F 2.C 2.D**
The teacher may have to break down the calculations of the mean and standard deviation into steps for students. Support for calculating means and standard deviation can be found in chapter 10, activities 267 and 268. Some students may need to be presented with the standard deviation answers, and just complete the mean calculations.
12B(iii); 1F(vi), 2C(i), 2D(i)

Activity 110, 111 **12.B 3.A 1.G**
The models in activity 110 can be projected onto the board and annotated by the teacher in the initial class discussion. The experiment in activity 111 is very simple and students could carry it out themselves if you wish. As extension, students can evaluate the method used in the investigation, and rewrite it to include more detail that would allow greater reliability and accuracy in the results. Chapter 10 can be referred to for specifics on investigations.
12B(iii); 3A(iii)(vi) 1G(i)

Activity 112 **12.B 1.G**
Access to a *Mimosa* plant, Venus flytrap or sundew plants is helpful for demonstrating the response. Prevent multiple touches, as the response is best when a single touch occurs. Extension can be offered to students interested in the mechanism of the response of one of the above plants, either as a research project or presentation.
12B(iii); 1G(ii)

DNA and Gene Expression

CHAPTER 5

Content anchor

The content anchor, "Real-Life Superpowers", uses the context of super abilities in humans, caused by genetic mutations, to introduce the chapter. Students utilize prior knowledge to discuss possible advantages and disadvantages of mutations, and what impact they might have on gene expression and phenotype in organisms.

The key focus is for students to understand how work of multiple scientists led to our current knowledge about the origin, structure, and function of DNA, as well as gene expression and the effect of mutation. Aspects of genetic technology, including PCR testing, gel electrophoresis, recombinant DNA, and CRISPR gene editing, are also required.

Activity 116 **7.A**
The 'unpacking' of a chromosome is used as a revision and introductory exercise. It adds new terms to the vocabulary that students are likely to recall from previous grades. Genetics is an area of biology that heavily uses vocabulary terms, so encourage students to use the glossary provided. Teachers could generate word scrambles, crosswords, word finds, matching word to definition, and fill in the blanks to build vocabulary .
7A(i)

Activity 117 **7.A 1.G**
Nucleic acids were introduced in activity 4; now students become familiar with how they are connected together to form DNA and RNA. Students are unlikely to have encountered some terms, such as 3', 5', hydroxyl, and terminal, and these should be clarified at the start of the lesson. Students can also create additional pages of glossary terms for each chapter, that can be attached into the book. This compare and contrast activity can be completed in small groups, before a class discussion.
7A(i); 1G(ii)

Activity 118 **7.A 1.G 2.A**
This activity focuses on using scientific models to convey information. It shows how models can be adapted and become more complex as more information is discovered. Begin by asking students to draw a model of how they think DNA could be represented, then compare their model with the ones provided in the worktext. Historically scientific discoveries by Watson and Crick, Franklin, and Chargaff, are included. Building the paper model reinforces the base-pairing rule. The **Resource Hub** provides instructions for creating a DNA model with candy.
7A (i); 1G(i)(ii), 2A(i)(ii)

Activity 119 **7.A 4.B**
This activity is information heavy, and can be divided into sections. Short documentaries on the **Resource Hub** are provided for support, if required. Use the question dice template on the **Resource Hub** to help students generate two-level questions. They can ask their peers to answer them. The question dice can be used in any activity where a large amount of information needs to be unpacked, understood, and discussed. Students could extract DNA from kiwifruit: they will actually be able to see the DNA. Refer to the link 'Bang goes the Theory", pg72, in the **Resource Hub**, for a suggested method.
7A (i); 4B(i)(iii)

Activity 120 **7.A 3.A**
This activity offers a number of hypotheses for the origin of DNA/RNA. Key to this activity is assisting students to understand the nature of science. Reinforce that it is considered 'good science' for scientists to modify old hypotheses, or construct new ones when new evidence is uncovered. Students can be asked why scientists 'change their minds', and why there might be different hypotheses offered for the same phenomenon. Extension could be offered to students by asking them to investigate the process of formulating a hypothesis, including multiple repeats of experiments, and peer review. The Science Practices chapter supports this approach.
7A(iii); 3A(i)(ii)(iii)(iv)(v)(vi)(vii)(viii)(ix)(x)(xii)

Activity 121 **7.B**
Activity 121 provides an engaging overview of gene expression. Students should extract the main stages and their locations. Unfamiliar terms can be defined using the glossary.
7B(i)(ii)(iii)

Activity 122 **7.B**
Transcription is explored in more detail. Students need to connect the process to the location in the cell, namely the nucleus, for transcription. An analogy of a photocopier can be used, where the mRNA is the different inks/toner used in different combinations to produce a (color) copy - the transcript. The 'master' (DNA) remains behind, from where repeated copies can be made from it. The copy is used to give instructions for the next phase, translation, outside the nucleus.
7B(i)(ii)(iii)

Activity 123 **7.B**
The focus is on how mRNA can be edited by removing introns and joining the remaining exons together, thus creating a vast number of different proteins. The **Resource Hub** offers an interactive to visualize the process.
7B(i)(ii)(iii)

Activity 124 **7.B**
Ensure students extract and understand the term codon. For differentiation, use the 'code crackers' activity, on the **Resource Hub** for students who need scaffolding. It uses a colored code wheel to decode the codons. This can be printed and laminated for repeated use .Extension material that involves locating a variety of codons from a code sheet is also provided. You may want capable students to consider why several different codons code for the same amino acid.
7B(i)(ii)(iii)

Activity 125 **7.B**
This activity describes the second stage of gene expression: translation. You can combine this activity with gene expression modeling, activity 126, or use one of the interactives, or videos in the **Resource Hub** to solidify understanding.
7B(i)(ii)(iii)

Activity 126 **7.B 1.G**
Any generic plastic building brick can be used in this modeling activity. For students with dexterity challenges, larger style blocks could be used. Having a class set will also be useful for modeling any chemical reactions, such as photosynthesis. If photographing and printing the final result is difficult, students could draw, or sketch around the outline, and color their models in the space provided.
7B(i)(ii)(iii); 1G(i)(ii)

Activity 127 **7.A**
Students can refer to activity 124 to link DNA, codons, and traits/phenotype. Variation and inheritance will be covered in the next chapter. Students can be extended by deeper investigation into one of the case studies in the activity, or their own researched case study.
7A(ii)

Activity 128 7.A 7.C

The concept of mutations arises in several areas of the worktext. This activity, demonstrating the process of mutation at a genetic level, can be referred back to at any time. Students could have a 'brainstorm' of possible causes of mutations as an introduction to the activity. Ensure students can differentiate and understand the significance of somatic and gametic mutations. Use the genetic mutation simulation on the **Resource Hub** for extension.
7A (ii), 7C(i)(ii)(iii)

Activity 129 7.C

Students can model these changes with strips of paper that have the sequences written on them; they can then be cut and removed, or reattached. For extension, bases can be written on them instead, and the codons can be interpreted using the table in activity 124. After the mutation, the codons can be re-interpreted using the codon chart and students can compare the differences. The mutation simulation on the **Resource Hub** would also work well for this activity.
7C(i)(ii)(iii)

Activity 130 7.C

This activity offers a wide range of case studies on beneficial and harmful mutation in humans. Cover them all broadly or select a few to cover in more detail. An alternative delivery is to assign expert groups to one case study. After a set time, one student from each expert group forms another group sitting in a circle, and students take it in turn to briefly outline the effects of 'their' mutation. This type of activity is useful when multiple areas or case studies of information are to be covered. Firstly, the students in the expert group pay close attention and contribute, as there is an expectation they will share their knowledge. Secondly, students each have a turn at talking and sharing equally, so normally reticent students have an opportunity to contribute.
7C(i)(ii)(iii)

Activity 131 7.D

This activity is an introduction to molecular technology and its applications. Most students would have heard the term GMO. Use an initial class discussion to elicit prior knowledge and misconceptions would be useful. Students may have varied opinions on whether GMO is good or bad,the views can be addressed through this series of activities.
7D(i)(ii)

Activity 132 7.D

PCR could be a familiar term to students but they probably won't have knowledge of the process. Create sequencing cards: students annotate them with a summary of the process step. The **Resource Hub** has animated videos which will also be useful to show the process.
7D(i)(ii)

Activity 133, 134 7.D 3.A

Ensure students have a good understanding of gel electrophoresis before moving to activity 134. The steps in the gel electrophoresis could be written on small cards, and groups of students can try to recall the sequencing of the steps from the activity. The online gel electrophoresis simulation lab in the **Resource Hub**, provides an alternative delivery mode. There are many steps in producing recombinant DNA. A paper strip activity could be generated to help students understand the steps.
7D(i)(ii); 3A(i)(ii)(iii)

Activity 135 7.D

This relatively new technology is often reported in mainstream media. Find examples of its use to share with your class if you wish. Use the videos and animations on the **Resource Hub** to introduce the activity effectively. Students could work in small groups to define and research new terms (e.g.PAM sequence or Cas9). Ensure students can differentiate between gene knock in and gene knock out.
7D(i)(ii)

Activity 136 7.D

Diabetes is covered in activity 82 and teachers may want to start the lesson by recapping the disorder. Some students, or those with family that have diabetes, may be willing to share about living with diabetes, and the process involved in checking and administering insulin. Students can be extended by comparing the pros and cons of traditionally sourced vs genetically modified insulin. Teachers could use this opportunity to discuss ethics involved, and how it is applied to genetic technologies.
7D(i)(ii)

Activity 137 7.D

COVID-19, and the testing involved, will be a shared experience for most students. Although Rapid Antigen Tests are now commonly used, PCR testing is still the most reliable method available. Refer to activity 132 for the specifics on PCR. Students may be confused that a lower Ct value indicates a more severe case of COVID-19, when instinct may tell them severe cases are linked to higher values. Ensure they understand that Ct relates to replication cycles, and is not a measure of a substance.
7D(i)(ii)

Activity 138 7.D 3.B 4.B 4.C

The final activity covers several case studies of molecular technology. Examples are connected to Texas or Texas research centers. After working through the examples students can research a STEM career related to concepts covered in this chapter. Inviting scientists in to discuss their role would be a nice addition. Schools close to a University or research facility, may be able to undertake a field trip. Students are encouraged to conduct a literature search using as many different types of media as possible.
7D(i)(ii); 3B(i)(ii)(iii)(iv), 4B(ix), 4C(i)(ii)

Patterns of Inheritance — CHAPTER 6

Content anchor

The content anchor, *"Anyone for chocolate"*, asks students to consider how traits in labrador dogs may be passed on, and how breeders are able to introduce specific traits into litters of pedigree dogs. This helps identify a student's prior knowledge around the topic.

The key focus is for students to understand different mechanisms for passing genetic information from one generation to another. They need to understand the details of meiosis, and be able to predict the possible phenotypes and genotypes of offspring. Students need to analyze both Mendelian and non-Mendelian traits and demonstrate their ability to predict genotype and phenotype ratios using a range of case studies.

Activity 142, 143, 144

These activities provide background to the topic. Review some key vocabulary terms in inheritance. To establish the relationship between the terms in inheritance genetics, teachers can print commonly used terms onto strips of paper and hand out to small groups. The groups can then arrange them on a large, blank piece of paper and draw connections between them, annotating relationships. i.e. DNA > genes; genes are made from long segments of DNA that code for a protein. An example is also shown in activity 144 between genotype and phenotype. The mindmap created can be shared, and additional connections can be made. Students can photograph the mindmap and use it for review. Creating genetic definition flip cards, with term/image on one side, and definition on the other side can also be useful during a revision lesson. Note: the key words are bolded in blue. Sources of variation will be important in this chapter, so ensure students have a good understanding of how this arises by interacting with the graphic in activity 144.

