CLASSROOM GUIDE

BIOZONE

BIOLOGY

FOR NGSS

BIOZONE

TEACHER'S EDITION

BIOLOGY

FOR NGSS

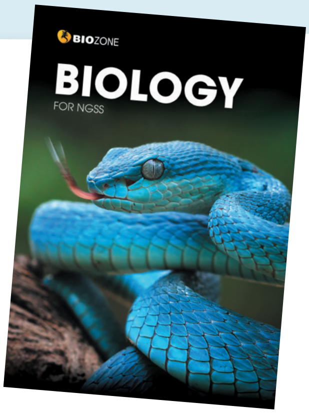
Contents

CLASSROOM GUIDE

STUDENT EDITION

APPENDIX

FAQs ABOUT BIOLOGY FOR NGSS



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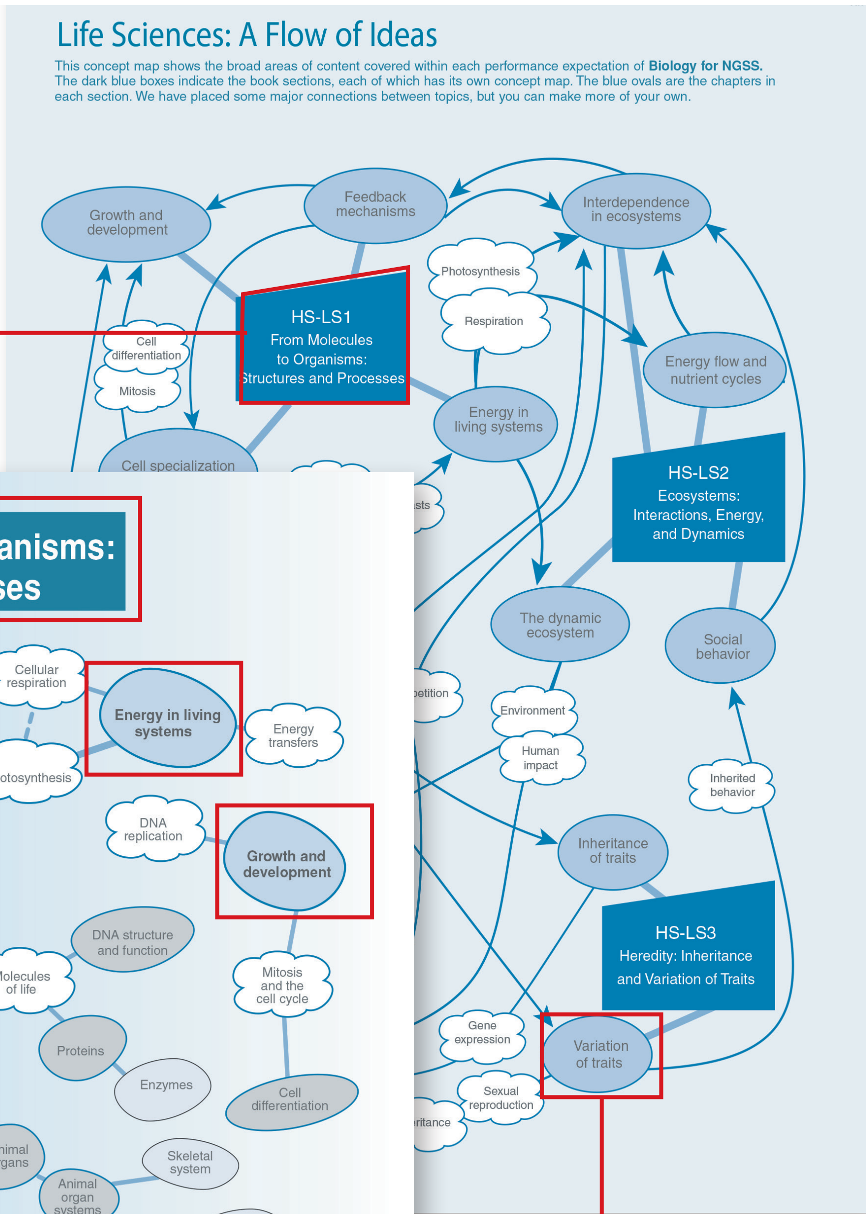
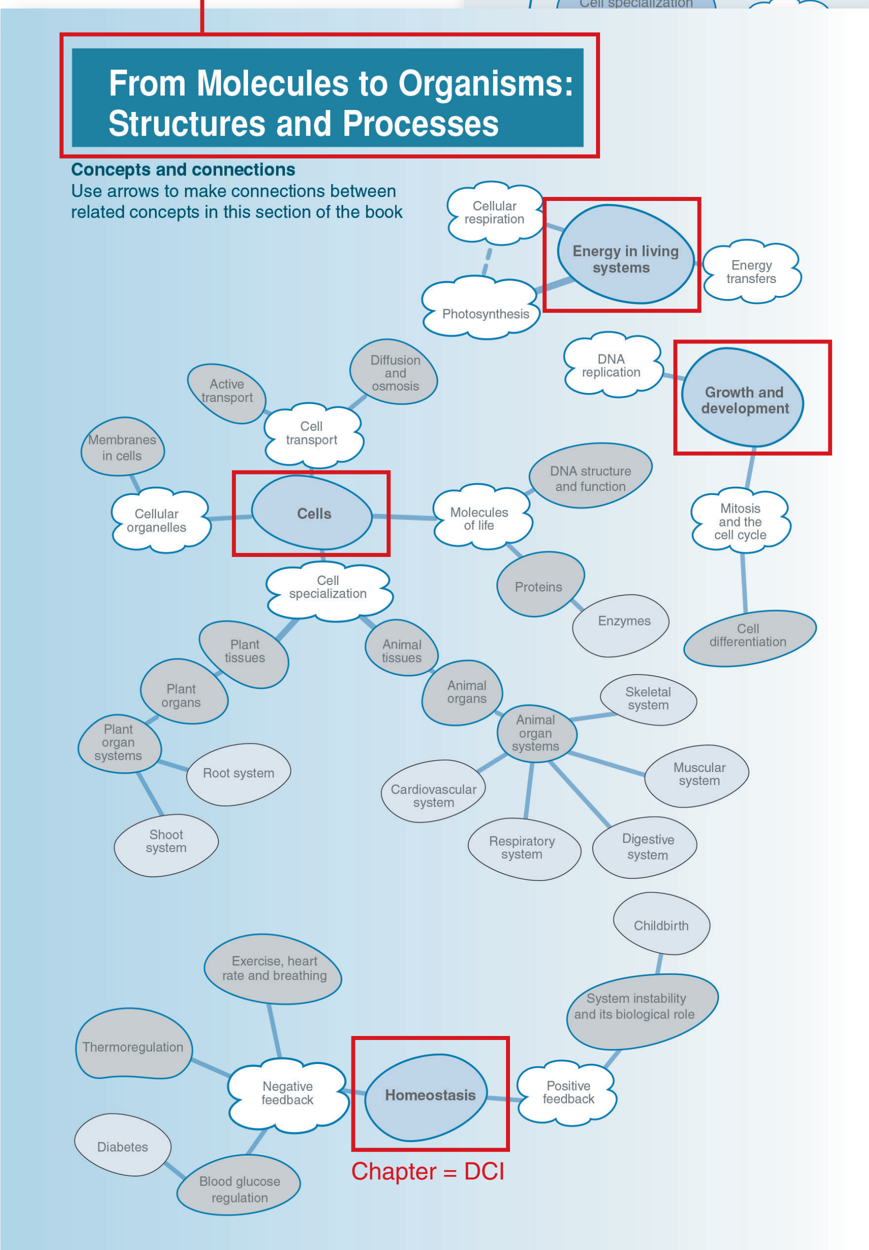
The Concept Maps

The concept maps in *Biology for NGSS* have two broad purposes: to provide a map of ideas covered in the program and to provide a vehicle for students to make their own connections between those ideas. They are particularly useful as graphic organizers for striving students and visual learners. The introductory map provides an overview of the structure of the *NGSS Life Sciences* program. Section concept maps divide the book into four parts, each providing a visual summary of one of four broad areas within the program, corresponding to LS1-LS4. Encourage students to draw their own connections between ideas on the concept maps as they work through the topics. This will help students to see the interrelatedness the topics, and realize that they are not isolated, but connect with many other topics within the program.



Each major section of the worktext corresponds to a set of overarching Performance Expectations. There are four sections: LS1-LS4.



Each chapter of the book corresponds to specific major DCI of the NGSS-LS program.