Activity 145 1.F
Traits to measure in class could include width of hand, from outstretched little finger to thumb, as a continuous phenotype. Value laden phenotypes, such as skin color, are best to be avoided. Before the investigation, as a class, construct a list of both continuous and discontinuous traits in humans, then narrow down the list to those that can be easily measured in class. Activity 265 in the Science Practices chapter provides guidelines for using tally charts and constructing histograms. Students can be extended by completing graphs for a discontinuous and continuous phenotype. The extra graph can be attached to the page. 1F(iii)(v)(x)(xi)

Activity 146 8.A
Use the stimulus photos to ask students to list the pros and cons of asexual and sexual reproduction. The main diagram shows how beneficial mutations move through generations by sexual reproduction, producing variation. The process of mutations interacting is called epistasis. Use the material on the **Resource Hub** to support delivery of this content.
8A(i)

Activity 147 8.A
This activity is designed to help students learn the steps and sequencing of meiosis. Use the videos and interactives on the **Resource Hub** to support students to acquire and retain this knowledge. Students can refer to question 3 when they need to revise the steps.
8A(i)(ii)(iii)

Activity 148, 149 8.A 1.D 1.F 1.G 3.A
These activities can be combined and run together if you wish to reinforce what is happening within the physical model. Genetic recombination is covered again in activity 198, in the context of evolutionary mechanisms, so students need a clear understanding of this process. They can refer back to these activities if they need to. In the physical model, the dots representing alleles can be different colors for different alleles, to make an easy visual reference during crossing over.
8A(i)(ii)(iii); 1.D(i), 1F(v), 1G(ii), 3A(iv)(vi)

Activity 150 8.A 2.B 3.A
This activity uses fruit flies, a commonly used organism in genetics experimentation, to explore the effect of linked genes on variability. The activity could be introduced with a short video from the **Resource Hub** on the experiments of Thomas Morgan. In small groups, students could write the advantages of using fruit flies for this research, and discuss as a class activity. For visual learners, consider making sets of 'chromosomes', either wooden or plastic, with genes stripe colored on them. This will make visualization of linked genes easier for the students to understand. Students can be extended by researching examples of linked genes in humans and other organisms, and discuss the evolutionary advantage of this phenomenon.
8A(iii); 2B(ii), 3A(iv)(vi)

Activity 151 1.B 2.B 4.A
Most students will have heard of Mendel and be aware of his experiments. Refresh understanding by showing the TED-Ed video on the **Resource Hub**. Teachers may need to scaffold some students when they calculate percentages and convert numerical data into ratios. Refer to activities 252 and 253 in the Science Practices chapter. Extension could be offered with a timeline research and presentation activity on the history of genetics discoveries, either on paper, or using a digital program.
1B(iii), 2B(ii), 4A(xi)

Activity 152 3.B
Ensure students have secure knowledge of the terms used, e.g. dominant, recessive, and use Punnett squares before progressing through the chapter. Completing a few Punnett squares on the board is a good way to help students. A common example, Mendel's pea flowers, is used to demonstrate Mendelian inheritance for a single gene. Information from activity 155, explaining features of a Punnett square, can be modified to suit a monohybrid Punnett square, drawn on the board, and students can annotate their page.
3B(ii)

Activity 153 2.B 2.C
This activity provides guidance for using two commonly used rules in inheritance, the product rule and sum rule. To extend question 3, two coins or tokens, with an allele drawn on each side (B, b, L, and l), can be handed out to small groups. Students can toss the two coins 16 times and record the ratio of genotypes (each will have 4 alleles - 2 x B and/or b, and 2x L and/or l). Students then compare their ratios to those in the Punnett square, and discuss why there might be differences. Ratios can be shared from all groups in the class and averaged. A class plenary can then discuss the averaged ratio of genotypes, and whether it more closely represents the Punnett square ratios. The final discussion can be on how this might be represented in real-life examples. 2B(ii), 2C(i)

Activity 154
Students gain practice in using monohybrid crosses in this activity. It can be used to reinforce understanding or could be used as a formative assessment opportunity.

Activity 155 8.B
Once students have mastered Punnett squares for monohybrid crosses, they can move onto dihybrid crosses; practice examples are provided. Material in the **Resource Hub** can be used for extension in class or set as homework. Teachers can make a class set of laminated 4 x 4 grids (or 2 x 2 grids for monohybrid crosses) which students can write on with a wipeable marker, to save paper in class. 8B(v)

Activity 156 8.B 2.B
This activity provides an introduction to non Mendelian inheritance. Incomplete dominance, codominance, and sex linkage are covered in other activities. This activity is designed to be used with small groups or pairs working together, to elicit their prior knowledge and preconceptions on inheritance examples that do not follow the rules of Mendelian genetics. One option could be to complete the first half on calico cats as an introductory exercise, then move directly onto sex linkage in activity 159. Likewise, the lower section on colored roses can be a lesson starter, then move onto activity 157 to investigate incomplete dominance. The order of teaching of the next three activities is flexible. 8B(i); 2B(iv)

Activity 157, 158, 159 8.B 2.B 3.B
These activities use case studies to explore non Mendelian inheritance. Students utilize Punnett squares and evaluate phenotype/genotype probabilities and ratios. Students can be extended by researching the ABO blood type as an example of multiple alleles, and how it is possible for O negative blood to be considered a universal donor. The hemophilia allele passing through the English royal family could be an interesting side project for some students. 8B(i)(ii)(iii)(iv); 2B(ii), 3B(ii)

Activity 160 8.B 2.B 2.C
The chi-squared test is actually quite straightforward but can look daunting to some students. Most are unlikely to have encountered the chi-square test previously. Teachers may decide to offer the activity to their extension students only, who have strengths in mathematics. A spreadsheet on the **Resource Hub**, can be used to support the calculations to get the chi-square result. Supporting videos on the **Resource Hub** also go through the process of chi-square calculations step-by-step.
8B(v); 2B(i), 2C(i)

Common Ancestry

CHAPTER 7

Content anchor

The content anchor "Dinosaur or Bird?" introduces students to the idea that various types of evidence, and different ways of looking at evidence, can be used to make claims about evolutionary processes. Feathered velociraptors are used as the context.

The key concept for students to understand in this chapter is that scientists use multiple types of evidence when developing hypotheses or theories. The chapter presents evidence for common ancestry from the fossil record, exploring different homologies, and using scientific explanations to understand why there are gaps in the record. The chapter concludes with a journey through the history of evolutionary theory, culminating in Darwin's Theory of Evolution by Natural Selection. This leads into the next chapter.

Activity 164 **9.A 3.B**

This activity provides a visual summary of all the information used to determine common ancestry. Students could provide additional examples from prior knowledge. The examples from each group could be added to a larger class poster which could be added to periodically as students move through the chapter. The final poster could be used as a revision tool.
9A (i)(ii)(iii)(iv); 3B(iv)

Activity 165 **9.A 9.B 4.A**

Students can recall the process of fossil formation and deposition covered in previous grades. For engagement, teachers may be able to access some examples of fossils, and there are explanatory videos in the **Resource Hub**. Extension can be offered by researching locations, dates, and species of fossil finds in Texas.
9A (vi) 9B(i); 4A(ii)

Activity 166 **9.A 9.B**

This short activity provides an opportunity for small group discussion on why fossils are found in the order they are and how the information can be used to track evolutionary change. This activity provides a springboard for later ones, including transitional fossils, and how this information can be used as evidence for common ancestry. Students should have a good understanding of this before moving on. The fossil record 'gaps' are introduced here, and more fully in activities 174-175.
9A(i) 9B(i);

Activity 167 **9.B 1.F 2.B 3.A**

Students apply what they already know about fossil deposition and disruption from geological events to correctly age the strata. You could begin the activity with image cards of different fossils. Students will need to research the images to identify age of fossil species, and place them in order of rock strata; see the **Resource Hub** for ideas. An online interactive game offers an opportunity to reinforce learning.
9B(i); 1F(xiii), 2B(ii), 3A(ix)

Activity 168 **9.A**

Explain the importance of transitional fossils. Show an image of *Archaeopteryx* and ask students why they think it is an example of such a fossil, based on its features. Remind students about the ideas discussed in the content anchor: how does this fossil provide evidence for evolutionary processes? The horse fossil record (provided) is an excellent documentation of the evolution of the modern horse. Other extension examples could include whale evolution or hominid evolution. Students could present their findings in a poster or slideshow.
9A(i)(vi)

Activity 169 **9.A**

Students should define the term homology, specifically anatomical homology, and understand that internal structures of different animals can be reasonably similar, even when the external structures appear not to be. The specialization of the generalized pentadactyl limb is an excellent example. Extension could include investigating why similar looking features, like penguin flippers and shark fins, have no close anatomical homology at all. Vestigial structures could also be applied as extension. Examples may include tail bones and an appendix in humans, pelvis bones in whales, or wing bones in flightless birds.
9A(iii)(viii)

Activity 170 **9.A 1.A**

The activity uses the origin and dispersal of the camel family as evidence for common ancestry in the context of biogeography. Remind students that continents have moved and were not always in their current location. Likewise, sea level has altered over time, exposing or hiding land features as it changed. Ask students how members of the camel family can occupy multiple continents, then unpack the information provided.
9A(ii)(vii); 1A(ii)

Activity 171 **9.A 2.B**

Students should understand that DNA and protein homology can both provide evidence for molecular homology, and are a way to determine common ancestry. All students should be able to make comparisons using the short DNA sequences, but some may need support decoding the phylogenetic tree. See the **Resource Hub.** Emphasize that order of branching, not the length of branches, determines common ancestry. Students could refer back to DNA base coding if they want to revisit nucleotide base sequences. The molecular clock hypothesis is a good extension opportunity. The video on John Maynard Smith in the **Resource Hub** can be used as a starter, and gives students the opportunity to evaluate different evidence, including endosymbiosis. This can be linked back to concepts covered in chapter 1 (TEK 5.B(iii)). This could also be an opportunity for teachers to discuss terminology, and the difference between hypothesis, theory, and law. Direct students to the glossary, and use the molecular clock hypothesis and theory of evolution as examples. 9A(iv)(ix); 2B(ii)

Activity 172 **9.A 4.A**

Protein homology uses changes in the Pax-6 protein and hemoglobin protein as case studies. The hemoglobin comparison visually shows how closely related species have fewer differences than more distantly related species. Discussion on Pax-6 can be extended by asking students why it is important for some proteins to be conserved (relatively unchanged). Can they think of any examples of conserved proteins? 9A(iv)(ix); 4A(v)

Activity 173 9.A
Direct attention to the graph. Do students see that each species passes through the same developmental stages at the same Carnegie sequence? This is evidence for common ancestry. In the second part of the activity, they explore how apoptosis shapes the limb bud into its final shape. Review activity 48 if required. This will help remind students about the connections between biology topics and that they are not stand alone concepts. As a summary, students could construct a mind map of the different types of evidence for common ancestry, showing links to other areas of biology.
9A(v)(x)

Activity 174 9.A 9.B 1.F 1.G 3.A
The Cambrian explosion represents a time when a large diversity of life-forms appear in the fossil record over a relatively short time. You could begin with a short video from the **Resource Hub**. Students do not need to remember the names of geologic time periods, but they are provided on the diagram so that the students have a context for the time period. They can see from the diagram that life becomes more complex. Students can place Tiktaalik (activity 178) on the timeline. The information on the second page addresses common questions regarding abrupt appearances in the fossil record. The questions can be answered as a group, and key points gathered as a whole class.
9A(i), 9B(i); 1F(vii), 1G(ii), 3A(x)

Activity 175 9.B 2.B 3.A 4.A
It is important for students to realize that evolutionary change does not occur at a constant rate, and that the fossil record can be used to monitor the changes. Students can compare the differences between punctuated equilibrium and phyletic gradualism, and apply this to the fossil record. Extension can be provided by investigating other examples of 'living fossils', such as the New Zealand tuatara. The trilobite models provide an opportunity for students to examine alternative hypotheses. A compare and contrast template could be drawn on the board to compare the two models; students can contribute their ideas to it. Once students have completed the analysis questions in "testing a model", they may want to go back and evaluate their answers in question 4 and rewrite on to fresh paper. It is important to note that, although numerous examples, such as horse transitional fossils or camel biogeography, have been provided, students need to be focused on general evidence so that they can demonstrate their understanding to novel contexts when assessed.
9B(i); 2B(ii), 3A(xii), 4A(i)(vi)(vii)

Activity 176 1.H 4A 4B
The introduction to the development of the theory of evolution provides a bridge between this chapter and the next, which examines mechanisms of natural selection. Students need to understand that most scientific knowledge has been built upon the discoveries and scientific research of others that have gone before them. A timeline activity can be constructed if desired.
1H(i) 4A(x)(xii) 4B(iii)(x)

Evolution and Natural Selection

CHAPTER 8

Content anchor

The content anchor, "How does an elephant lose its tusks?" opens and concludes this chapter and demonstrates an example of evidence of evolution by natural selection. It shows how evolution is an ongoing process rather than something that only occurred in the past, and has been the mechanism that has resulted in the biodiversity we see on Earth today.

The key concept for students to understand in this chapter is that variation exists among members of a species and some of this variation is heritable. At a basic level, we know this because offspring often resemble their parents. Variation results in some individuals having better traits for surviving in a particular environment than others. In general, organisms produce more offspring than are needed to replace the parents, which leads to competition for resources. Individuals with traits that give them an advantage in a particular environment are more likely to survive and pass those traits to their offspring. Individuals with less advantageous traits are unlikely to survive. This is how natural selection works and led to Darwin's theory of evolution by means of natural selection. You may wish to both introduce and conclude the chapter with these facts.

Activity 180 10.B 3.A
Recall that the development of evolutionary theory was introduced in the previous chapter (activity 176). Teachers could start with a short, engaging video from the **Resource Hub** on the life and times of Darwin. Students could work in small groups, brainstorming what might be required in a population for natural selection to occur. Follow with a short class plenary/ discussion before moving on to the activity. The M&M's® photo panels are a simple, visual model of selection in action. The succinct overview on the first page can be used to visually reinforce the theory of evolution by natural selection. Ensure students understand the terms natural selection, evolution, and phenotype by referring them to the glossary.
10B (i)(ii)(iii)(iv)(v)(vi); 3A(vi)

Activity 181 10.B 1.B 1.C 1.E 1.G 2.A
This activity uses M&M's® to explore the selection pressures acting on phenotype variation in a population. As students have not yet covered the concept of selection pressures, the teacher may wish to read out (or have students read out) the top paragraphs in activity 184. Return to this activity later. Model simulations are an important pedagogical tool to assist conceptual development of phenomena in students. The candy can be substituted for non-food tokens if there is risk of allergies. If food is being used, advise the students not to consume until after the investigation due to hygiene risk. Teachers can ask students to make predictions before the investigation, and facilitate further, in-depth, discussion after. Data could be pooled at the end. Students can calculate the mean from pooled class data. Discuss why some groups' data may differ from the class mean.
10B (i)(ii)(iii); 1B(v) 1C(v) 1E(i) 1G (ii) 2A(i)(ii)

Activity 182 10.A 10.B 3.A
This is a short but crucial activity, showing the importance of variation in evolution. Discuss new terms, e.g. fitness, with students. Observing variation in local populations, or in images

provided by the teacher, allows students to see differences in phenotypes. What effect might variation have on fitness? Are all individuals selected against equally? How might this affect fitness?
10A(i)(ii), 10B(i); 3A(vi)

Activity 183 **10.B 1.F 1.G 2.B 4.B**
This activity provides a context in which to explore fitness, a term introduced in the previous activity. Darwin's famous work on the beaks of the Galápagos finches is used as a case study for natural selection. Introducing the species of finches, their diets, and beak phenotypes, shows students how wide the variation amongst the finches is. The graphing activity shows how selection pressure (drought) drove selection, based on beak size. Support material is provided in the **Resource Hub**. For extension, some students may want to delve deeper into Darwin's natural selection theory and present a report or presentation. Other research ideas could be an account of the other species he studied, or the work of Wallace in helping develop the theory.
10B(iv)(v)(vi); 1F(iii), 1G(ii), 2B(i)(ii), 4B(ix)

Activity 184 **10.A 1.G 3.A**
Selection pressures are introduced in a general sense, followed by specific examples of each. Students need to name and describe the three types of selection. Teachers could provide students with a local example, or ask students to research an example themselves.
10A(i)(ii); 1G(ii) 3A(vi)

Activity 185 **10.A 10.B 2.B**
The peppered moth is used to explore directional selection in more detail. Students interpret a graph to study historical shifts in moth phenotypes in response to environmental conditions. Support material is provided in the **Resource Hub**, including an interactive game that could be used as extension. Reinforce the fact that selection pressures have caused change to the population, not the individuals themselves.
10A(i); 10B(i) 2B(ii)

Activity 186 **2.C 3.A**
Gene pool changes are illustrated using a simple diagrammatic model. A basic tabulation activity gives students an opportunity to practice basic data transformations. It provides a good opportunity for students to compare data sets (phase 1 and phase 2). Teachers can reinforce this skill by using tokens to create sets of beetles for each genotype. Call out different scenarios, e.g. half the yellow tokens eaten by a new predator. The students recalculate the genotype frequency after each event.
2C(i) 3A(iii)

Activity 187 **10.B 1.F 2.B 3.A**
This activity uses a data set to illustrate how coat color acts as a selection pressure in populations of rock pocket mice. Introduce the activity with a short video about rock pocket mice, from the **Resource Hub.** This will familiarize students with the environments and the two coat color phenotypes. Data analysis of rock pocket mice provides an opportunity to graph, and examine patterns. Direct students to activity 264 in the Science Practices chapter for guidelines on how to draw a bar graph. Finish the activity with a class discussion.
10B(i); 1F(iii) 2B(ii) 3A(iii)

Activity 188 **10.B 1.B 1.F 1.G 2.A 2.B 3.A 4.A**
This computational model (spreadsheet model) models gene pool changes in a population of rock pocket mice due to natural selection. Although it may appear daunting at first glance, the steps are easy to follow once you get started. There are options for delivery: students can follow the instructions to build the spreadsheet themselves, then graph the results or the teacher can project the spreadsheet onto the board and work through, step by step, as a demonstration. Alternatively, a premade spreadsheet in the **Resource Hub** can be utilized. Teachers may want students to do their own graphing.
10B(v); 1B(v) 1F(vi) 1G(i) 2A(i)(ii) 2B(ii) 3A(iii)(vi) 4A(v)

Activity 189 **1.G 3.A**
Explore the two definitions of species provided. 1) biological species concept: a group of organisms that can interbreed to produce fertile offspring. 2) phylogenetic species concept: where species are defined on the basis of their evolutionary history through shared, derived characteristics. Students will probably be more aware of the biological species concept. The domestic dog example provides a talking point for why morphological appearance is not always a good indicator of species. You could refer back to molecular homology and reference how it is used in redefining the classification of organisms. Ask students to provide examples of 'species' that can interbreed, and discuss why they are still considered species. Evaluate the use of both BSC and PSC systems of species definitions.
1G(ii) 3A(v)

Activity 190 **10.C**
The steps in species formation are summarized within an accessible diagram in this activity. A number of new terms are introduced throughout. Encourage students to use the glossary to find their definitions and encourage them to use these terms as they discuss the content. Material in the **Resource Hub** supports the content. Students can be extended by delving into the squirrel or cichlid speciation examples more deeply.
10C(i)(ii)

Activity 191 **10.C**
Highlight that species diversification does not occur in a uniform way. Compare and contrast divergent and convergent evolution and explain adaptive radiation. Adaptive radiation in mammals provides a good case study. Use the content in the **Resource Hub** to support and extend student understanding.
10C(i)(ii)

Activity 192 **10.D**
This activity examines evolutionary mechanisms in gene pools: recombination, genetic drift, mutation, and migration, and reiterates that changes in allele frequency in a population over time cause microevolutionary changes. These mechanisms all contribute to changes in a gene pool. Tag this activity as a reference page; students can refer back to it at any time for definitions and clarification of the four mechanisms.
10D(i)(ii)(iii)(iv)

Activity 193 **10.D 1.G 2.D 3.A 4.B**
Use the key question to ask students how gene flow into and out of a population could affect allele frequencies. What answers do they come up with? Unpack the activity, looking at the two populations: one with gene flow, the other without. Students should notice that when organisms move in or out of a gene pool, their genes/alleles move with them, altering the composition of the gene pool. Highlight that geographical barriers prevent gene flow and this can decrease genetic diversity in the isolated gene pool. Unpack the case studies (Texas ocelot and Texas puma) as illustrative examples. This activity may take several lessons to complete. Support and extension material is provided in the **Resource Hub**. Some schools may have an opportunity to visit a nearby conservation reserve for a field trip, or invite a conservation expert to the school to discuss work they are doing to conserve species impacted by lack of gene flow.
10D(ii)(vi); 1G(ii), 2D(ii), 3A(vi), 4B(viii)

Activity 194 **10.D 4.A**
This activity introduces the concept of genetic drift. It is expanded upon in the following two activities by looking at the founder effect and the bottleneck effect. The model and data provided illustrate the effect of genetic drift. For a hands on alternative, teachers provide marbles and containers for students to carry out the simulation themselves. Alternatively this could be a teacher-led demonstration. Remind students to use the glossary to define terms such as alleles, genetic drift, gene pool, population, and variation, should they need to.
10D(i)(v); 4A(i)

Activity 195 **10.D 2.C**
Introduce the activity with the short videos in the **Resource Hub** on anole lizards and the founder effect. The diagram illustrates the founder effect visually, and the tables calculating allele frequencies show how allele frequencies vary between the two populations. Note that the allele calculations simply involve counting the occurrence of 'A' and 'a' alleles within the population, followed by calculating the percentage. Specific examples are provided: anole lizard data and examples of the founder effect on human populations. The human examples help students understand that the human species also experiences evolutionary change. Students can be extended by a deeper investigation of different founder effect case studies, such as cheetah populations.
10D(i)(v); 2C(i)

Activity 196 **10.D 1.G 4.A**
Genetic bottlenecks are the result of large scale reductions in a population. The reduction in numbers may result in loss of genetic diversity, but it should be noted that all phenotypes can be affected equally. The red wolf case study on genetic bottlenecks is an engaging way to put a regional context to this activity. Material in the **Resource Hub** can be used to support its delivery. The key idea is to discuss the consequences of this mechanism: even if populations grow back to their original size, they may not recover their genetic diversity. This links to biodiversity (including genetic biodiversity) covered in-depth in chapter 9.
10D(i)(v); 1G(ii) 4A(ii)

Activity 197 **10.D 2.B 3.B**
Mutation has previously been covered, in activities 128-130. Revisit if students need to refresh their understanding of mutations. The emphasis is on how mutation is a source of new alleles. What is the effect of the new allele on a population's gene pool? Students should understand that most mutations do not provide a selective advantage. However, they can sometimes be beneficial. The Antarctic ice-fish is provided as a case study of beneficial mutation. Other examples could include investigating sickle cell mutations, with reference to malaria in humans, or red color vision in monkeys. The nylonase bacteria has a mutation that allows the organism to 'digest' nylon. This has an application in the breakdown of plastic in wastewater plants and provides an interesting context. Resources to support this activity are provided on the **Resource Hub**.
10D(iii)(vii); 2B(ii) 3B(ii)

Activity 198 **10.D 1.G**
Details of genetic recombination have been previously covered in activity 148 (meiosis and variation). Refer back if students need to be reminded of the process. The key focus of this activity is looking at how recombination can increase variation in a gene pool, and therefore act as a microevolutionary mechanism. Students can investigate genetic variation in their own extended families, or teachers can provide images of families for students to note differences in phenotypes.
10D(iv)(viii); 1G(ii)

Ecological Interactions — CHAPTER 9

Content anchor

The content anchor, "*A Mammoth Task*" introduces students to the idea that stability of an ecosystem is dependent on a wide range of interactions and change to any one, either through natural means or human activity, can create changes in the ecosystem. Human intervention can sometimes be used to reverse the changes.

The key focus for students to understand in this chapter is that disruption in ecosystems, whether the result of natural changes or human activity, can impact ecosystem stability and biodiversity. Students will bring prior knowledge of ecology concepts into the class from previous grades. This will be built on to explore the consequences of change.

Activity 202, 203, 204 **2.B**
These introductory activities review key concepts in ecology with a variety of case studies. The nested relationship between population (one species, usually in a geographically connected region), community (the biotic component of an ecosystem), and ecosystem (the community and its abiotic environment) needs to be understood so that these terms are used appropriately. The specific characteristics of particular ecosystems arise as a result of the interactions between biotic and abiotic components. As an alternative, these activities can be approached using a local example of an ecosystem, allowing students to explore, in a local context, key aspects of a selected animal or plant habitat and niche. Students should refer to the glossary to become familiar with the terms used.
2B (i)(ii)

Activity 205 **13.D 2.B**
The terms stability and biodiversity are introduced in this activity, and it is important that students become familiar with them, and also the relationship between them. Examples are provided, but local case studies could be identified for students to research in a small group. The **Resource Hub** contains material on termites which can be used for extension.
13D(ii); 2B(ii)

Activity 206 **13.D 2.B 3.A**
A new term, resilience, is introduced. Use the graphs to explore this concept. Students could be extended by building a mind map of the terms covered so far in the chapter, as there are multiple interconnections between them. Some students may need help to interpret the graphical evidence provided.
13D(ii); 2B(ii) 3A(ii)

Activity 207 **13.A 3.A**
This activity takes a closer look at ecosystem resilience in the form of a case study. An introductory video from the **Resource Hub**, can be used at the start of the lesson. Some students may need support with the interpretation of the information in the graph in this activity. Consider breaking students into small groups, and then discuss as a class, where students can share their analysis.
13A(i)(vi); 3A(i)

Activity 208 **1.G**
Species interactions were covered in previous grades so this activity serves as a reminder. The activity provides a wide range of examples but students could be extended by drawing up a chart with interaction types as headings; they can research

online to find more examples. It could be made into a class competition between groups, to see which group can find the most examples, with local examples worth double points. Each interaction will be explored in more detail in following activities. 1G(i)

Activity 209 13.A 2.B

Predator-prey relationships are an engaging topic for students. The hare-lynx relationship can be introduced by watching a video from the **Resource Hub.** Discussion on the data in class or small groups can precede the students answering the questions, which could be in the form of summarizing the key points discussed. Additional case study ideas from local examples can be used for a research focus.
13A(i)(vi); 2B(i)

Activity 210 13.A 2.D

This activity uses a well documented case study to look at the effects of predation on ecosystem stability. Data is presented as an accessible infographic. Evaluation in question 2 may need some scaffolding as it is a more complex skill. To extend, students can identify elements of the unstable predator-prey system on Coronation Island, and then compare and contrast to the more stable systems in the previous activity. 13A(vi); 2D(i)

Activity 211 13.A 1.C 1.E 1.F 2.C

The predator-prey simulation investigation is generalized, but teachers could select a context that is relatable to students if they wished. Modifications to the activity may need to be made to accommodate all students, such as a bigger spoon or tokens for students with physical impairment. Large classes may need two sets of equipment and be divided into 2 groups for the investigation. The class discussion at the end can compare group results with the overall pattern suggested at the start. Students can be extended by comparing their investigation results with the Coronation Island data, looking for similarity
13A(i); 1C(v) 1E(i) 1F(ii) 2C(i)

Activity 212 13.A

This introductory activity defines competition and the types of resources organisms compete for. Students most often think of animals in competition, so remind students that plants undergo competition too. Ensure students can distinguish between intraspecific and interspecific competition. You may wish to define the prefixes intra, and inter, so students are aware of the distinction when applied to competition types. Teachers could provide scenario images; students need to identify the type of competition shown and what resource(s) are being competed for.
13A(x)

Activity 213 13.A 4.A

Students can be extended by developing positive/negative impact charts for each of the three types of intra-species competition: scramble, contest, and social order, identifying which members of the population are advantaged, and how each type of behavior benefits the population overall. Students may note be familiar with the rufous-collared sparrow, so provide context with a short video from the **Resource Hub**.
13A(x); 4A(v)

Activity 214 13.A

Refer to activity 204 to remind students that competition forces organisms to occupy a smaller niche than is actually available to them. Ask students why interspecific competition is less intense than intraspecific competition. Plant and animal examples are provided but local examples could be used instead. For example, species of birds of prey in competition. Ask students to research the niches of each, such as hunting region, food type, and nest location (or this could be provided on information cards), and identify how they avoid being in direct competition.
13A(x)

Activity 215 13.A 1.B

Invasive species most often have a negative effect as they out-compete established species. Invasive in this context is a scientific term meaning a species is outside its natural range. Ensure students know species can be introduced by humans accidentally or on purpose, or find their way into new locations independently. Two case studies affecting Texas are provided. Extension can include finding another example, or investigating species and resources the introduced species competes with.
13A(v); 1B(iv)

Activity 216 13.A 1.B 3.B

The zombie cockroach example is an engaging introduction to parasitism. If required, teachers can expand on the *Cyclospora* parasite outbreak that many students may be familiar with. Re-emphasize the benefit-loss balance for examples provided. Ask students to determine what each species benefits or loses from in each example. Link parasitism to destabilization using white nose syndrome in bats. For extension, students can discuss the consequences of a parasite outbreak, and why is it likely to be unsustainable in an ecosystem in the long term.
13A(ii)(vii); 1B(ii)(iv)(v) 3B(vi)

Activity 217 13.A 1.B

Define commensalism, if required. Highlight the positive and neutral benefits experienced by the species involved. The case study has a Texas focus. Highlight the impacts if there is a change in the relationship (question 2). The report can be used as a formative assessment if desired.
13A(iii)(viii); 1B(iv)

Activity 218 13.A 1.C 1E 3.B

Define mutualism, if required. Highlight the beneficial outcomes to all the species involved. A range of case studies are provided as contextual examples. Students conduct an investigation of their own. If a field visit to observe the pollination of flowering plants is not possible, then students can view a video of the process from the **Resource Hub** instead. This may be a good option for those students with severe allergic reactions to bee stings.
13A(iv)(ix); 1C(iii)(vi) 1E(ii) 3B(ii)(iii)

Activity 219 13.B 1.F

Introducing the engaging context of the Texas blind salamander with a video from the **Resource Hub** will set the scene of this activity. The chapter moves on to energy and matter moving through the ecosystem, and this activity provides students with a recap lesson, covering concepts from previous grades.
13B(ii); 1F(xiii)

Activity 220, 221 13.B 3.A 3.B

Students will be familiar with the terms producer and consumer, but they can now be extended. The next two activities are essentially recap lessons to re-establish concepts covered in previous grades. Online labs and interactives in the **Resource Hub** provide extension material; also, links to a card resource game for students to construct food chains and webs.
13B(ii); 3A(v) 3B(viii)

Activity 222, 223 13.B 1.G 3.A

This activity introduces nutrient cycles in terms of how matter moves through the ecosystem. Students can refer back to chapter 3 if they need to clarify the process of photosynthesis and respiration when looking at the carbon and oxygen cycles. Nutrient cycles are explored in more detail in later activities. Disruptions to matter cycles are explored within the context of Texas Longhorn cattle or rangelands.
13B (i); 1G(i), 3A(v)

Activity 224 1.F 1.G 2.B 2.C 3.A

The 10% rule is an important concept to illustrate that not all energy passes to the next trophic level. Students may need scaffolding for the efficiency calculations in this activity. This could be achieved by working through some steps on the board. The initial food chain in the activity can be used as a context for the calculations. Question 5 is tagged as extension.
1F(iv)(vii)(xiii),1G(ii), 2B(i), 2C(i), 3A(v)

Activity 225 **1.F 1.G 2.A 4.A**
Ecological pyramids represent relationships between trophic levels, and it is important for the students to select the most appropriate way to represent data. Students should be able to justify their choice from the different ecological pyramids. Inverted pyramids (question 6) may need explanation.
1F(vii)(ix)(x), 1G(ii), 2A(i), 4A(ii)

Activity 226 **13.B 1.B 1.F 3.B**
This interactive investigation allows students to collect and analyze data from a virtual river simulation to construct biomass and energy pyramids. The simulation is tagged as extension, but all students can complete it with support. For students unable to access a device, or work online, this activity can be projected onto the board, and students can complete the questions as a class. This linked interactive programme allows students to collect and analyze data from a virtual river simulation to construct biomass and energy pyramids.
13B(ii); 1B(i)(v), 1F(vi)(xii), 3B(v)

Activity 227 **13B 1.F 3.A**
Simple schematics demonstrate how a variety of disturbances can affect trophic levels. In question 3, students apply their understanding to model the effect of disruption of Hurricane Harvey on bird species.
13B(ii); 1F(ix)(xiii), 3A(v)

Activity 228 **13.C 1.G**
The activity summarizes biogeochemical cycles and their interactions. If there is access to a compost bin, students can examine the difference in material between the fresh waste on top, and composted material at the bottom.
13C(i)(ii); 1G(i)(ii)

Activity 229, 230 **13.C 1.C 1.D 1.F 1.G 3.A**
The carbon cycle was covered in previous grades, so a more complex model is provided. To scaffold for students with gaps in their knowledge, they can be referred to the **Resource Hub** for less complex carbon cycle interactives. Links to online lab modules are available to extend students. Students can complete the model in activity 230 or the teacher could have a pre-made model available as an engagement activity
13C(i); 1C(i)(iv) 1D(i) 1F(viii)(xiv) 1G(i)(ii) 3A(v)

Activity 231 **13.C 1.G 3.A**
Once students have a secure understanding of the carbon cycle, they can explore the effects of disruption on it. Data showing short- and long-term changes are provided. Students should understand that some variation is natural, but human activity has caused disruption to the carbon cycle. The greenhouse effect is explained in this activity, to explain the effect of disrupting the carbon cycle and its effect on temperature. The effect of temperature change is illustrated using the North American Pika, but the lesson can be extended by using one or more of the examples in the **Resource Hub**. Climate change impacts will be covered in activity 238, in the context of biodiversity impacts.
13C(iii); 1G(ii) 3A(i)

Activity 232 **13.C 1.B 1.C 1.D 2.B 2.D 4.A**
Ocean acidification is often talked about, but it is important to note that the oceans are not actually acidic, although the pH is trending down. Some students may be daunted by the chemistry contained within the graphic, so talk through this as a class if necessary. The oceans act as a carbon sink so it is important that students link increased carbon in the ocean to a disruption in the carbon cycle. This investigation requires access to dry ice. As an alternative, students can use straws to blow into the solutions, however there is a risk, so great care must be taken to ensure no liquid is consumed.
13C(iii); 1B(iii) 1C(i)(iv) 1D(i) 2B(ii) 2D(i) 4A(iii)

Activity 233 **13.C 1.G 3.A**
The activity provides an overview of the nitrogen cycle followed by a more complex model (marked as extension). Complete one or both, depending on the level required. The second model will require some understanding of chemical formulae that is not stipulated in the TEKS for this subject.
13C(ii); 1G(i) 3A(iv)

Activity 234 **13.C 1.F 2.B 2.C**
Human impacts on the nitrogen cycle through fertilizer application are described. The examples are very general, so local examples could be provided by the teacher if desired. Some material on the second page is tagged as extension. Biodiversity is introduced to bridge to the final section of this chapter.
13C(ii)(iv); 1F(iv), 2B(ii) 2C(i)

Activity 235 **13.D 1.G 3.A**
Students have already covered ecosystem resilience, but need to understand that some events are so significant an ecosystem cannot return to its original state. Mt Saint Helens is provided as a case study. If students require help interpreting the schematic, project the image onto the board and draw over, as the class discusses the changes. For a Texas example, students could explore the loss of wetlands around the Gulf of Mexico coast.
13D(i); 1G(ii) 3A(iv)

Activity 236 **13.D 1.F 2.B 2.C**
Biodiversity and its importance is introduced. Students explore biodiversity measures and then compare biodiversity in two ecosystems using the Simpson's Index of Diversity. If the tables are used, the mathematical calculations are straightforward, although some students will require support to complete them. A digital calculator tool for Simpson's Index of Diversity is provided in the **Resource Hub**, which may help students who struggle with mathematics. This index will be used again in activity 238, so students will need to understand clearly what the values from 0-1 indicate.
13D(ii); 1F(iv)(v)(vii), 2B(iv), 2C(i)

Activity 237 **13.A 13.D 3.A**
Keystone species are introduced in the content anchor, and a variety of other case studies are offered in this activity. Students must understand the importance of keystone species and their key functional positions in ecosystems. Removal of a keystone species can have a disproportionate influence on ecosystem stability. These roles may be different in each case but include species with roles in nutrient recycling (termites), as predators (sea otters, mountain lions, sea stars), in shaping the characteristics of the environment (elephants, prairie dogs), and even as pollinators (hummingbirds in the Sonoran desert). You could use one of the videos on the **Resource Hub** as a starter for this activity.
13A(i)(v)(vi)(x) 13D(i)(ii); 3A(i)

Activity 238 **13.D 1.B 1.F 2.A 2.B 2.C 2.D 3.A 4.B**
Refer to activity 231 to review the impact of changes in the carbon cycle. Three climate change impact case studies are provided; the focus is on how these changes affect biodiversity. Other examples can be found in the **Resource Hub**. If investigating all examples, more than one lesson will be required. The investigation requires application of the Simpson's Index of Diversity, so refer back and provide support to students as required. This has been tagged as extension as a reminder that some students will require support. Part 4 of the investigation can be completed in groups or with the class.
13D(i)(ii); 1B(ii)(v), 1F(v)(vi), 2A(i)(ii), 2B(ii), 2C(i), 2D(i), 3A(i), 4B(xi)

Activity 239 **13.D 1.B 1.F 2.A 2.D 3.A 3.C**
Some students will have more knowledge of the fishing industry than others, so an introductory video from the **Resource Hub** could set the scene. Work through the material provided before beginning the investigation. The investigation can be structured so that any physically impaired students can use a larger tool to 'catch' fish more easily. The data from the

investigation can be collated as a class and averaged. Explain the importance of reliability in results by using multiple sets of data. Students can share the rules they have made in question 8 and, as an alternative method, the class can all use the same agreed 'rules'. Activity 239 will require more than one lesson to complete.
13D(i)(ii); 1B(v) ,1F(iv)(x), 2A(ii), 2D(i), 3A(vii)(viii), 3C(i)(ii)

Activity 240 **13.D 2.B 3.B 3.C 4.A**

Deforestation may not be a context students have observed locally, so utilize the **Resource Hub** to support the content. This activity provides an opportunity for a class debate. Teachers may wish to explain the ground rules of the debate and act as mediator, if students are unfamiliar with the approach. If time is short, two groups can organize themselves on either side, with the remainder of the class observing and making notes for their presentation report.
13D(i)(ii); 2B(ii), 3B(ii)(iv), 3C(i)(ii), 4A(x)

Activity 241 **13.D 3.A 3.B 4.B**

The case study of Madrean Pine-Oak Woodlands provides a context for how humans affect biodiversity. Once completed, students consider different conservation options for a local species. Some schools may have the opportunity to visit a conservation area, or invite a conservation expert in to discuss conservation efforts, or their role as a conservation officer and what the job entails.
13D(i); 3A(vii)(viii), 3B(iv), 4B(xi)

Activity 242 **13.D 3.A**

How does the human activity of damming affect biodiversity? Begin the lesson with a short video from the **Resource Hub** to engage students with the damming process. After a general introduction to damming, specific examples on the Colorado River are provided for context. This activity could be completed at home or in class.
13D(i)(ii); 3A(iv)

Activity 243

This activity highlights that biodiversity is not only important for ecosystem stability, but that humans depend on biodiversity too. Before beginning the activity, ask students to consider how humans might depend on biodiversity. Introduce the term 'ecosystems services'. Teachers could assign groups of students to research and present on the different types: cultural, supporting, provisioning, and regulatory.

Science Practices — CHAPTER 10

This chapter provides support for the science practices. Activities can be used at any time, and the chapter is not designed to be delivered in sequence. Use it whenever support is required for a Scientific and Engineering Practices skill. Activities can be set prior to, or as part of, a lesson. Where relevant, activities in the content chapters have a 'Need help?' icon that refers to the Science Practices chapter.

Activity 246 **1.A 4.C**

This activity outlines the dynamic process of the scientific method. It could be a suitable start to the *Biology for Texas* program, to reinforce that the scientific process is not linear and is subject to refinement. Adapt as a postbox activity if desired, as follows: Statements from the activity, along with any additional statements considered relevant by the teacher, are placed on boxes or plastic containers around the room. Small groups move around each station, read the statement, and write their comment, reflection, or answer, on a piece of paper and 'post' it into a slot in top of the box. The teacher rings a bell, and students move onto the next box. When all stations have been covered, each group takes responsibility for the stations they are at and read the statements. The group summarizes the statements and reports on the findings.
1A(i) (ii), 4C(i)(ii)

Activity 247 **1.G 2.A**

Models can be many things and are a helpful tool to understand systems. Refer students to this when they explore different models.
1G(i)(ii), 2A(i)(ii)

Activity 248 **1.H**

The terms hypothesis, law, and theory, are terms students will frequently come across. This reference page provides clear differentiation between each. Encourage students to use these terms in the correct context.
1H (i)

Activity 249 **1.A 1.B**

This activity could be used prior to any investigation that requires observations. Explain why assumptions sometimes need to be made in science. Several terms are introduced. Ensure students use the glossary to obtain clear definitions of each.
1A(i)(ii), 1B(i)(ii)(iii)(iv)(v)(vi)

Activity 250 **1.B**

Investigations requires students to obtain results that are both accurate and precise. The simple analogy in this activity explains the two clearly, for students who are having trouble differentiating the terms. When reporting results, students often report to levels they have not accurately been able to measure. The section on significant figures explains how to report to levels that are meaningful for the investigation.
1B(vii)

Activity 251 **2.C**

This activity can be used as a reference throughout the program when any of these mathematical skills are required. A few practice questions are given but teachers can expand on these with additional questions. For students who need scaffolding for mathematics, teachers can construct a worked exemplar of each problem on the board. Ensure that students have written down the simple steps required to solve the problem.
2C(i)

Activity 252 **2.C**

Students will encounter tally charts, percentage calculations, and rates several times within *Biology for Texas*. This activity explains each, and provides practice examples.
2C(i)

Activity 253 **2.C**

Fractions and ratios often cause problems for students. This activity provides support for carrying out these transformations. Ratios feature often in the inheritance material, so teachers may want students to complete this activity before carrying out ratios in that chapterl.
2C(i)

Activity 254 **2.C**

Exponential and log transformations are compared as ways to graph data dealing with large numbers. Log transformations can initially confuse students, but graphing data onto log paper can make very large numbers easier to work with and interpret. A worked example has been provided to demonstrate how log transformations can be calculated.
2C(i)

Activity 255 **1.D**

Selecting the correct apparatus and glassware is an important skill when designing an investigation. Highlight to students that the wrong equipment can affect their results and make the outcome of their investigation invalid. Teachers could place

different measuring apparatus out and present a range of laboratory scenarios, with students asked to identify the correct piece of equipment to use for the task. The investigations in *Biology for Texas* provide a list of equipment required (see equipment list in appendix). However, on some occasions, students plan their own investigation and need to select the correct equipment, so this activity will prove useful for this.
1D(i)

Activity 256 1.E

Understanding different types of data is integral to understanding the best ways to collect and report it. Here, students are introduced to quantitative, qualitative, and ranked data. Emphasize that quantitative data or numerical data is easier to analyze without bias.
1E(i)(ii)

Activity 257 1.B

This activity introduces the types of variables students will encounter within the investigations they carry out. They often confuse dependent and independent variables, so ensure these are understood, and students can graph them. Explain to students that experimental controls are an important component of investigations. They are included to check that the experiment is working properly and that the results can be trusted (e.g. the control line on a Rapid Antigen Test for Covid-19).
1B(i)(ii)(iii)(iv)(v)(vi)

Activity 258 1.D 1.E

Recording results and observations is a key skill in science. Explain the significance of log books and ensure students make accurate records in a timely manner. Data loggers are becoming common tools for recording data, and are very helpful for long term or remote data collection. However, not all schools will have access to data loggers.
1D(i), 1E(i)(ii)

Activity 259 1F

Explain how recording data in tables not only helps to organize results in a logical way, but often allows for trends in the data to be observed more easily. Refer students to this activity when they need to construct tables themselves.
1F(v)(xi)

Activity 260, 261, 262, 263, 264, 265, 266 1.F

Students often need reminding that the type of graph they use to display their data depends on the type of data they have collected. These activities provide guidance on selecting the correct type of graph to use and the features of each graph type. It is helpful to use these activities as a refresher just before a graphing component is required. Encourage students to refer to these activities often so that they become familiar with the rules of graphing. Drawing a line of best fit is an additional skill to be covered, in conjunction with scatter plots. The concepts of correlation and causation can be returned to, whenever relevant. 1F(i)(ii)(iii)(iv)(v)

Activity 267 2.B 2.C

Measures of central tendency are commonly used in *Biology for Texas*. Information and flow charts are provided to help students select the correct measure (mean, median, or mode). An example is provided to help consolidate understanding of the skills required. Teachers could pair up students of differing mathematical abilities to work through the problems.
2B(i), 2C(i)

Activity 268, 269 2.B 2.C

Activity 268 covers standard deviation, a concept that can be challenging for some students. Provide support as required. For some, this may mean providing the final calculation, and having students analyze the data only. Evaluating data for bias (activity 269) is an advanced skill, and teachers may need to scaffold delivery for students needing support.
2B(i)(ii), 2C(i)

Activity 270, 271 1.F

A number of opportunities for the students to use biological drawings exist in the worktext, especially in chapter 1, when observing cells and using microscopes. Students may have concerns that they are not artistic, so remind them that a good biological drawing can be very simple. Equally, remind students to draw what they see, and follow the rules provided in activity 270 to produce scientifically accurate drawings. Alternatively, teachers can project an image onto the board. Practice is provided in activity 271.
1F(vii)(xiii)

Activity 272 1.C

Safety is an important aspect in the classroom any time an investigation is carried out. This activity can be used on day one as an engagement activity to highlight appropriate behavior and practices. It is also suitable as a homework activity before the first laboratory session. Reminders can be provided throughout the program, as appropriate. Draw student attention to specific safety rules for each investigation or demonstration, and use TEA Texas Safety Standards to promote safe activity. The second part of the activity addresses ethics, and the importance of honest and ethical practices and reporting.
1C(i)(ii)(iii)(iv)(vi)

Activity 273 1.E 1.F

This activity provides an excellent example of collecting and analyzing qualitative data. It could be delivered prior to an investigation collecting qualitative data or it could be used as an assessment task.
1E(ii), 1F(x)(xi)

Activity 274 1.B 1.C 1.E 1.F 2.B 2.D 4.A

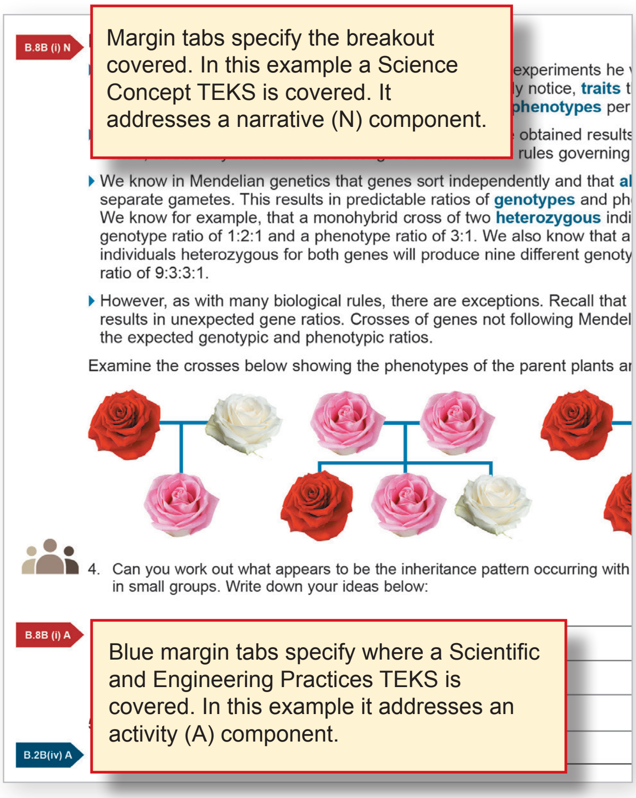
An experimental method, background and quantitative data are provided. Students work through a series of questions designed to test their understanding of the investigation set-up, before tabulating data and carrying out central tendency calculations. Finally, they graph and analyze the data. The activity could be used as a summative assessment.
1B(i)(ii),1C(i), 1E(i), 1F(ii)(v), 2B(ii)(iv), 2D(i), 4A(xi)

Locating the TEKS and ELPS

The TEKS and ELPS form an integral component of *Texas for Biology*. We have ensured that these components are evident to both students and teachers, however the level of detail varies between the Student Edition and Teacher's Edition. As you would expect, a higher level of detail is provided to teachers. A guide to locating the TEKS and ELPS within the Teacher's Edition is provided below. Summary tables identifying the location of specific TEKS and ELPS are provided on CG48-CG60.

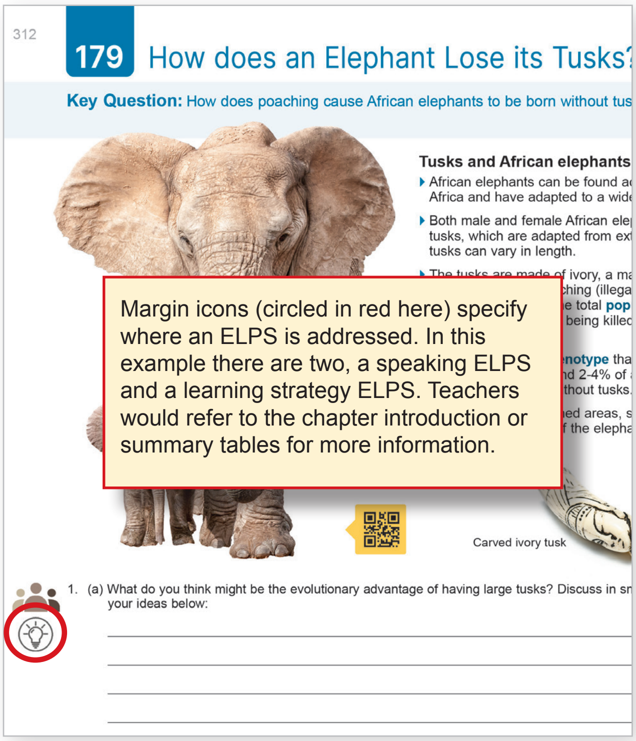
Locating the TEKS in the Teacher's Edition

- The Science Concept TEKS and Scientific and Engineering Practices TEKS are identified in the chapter introduction. For more information, see CG12.
- Tabs on the first page of an activity identify the TEKS covered within that activity. Red tabs indicate the Science Concept TEKS while blue tabs indicate Scientific and Engineering Practices TEKS. For more information, see CG15.
- Coding within the margin of a Teacher's Edition identify the TEKS breakout covered within the activity (as shown, right). Red tabs identify the Science Concept TEKS and blue tabs identify the Scientific and Engineering Practices TEKS. Along with the specific breakout code, the tab will also identify if the breakout specifically addresses a narrative (N) or an activity (A) component.
- Summary tables (CG48-CG55) list all of the TEKS covered throughout *Biology for Texas*. The information is provided for each chapter for including the TEKS statement and code covered, and where the TEKS component is located (activity number and page number). Both narrative and activity components of the TEKS are identified in this way. Narrative components provide an opportunity for a teacher to teach the information. Activity components provide an opportunity to assess whether students understand the information.



Locating the ELPS in the Teacher's Edition

- The ELPS are identified in the chapter introduction. For more information, see CG13.
- Icons within the activity margin identify where an ELPS component is covered within an activity (right). An explanation of the ELPS icons is provided below.
- Summary tables (CG56-CG60) list all of the ELPS covered throughout *Biology for Texas*. The information is provided for each chapter. Tables identify the ELPS statement, student expectation, the associated breakout, and proficiency level. Teacher only ELPS are clearly identified.



1. **Learning Strategies:** developing awareness of the learning process through a variety of strategies.
2. **Listening:** gaining increased comprehension of spoken language presented in a range of mediums.
3. **Speaking:** using both formal and informal speech to craft fluent and accurate communication with appropriate vocabulary.
4. **Reading:** utilizing a variety of text types with different purposes to gain increasing comprehension.
5. **Writing:** effectively address specific purposes to a range of audience types using accurate written communication.

Strategies for Using the ELPS

A typical classroom has a mix of students who come from a wide range of educational backgrounds, and have varied academic ability and English language skills. The English Language Proficiency Standards (ELPS) outline instruction and support that must be provided to English language learners (ELLs) in order for them to have a full opportunity to learn English and to succeed academically.

The ELPS have been integrated throughout *Biology for Texas* in a way that requires students to think critically, understand and learn new concepts, process complex academic material, and interact and communicate in English within the science classroom. The information below provides **general strategies** for using the features of *Biology for Texas* to deliver the ELPS as you work through the chapters. A complete summary of the specific ELPS covered in this worktext can be found on CG56-CG60.

Beginning:

Have students preview the chapter, identifying text features such as the chapter title, Key Questions, headings, boldface words, illustrations, graphics, and captions that can aid understanding.

Begin each lesson by reading aloud the Key Question, pausing to discuss any unfamiliar words. Lead a class discussion of the question and students' responses. Tell students to keep the question in mind as they read the rest of the section. Invite and answer questions as needed.

Throughout the chapter, chunk the reading to allow for frequent checks for understanding. Remind students to look for cognates as they read. Have students highlight important information and note any questions they have. Students can address their questions to you or a classmate. Then, have students work in pairs or small groups to complete the questions, activities, and investigations.

Check in with students throughout each lesson to make sure they are following the point-of-use ELPS activity instructions as well as the general instructions. Remain available to answer questions.

Examples of ELPS addressed: 1.B.i, 2.C.iii, 2.C.iv, 2.D.i, 2.D.ii, 2.I.v, 3.D.i, 3.E.i, 3.F.i, 4.D.i, 4.F.i, 4.F.ii, 4.F.vii

Intermediate:

Intermediate: Use the strategies provided above for Beginning ELLs as needed. In addition, provide intermediate students with a guided notetaking sheet to capture key ideas. Then have them use their notes to complete the questions, activities, and investigations individually or with a partner.

Examples of ELPS addressed: 1.B.i, 1.E.iv, 2.C.iii, 2.C.iv, 2.D.i, 2.D.ii, 2.I.v, 3.D.i, 3.E.i, 3.F.i, 4.D.i, 4.F.i, 4.F.ii, 4.F.vii, 4.G.iv

Advanced:

Use the strategies provided above for Beginning and Intermediate ELLs as needed. Have students take notes of key ideas as they read the text. Students can use their notes to complete the questions, activities, and investigations independently. These students may also benefit from working with a less advanced student to answer questions, assist with vocabulary acquisition, and summarize key concepts.

Examples of ELPS addressed: 1.B.i, 1.E.i, 1.E.iii, 1.E.iv, 2.C.iii, 2.C.iv, 2.D.i, 2.D.ii, 2.I.v, 3.D.i, 3.E.i, 3.F.i, 3.F.ii, 3.H.iii, 4.D.i, 4.F.i, 4.F.ii, 4.F.vii, 4.G.iv

Advanced High:

Have students take notes on key ideas as they read the text. Students can use their notes to complete the questions, activities, and investigations independently. Pair students with less advanced students to answer questions, assist with vocabulary acquisition, summarize key concepts, and perform investigations. Since these students show an aptitude for learning languages, they might enjoy exploring the Greek and Latin roots of scientific terms. Challenge them to identify words with Greek and Latin roots in each chapter. What is the meaning of the roots and how can they help us to understand the terms? For instance, chloroplast comes from the Greek words khloros, meaning "green" and plastos, meaning "formed."

Examples of ELPS addressed: 1.B.i, 1.E.i, 1.E.iii, 1.E.iv, 2.C.iii, 2.C.iv, 2.D.i, 2.D.ii, 2.I.v, 3.D.i, 3.E.i, 3.F.i, 3.F.ii, 3.H.iii, 4.D.i, 4.F.i, 4.F.ii, 4.F.vii, 4.F.x, 4.G.iv

TEKS SCIENCE CONCEPTS

CHAPTER ONE: B.5: Science Concepts: biological structures, functions, and processes.

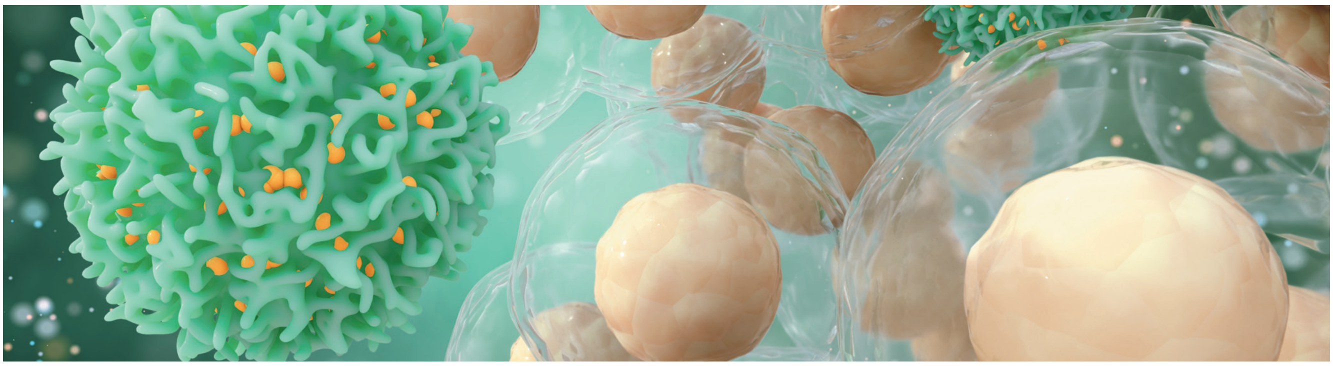
- The student knows that biological structures at multiple levels of organization perform specific functions and processes that affect life.

TEKS Student Expectation		Activity Number	Page number		Activity Number	Page number	
			Narrative	Activity		Narrative	Activity
B5.A	Relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell	2	4	5	7	12	12
		3	6,7	6,7	8	16	16
		4	8	8	24	41	
		5	9		32		57
		6	10		33		59
B5.B	Compare and contrast prokaryotic and eukaryotic cells, including their complexity, and compare and contrast scientific explanations for cellular complexity	1		3	17	29	
		13	24	24	18	30	30
		14	26	26	19	31	
		15	27	27	32		57
		16	28	28	33		59
B5.C	Investigate homeostasis through the cellular transport of molecules	20	33, 34	33	23	40	
		21	37	37, 38	24	41	41
		22	39	39	25	42, 43	42, 43
B5.D	Compare the structures of viruses to cells and explain how viruses spread and cause disease	13	24	24	29	50, 52	51, 52
		17	29		30	53	53
		26	44, 45	45	31	55, 56	55, 56
		27	46, 47	47	33		59, 60
		28	48, 49	49			

CHAPTER TWO: B.6: Science Concepts: biological structures, functions, and processes.

- The student knows how an organism grows and the importance of cell differentiation.

TEKS Student Expectation		Activity Number	Page number		Activity Number	Page number	
			Narrative	Activity		Narrative	Activity
B6.A	Explain the importance of the cell cycle to the growth of organisms, including an overview of the stages of the cell cycle and deoxyribonucleic acid (DNA) replication models	35	64	64	39	70	70
		36	65	65	40	71	
		37	67, 68	68	49		85
		38		69	50		87
B6.B	Explain the process of cell specialization through cell differentiation, including the role of environmental factors	42	75	75	47	80, 81	80, 81
		43	76	76	49		85
		46	79	79	50		87
B6.C	Relate disruptions of the cell cycle to how they lead to the development of diseases	35	66	66			
		48	82, 83, 84	82, 83, 84			



CHAPTER THREE: B.11: Science Concepts: biological structures, functions, and processes.

- The student knows the significance of matter cycling, energy flow, and enzymes in living organisms.

TEKS	Student Expectation	Activity Number	Page number: Narrative	Page number: Activity	Activity Number	Page number: Narrative	Page number: Activity
B11.A	Explain how matter is conserved and energy is transferred during photosynthesis and cellular respiration using models, including the chemical equations for these processes	53	95	95	59	104	104
		54	96	97	61		109
		55	99	99			
		58	102	102			
B11.B	Investigate and explain the role of enzymes in facilitating cellular processes	52	92	92	64		115
		55	98	98	65	116, 117	117
		62	113		66	119	
		63	114	114			

CHAPTER FOUR: B.12: Science Concepts: biological structures, functions, and processes.

- The student knows that multicellular organisms are composed of multiple systems that interact to perform complex functions.

TEKS	Student Expectation	Activity Number	Page number: Narrative	Page number: Activity	Activity Number	Page number: Narrative	Page number: Activity
B12.A	Analyze the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals	72	131	131	81	145, 146, 147	146, 147
		73	132	132	82	148, 149	149
		74	133, 134	133, 134	83	150, 151	151
		75	135	135	84	152, 153	153
		76	136	136	85	154	
		77	137	137	86	155	
		78	138, 139	139	87	156	156
		79	140, 141	141	88	157, 158	157, 158
		80	142	142, 143			
B12.B	Explain how the interactions that occur among systems that perform functions of transport, reproduction, and response in plants are facilitated by their structures	89	159	159	101	177	177
		90	160, 161	161	102	178, 179	179
		91	162	162	103	180	180
		92	163	163	104	181	
		93	164, 165	164, 165	105	182	
		94	166		106	183	
		95	169, 170	170	107	184, 185	184
		96	171	171	108	186	186
		97	172	172	109	187	
		98	173	173	110	188	188
		99	174	174	111	189	
		100	175, 176	175, 176	112	190, 191	191

CHAPTER FIVE: B.7: Science Concepts: mechanisms of genetics.

- The student knows the role of nucleic acids in gene expression

TEKS Student Expectation		Activity Number	Page number		Activity Number	Page number	
			Narrative	Activity		Narrative	Activity
B7.A	Identify components of DNA, explain how the nucleotide sequence specifies some traits of an organism, and examine scientific explanations for the origin of DNA	**116**	199		**120**	209, 210	210, 211
		117	200	200	**127**	220	220
		118	201, 202	202	**128**	221	221
		119	206, 207	207			
B7.B	Describe the significance of gene expression and explain the process of protein synthesis using models of DNA and ribonucleic acid (RNA)	**121**	212	212	**124**	215	215
		122	213	213	**125**	216	
		123	214		**126**	217	217
B7.C	Identify and illustrate changes in DNA and evaluate the significance of these change	**128**	221, 222	221, 222	**130**	225, 226	225, 226
		129	223, 224	223, 224			
B7.D	Discuss the importance of molecular technologies such as polymerase chain reaction (PCR), gel electrophoresis, and genetic engineering that are applicable in current research and engineering practices	**131**	227	227	**135**	233	233
		132	228	228	**136**	234, 235	
		133	229, 230		**137**	236	236
		134	231	232	**138**	237, 238	237, 238

CHAPTER SIX: B.8: Science Concepts: mechanisms of genetics.

- The student knows the role of nucleic acids and the principles of inheritance and variation of traits in Mendelian and non-Mendelian genetics.

TEKS Student Expectation		Activity Number	Page number		Activity Number	Page number	
			Narrative	Activity		Narrative	Activity
B8.A	Analyze the significance of chromosome reduction, independent assortment, and crossing-over during meiosis in increasing diversity in populations of organisms that reproduce sexually	**146**	252	252	**149**	256	256, 257
		147	253	253	**150**	258	258
		148	254	255			
B8.B	Predict possible outcomes of various genetic combinations using monohybrid and dihybrid crosses, including non-Mendelian traits of incomplete dominance, codominance, sex-linked traits, and multiple alleles	**155**	266	266, 267, 268	**159**	274, 275	274, 275
		156	269	269	**160**	276	277
		157	270, 271	270, 271	**161**		278
		158	272, 273	272, 273			

CHAPTER SEVEN: B.9: Science Concepts: biological evolution.

- The student knows that evolutionary theory is a scientific explanation for the unity and diversity of life that has multiple lines of evidence.

TEKS Student Expectation		Activity Number	Page number		Activity Number	Page number	
			Narrative	Activity		Narrative	Activity
B9.A	Analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental	**163**	285		**171**	296	296
		164	286		**172**	297	297
		165	287		**173**	298	298
		166	288		**174**	300	
		168	290, 291	290, 291	**177**		306
		169	292, 293	292, 293	**178**		308, 309
		170	294, 295	294, 295			
B9.B	Examine scientific explanations for varying rates of change such as gradualism, abrupt appearance, and stasis in the fossil record	**165**		287	**174**	299, 300	
		166	288	288	**175**	301, 302, 303	301, 302, 303
		167		289	**178**		308

CHAPTER EIGHT: B.10: Science Concepts: biological evolution.

- The student knows evolutionary theory is a scientific explanation for the unity and diversity of life that has multiple mechanisms.

TEKS	Student Expectation	Activity Number	Page number		Activity Number	Page number	
			Narrative	Activity		Narrative	Activity
B10.A	Analyze and evaluate how natural selection produces change in populations and not in individuals	**179**		312	**185**	321	321
		182	316		**199**		342
		184	319, 320	319, 320	**200**		344
B10.B	Analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success	**179**		312	**185**	321	
		180	313, 314	314	**187**		324
		181		315	**188**		327
		182	316		**199**		342
		183		317			
B10.C	Analyze and evaluate how natural selection may lead to speciation	**190**	329, 330	330	**200**		244
		191	331				
B10.D	Analyze evolutionary mechanisms other than natural selection, including genetic drift, gene flow, mutation, and genetic recombination, and their effect on the gene pool of a population	**192**	332		**196**	339	339
		193	333, 334, 335	334, 335	**197**	340	340
		194	336	336	**198**	341	341
		195	337, 338	337, 338	**200**		244, 245

CHAPTER NINE: B.13: Science Concepts: interdependence within environmental systems.

- The student knows that interactions at various levels of organization occur within an ecosystem to maintain stability.

TEKS	Student Expectation	Activity Number	Page number		Activity Number	Page number	
			Narrative	Activity		Narrative	Activity
B13.A	Investigate and evaluate how ecological relationships, including predation, parasitism, commensalism, mutualism, and competition, influence ecosystem stability	**207**	355	355	**215**	367	367
		209	358, 359	358, 359	**216**	368, 369	368, 369
		210	360	360	**217**	370	370
		211	361	361, 362	**218**	371, 372	371, 372
		212	363	363	**237**	403	403
		213	364	365	**245**		421, 422
		214	366	366			
B13.B	Analyze how ecosystem stability is affected by disruptions to the cycling of matter and flow of energy through trophic levels using models	**219**		373	**226**	384	
		220		375	**227**	385	385
		223	379	379			
B13.C	Explain the significance of the carbon and nitrogen cycles to ecosystem stability and analyze the consequences of disrupting these cycles	**201**		348	**231**	390, 391	390, 391
		228	386	387	**232**	392	392
		229	388		**233**	394	394, 395
		230		389	**234**	396, 397	396, 397
B13.D	Explain how environmental change, including change due to human activity, affects biodiversity and analyze how changes in biodiversity impact ecosystem stability	**201**	348	348	**239**	408, 409	409, 411
		205	352, 353	353	**240**	412, 413	413
		206	354	354	**241**	414	414, 415
		235	398, 399	399	**242**	416	416, 417
		236	400		**244**		419
		237	402, 403	402	**245**	422	422
		238	404, 405	405, 406			

TEKS SCIENTIFIC AND ENGINEERING PRACTICES

B.1: Scientific and engineering practices.

- The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

TEKS	Student Expectation	Activity Number	Page number	Activity Number	Page number	Activity Number	Page number
B1.A	Ask questions and define problems based on observations or information from text, phenomena, models, or investigations	**34**	63	**94**	166, 167	**246**	424
		66	119, 120	**170**	295	**249**	427
B1.B	Apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems	**11**	20	**102**	179	**238**	406
		21	38	**151**	260	**239**	410
		30	53	**181**	315	**249**	427
		56	100	**188**	326	**250**	428
		60	106	**215**	367	**257**	435
		66	119	**216**	369	**274**	457
		80	143, 144	**217**	370		
		94	166, 167, 168	**226**	384		
		98	173	**232**	393		
B1.C	Use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards	**11**	20	**66**	119, 120	**232**	393
		21	38	**181**	315	**272**	452, 453, 454
		38	69	**211**	361	**274**	457
		60	106	**218**	372		
		65	117	**230**	389		
B1.D	Use appropriate tools	**11**	20	**65**	117	**232**	393
		21	38	**90**	161	**255**	433
		56	100	**149**	256	**258**	436
		60	106	**230**	389		
B1.E	Collect quantitative data using the International System of Units (SI) and qualitative data as evidence	**21**	38	**94**	167	**258**	436
		30	53	**181**	315	**273**	455
		60	106	**211**	361	**274**	456, 457
		65	117	**218**	372		
		90	161	**256**	434		
B1.F	Organize quantitative and qualitative data using scatter plots, line graphs, bar graphs, charts, data tables, digital tools, diagrams, scientific drawings, and student-prepared models	**11**	20	**109**	187	**236**	400, 401
		21	38	**145**	251	**238**	406
		28	49	**149**	256	**239**	408, 411
		29	51	**167**	289	**244**	419
		30	53, 54	**174**	299	**245**	421
		38	69	**183**	318	**259**	437
		47	81	**187**	323	**260**	438
		50	87	**188**	325, 326, 327	**261**	439
		53	95	**211**	362	**262**	440
		56	100	**219**	373	**263**	441
		60	106, 107, 108	**224**	380, 381	**264**	442
		65	117, 118	**225**	382, 383	**266**	444
		66	120	**226**	384	**270**	449, 450
		80	142	**227**	385	**271**	451
		90	161	**230**	389	**273**	455
		94	167, 168	**234**	397	**274**	456, 457, 458

TEKS Student Expectation		Activity Number	Page number	Activity Number	Page number	Activity Number	Page number
B1.G	Develop and use models to represent phenomena, systems, processes, or solutions to engineering problems	**1**	3	**117**	200	**198**	341
		6	10	**118**	202	**208**	356
		7	12	**126**	217	**223**	379
		19	31	**149**	256	**224**	380
		20	35	**174**	299	**225**	382
		30	53	**181**	315	**228**	386, 387
		38	69	**183**	317	**229**	388
		50	87	**184**	319	**230**	389
		61	109, 110	**188**	325	**231**	391
		108	186	**189**	328	**233**	395
		111	189	**193**	333	**235**	398
		112	190, 191	**196**	339	**247**	425
B1.H	Distinguish among scientific hypotheses, theories, and laws	**19**	32	**176**	305	**248**	426

B.2: Scientific and engineering practices.

- The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

TEKS Student Expectation		Activity Number	Page number	Activity Number	Page number	Activity Number	Page number
B2.A	Identify advantages and limitations of models such as their size, scale, properties, and materials	**118**	201, 202	**238**	407		
		181	315	**239**	411		
		188	325	**247**	425		
		225	382				
B2.B	Analyze data by identifying significant statistical features, patterns, sources of error, and limitations	**17**	29	**153**	264	**204**	351
		30	53	**156**	269	**205**	353
		47	81	**157**	270	**206**	354
		56	100	**158**	272	**209**	359
		60	107	**159**	274, 275	**224**	381
		65	118	**160**	276, 277	**232**	392
		66	120	**167**	289	**234**	396
		78	139	**171**	296	**236**	401
		80	144	**175**	303	**238**	405
		82	148	**183**	318	**240**	413
		94	167, 168	**185**	321	**267**	445, 446
		98	173	**187**	324	**268**	447
		102	179	**188**	327	**269**	448
		150	258	**197**	340	**274**	457, 458
		151	260	**203**	350		
B2.C	Use mathematical calculations to assess quantitative relationships in data	**10**	19	**160**	276, 277	**252**	430
		17	29	**186**	322	**253**	431
		41	73, 74	**195**	337	**254**	432
		56	100	**211**	362	**267**	445, 446
		58	103	**224**	381	**268**	447
		59	105	**234**	397	**269**	448
		60	107, 108	**236**	400, 401		
		109	187	**238**	406, 407		
		153	264	**251**	429		
B2.D	Evaluate experimental and engineering designs	**21**	38	**109**	187	**238**	407
		30	54	**193**	335	**239**	411
		66	120	**210**	360	**274**	458
		80	144	**232**	393		

B.3: Scientific and engineering practices.

▸ The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.

TEKS	Student Expectation	Activity Number	Page number	Activity Number	Page number	Activity Number	Page number
B3.A	Develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories	**6**	11	**76**	136	**188**	327
		8	16	**80**	144	**189**	328
		16	28	**81**	146	**193**	334
		19	31	**90**	161	**206**	354
		21	37, 38	**93**	165	**207**	355
		22	39	**94**	168	**220**	375, 376
		24	41	**110**	188	**221**	377
		25	42	**120**	211	**222**	378
		26	45	**133**	230	**224**	380
		27	47	**134**	232	**227**	385
		29	52	**148**	254, 255	**229**	388
		31	56	**149**	257	**231**	390
		33	59, 60	**150**	258	**233**	395
		36	65	**167**	289	**235**	399
		39	70	**174**	299	**237**	403
		41	74	**175**	303	**238**	405
		47	81	**177**	306	**239**	411
		41	74	**178**	308, 309	**241**	415
		47	81	**180**	313	**242**	417
		53	95	**182**	316	**245**	421
		65	118	**184**	319		
		72	131	**186**	322		
		74	133	**187**	324		
B3.B	Communicate explanations and solutions individually and collaboratively in a variety of settings and formats	**1**	3	**162**	282	**220**	376
		38	69	**164**	286	**226**	384
		65	118	**179**	312	**240**	413
		138	239	**197**	340	**241**	415
		152	263	**216**	369	**245**	422
		157	271	**218**	372		
B3.C	Engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.	**239**	411	**240**	413	**244**	419

B.4: Scientific and engineering practices.

▸ The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society.

TEKS	Student Expectation	Activity Number	Page number	Activity Number	Page number	Activity Number	Page number
B4.A	Analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student	**12**	23	**151**	259	**199**	342
		19	31, 32	**163**	285	**213**	365
		20	34	**165**	287	**225**	383
		21	38	**172**	297	**232**	393
		41	74	**175**	301, 303	**240**	413
		70	128	**176**	304	**244**	419
		79	140	**188**	327	**274**	458
		90	161	**194**	336		
		94	168	**196**	339		
B4.B	Relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content	**9**	17	**135**	233	**183**	318
		12	22, 23	**138**	237	**193**	334
		26	45	**162**	282	**238**	407
		82	148	**163**	285	**241**	415
		119	206, 207, 208	**176**	304, 305		
B4.C	Research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM career	**138**	239	**246**	424		

ELPS

(1) Cross-curricular second language acquisition/learning strategies.

- The ELL uses language learning strategies to develop an awareness of his or her own learning processes in all content areas. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency.

ELPS Student Expectation		ELPS Breakout	Proficiency level	Activity Number	Page number
1.A	Use prior knowledge and experiences to understand meanings in English	(i) use prior knowledge to understand meanings in English	Beginning to Advanced	**141**	246
		(ii) use prior experiences to understand meanings in English	Advanced High	**71**	130
1.B	Monitor oral and written language production and employ self-corrective techniques or other resources	**TEACHER ONLY** (i) monitor oral language production and employ self-corrective techniques or other resources	Beginning	**34**	63
1.D	Speak using learning strategies such as requesting assistance, employing non-verbal cues, and using synonyms and circumlocution (conveying ideas by defining or describing when exact English words are not known)	(i) speak using learning strategies	Beginning	**181**	315
1.E	Internalize new basic and academic language by using and reusing it in meaningful ways in speaking and writing activities that build concept and language attainment	(i) internalize new basic language by using and reusing it in meaningful ways in speaking activities that build concept and language attainment	Beginning	**179**	312
		(ii) internalize new basic language by using and reusing it in meaningful ways in writing activities that build concept and language attainment	Intermediate	**153**	264
		(iii) internalize new academic language by using and reusing it in meaningful ways in speaking activities that build concept and language attainment	Intermediate	**130**	225
		(iv) internalize new academic language by using and reusing it in meaningful ways in writing activities that build concept and language attainment	Intermediate	**117**	306
1.F	Use accessible language and learn new and essential language in the process	TEACHER ONLY (i) use accessible language and learn new and essential language in the process	Beginning to High Advanced	**All**	All

(2) Cross-curricular second language acquisition/listening

- The ELL listens to a variety of speakers including teachers, peers, and electronic media to gain an increasing level of comprehension of newly acquired language in all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in listening. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency.

ELPS Student Expectation		ELPS Breakout	Proficiency level	Activity Number	Page number
2.C	Learn new language structures, expressions, and basic and academic vocabulary heard during classroom instruction and interactions	TEACHER ONLY (i) learn new language structures heard during classroom instruction and interactions	Advanced High	**119**	206
		TEACHER ONLY (ii) learn new expressions heard during classroom instruction and interactions	Beginning to Advanced High	**179**	312
		(iii) learn basic vocabulary heard during classroom instruction and interactions	Intermediate	**3**	6
		(iv) learn academic vocabulary heard during classroom instruction and interactions	Intermediate	**197**	340
2.D	Monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed	**TEACHER ONLY** (i) monitor understanding of spoken language during classroom instruction and interactions	Beginning to Advanced	**All**	All
		(ii) seek clarification [of spoken language] as needed	Beginning	**34**	63
2.E	Use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language	(iii) use linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language	Beginning	**152**	262
2.I	Demonstrate listening comprehension of increasingly complex spoken English by following directions, retelling or summarizing spoken messages, responding to questions and requests, collaborating with peers, and taking notes commensurate with content and grade-level needs	(i) demonstrate listening comprehension of increasingly complex spoken English by following directions commensurate with content and grade-level needs	Intermediate	**80**	142
		(iii) demonstrate listening comprehension of increasingly complex spoken English by responding to questions and requests commensurate with content and grade-level needs	Beginning	**184**	319
		TEACHER ONLY (iv) demonstrate listening comprehension of increasingly complex spoken English by collaborating with peers commensurate with content and grade-level needs	Intermediate	**56**	100
		(v) demonstrate listening comprehension of increasingly complex spoken English by taking notes commensurate with content and grade-level needs	Advanced	**232**	393

(3) Cross-curricular second language acquisition/speaking.

- The ELL speaks in a variety of modes for a variety of purposes with an awareness of different language registers (formal/informal) using vocabulary with increasing fluency and accuracy in language arts and all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in speaking. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency.

ELPS Student Expectation		ELPS Breakout	Proficiency level	Activity Number	Page number
3.B	Expand and internalize initial English vocabulary by learning and using high-frequency English words necessary for identifying and describing people, places, and objects, by retelling simple stories and basic information represented or supported by pictures, and by learning and using routine language needed for classroom communication	(ii) expand and internalize initial English vocabulary by retelling simple stories and basic information represented or supported by pictures	Advanced	**127**	220
		(iii) expand and internalize initial English vocabulary by learning and using routine language needed for classroom communication	Intermediate	**38**	69
3.D	Speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency	(i) speak using grade-level content area vocabulary in context to internalize new English words	Advanced	**6**	10
		(ii) speak using grade-level content area vocabulary in context to build academic language proficiency	Beginning	**149**	256
3.E	Share information in cooperative learning interactions	(i) share information in cooperative learning interactions	Intermediate	**201**	348
3.F	Ask and give information ranging from using a very limited bank of high-frequency, high-need, concrete vocabulary, including key words and expressions needed for basic communication in academic and social contexts, to using abstract and content-based vocabulary during extended speaking assignments	(i) ask [for] information ranging from using a very limited bank of high-frequency, high-need, concrete vocabulary, including key words and expressions needed for basic communication in academic and social contexts, to using abstract and content-based vocabulary during extended speaking assignments	Beginning	**151**	261
		(ii) give information ranging from using a very limited bank of high-frequency, high-need, concrete vocabulary, including key words and expressions needed for basic communication in academic and social contexts, to using abstract and content-based vocabulary during extended speaking assignments	High Advanced	**60**	106
3.G	Express opinions, ideas, and feelings ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics	TEACHER ONLY (i) express opinions ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics	Intermediate	**168**	291
		(ii) express ideas ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics	Advanced	**174**	299
3.H	Narrate, describe, and explain with increasing specificity and detail as more English is acquired	(ii) describe with increasing specificity and detail as more English is acquired	Advanced	**181**	315
		(iii) explain with increasing specificity and detail as more English is acquired	Advanced	**168**	290

(4) Cross-curricular second language acquisition/reading.

- The ELL reads a variety of texts for a variety of purposes with an increasing level of comprehension in all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in reading. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. For kindergarten and first grade, certain of these student expectations apply to text read aloud for students not yet at the stage of decoding written text.

ELPS Student Expectation		ELPS Breakout	Proficiency level	Activity Number	Page number
4.C	Develop basic sight vocabulary, derive meaning of environmental print, and comprehend English vocabulary and language structures used routinely in written classroom materials	(i) develop basic sight vocabulary used routinely in written classroom materials	Beginning	**34**	63
		(ii) derive meaning of environmental print	Beginning	**28**	49
		(iii) comprehend English vocabulary used routinely in written classroom materials	Beginning	**56**	100
		(iv) comprehend English language structures used routinely in written classroom materials	Intermediate	**16**	28
4.D	Use prereading supports such as graphic organizers, illustrations, and pretaught topic-related vocabulary and other prereading activities to enhance comprehension of written text	(i) use prereading supports to enhance comprehension of written text	Intermediate	**117**	200
4.E	Read linguistically accommodated content area material with a decreasing need for linguistic accommodations as more English is learned	TEACHER ONLY (i) read linguistically accommodated content area material with a decreasing need for linguistic accommodations as more English is learned	Beginning to Advanced	**69**	127
4.F	Use visual and contextual support and support from peers and teachers to read grade-appropriate content area text, enhance and confirm understanding, and develop vocabulary, grasp of language structures, and background knowledge needed to comprehend increasingly challenging language	(i) use visual and contextual support to read grade-appropriate content area text	Beginning	**190**	329
		(ii) use visual and contextual support to enhance and confirm understanding	Beginning	**170**	295
		(iii) use visual and contextual support to develop vocabulary needed to comprehend increasingly challenging language	Beginning Advanced	**99** **204**	174 351
		(v) use visual and contextual support to develop background knowledge needed to comprehend increasingly challenging language	Beginning	**58**	102
		(vi) use support from peers and teachers to read grade-appropriate content area text	Beginning	**238**	404
		(vii) use support from peers and teachers to enhance and confirm understanding	Beginning	**138**	237
		(viii) use support from peers and teachers to develop vocabulary needed to comprehend increasingly challenging language	Intermediate	**48**	82
		(ix) use support from peers and teachers to develop grasp of language structures needed to comprehend increasingly challenging language	Intermediate	**63**	114
		(x) use support from peers and teachers to develop background knowledge needed to comprehend increasingly challenging language	Advanced	**50**	86-88
4.G	Demonstrate comprehension of increasingly complex English by participating in shared reading, retelling or summarizing material, responding to questions, and taking notes commensurate with content area and grade level needs	(ii) demonstrate comprehension of increasingly complex English by retelling or summarizing material commensurate with content area and grade level needs	Beginning / Intermediate	**207**	355
		(iii) demonstrate comprehension of increasingly complex English by responding to questions commensurate with content area and grade level needs	Advanced	**65**	118
		(iv) demonstrate comprehension of increasingly complex English by taking notes commensurate with content area and grade level needs	Intermediate	**148**	254

(5) Cross-curricular second language acquisition/writing.

- The ELL writes in a variety of forms with increasing accuracy to effectively address a specific purpose and audience in all content areas. ELLs may be beginning, intermediate, advanced, or advanced high stage of English language acquisition in writing. In order for the ELL to meet grade-level learning expectations across foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. For kindergarten and first grade, certain of these student expectations do not apply until the student has reached the stage of generating original written text using a standard writing system

ELPS Student Expectation		ELPS Breakout	Proficiency level	Activity Number	Page number
5.B	Write using newly acquired basic vocabulary and content-based grade-level vocabulary	(i) write using newly acquired basic vocabulary	Advanced	**89**	159
		(ii) write using content-based grade level vocabulary	Advanced High	**120**	211