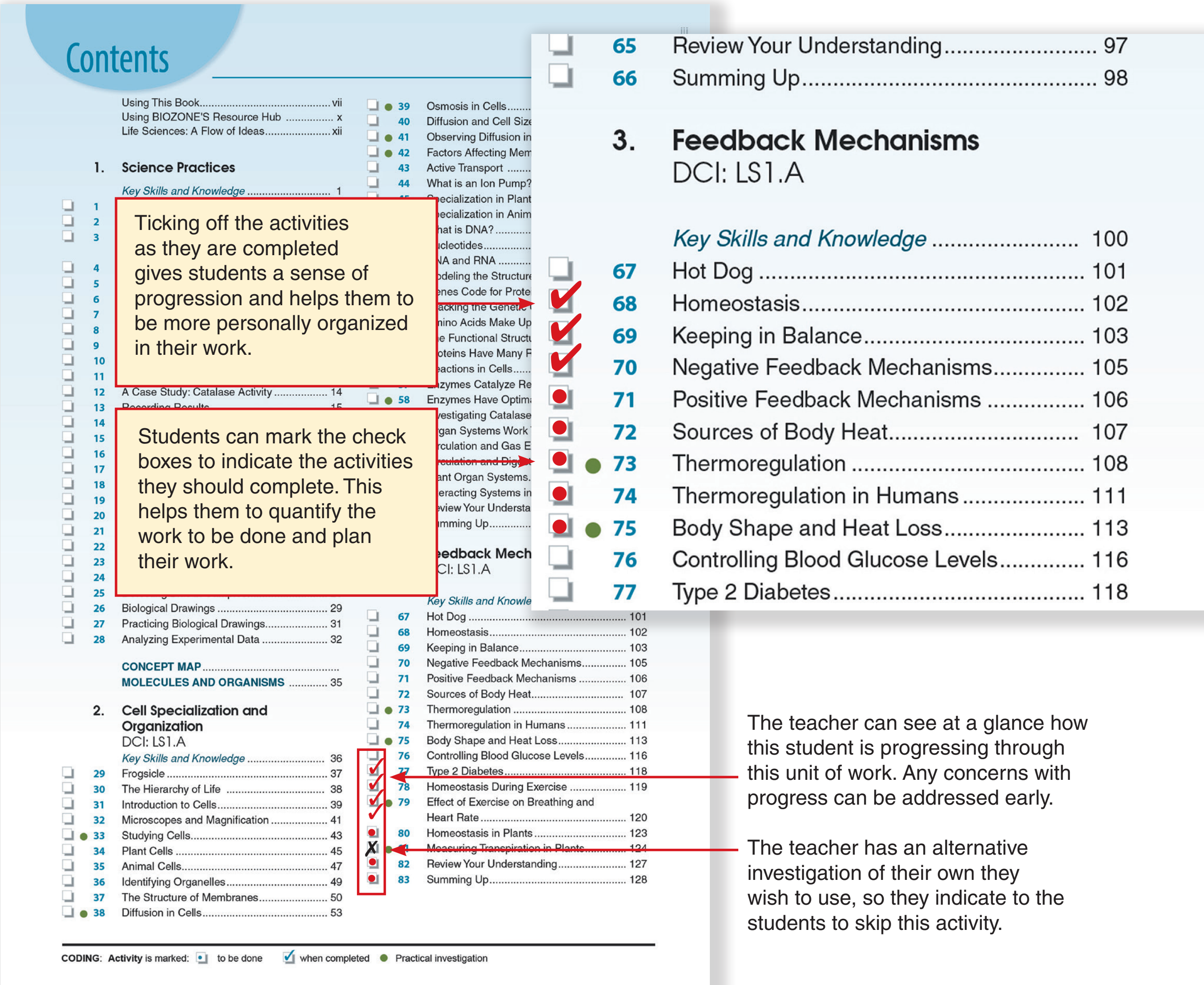
There is one concept map for the entire program (above) and one for each major collection of DCIs within a section (left).

Content coverage indicated in hierarchical order: chapter heading (blue ovals), main concepts (clouds), and related concepts (gray ovals).

Encourage your students to make their own connections between topics and annotate the map with their own ideas.

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.



Pacing Guide

A pacing guide is available for teachers to download from the Resource Hub for this title.

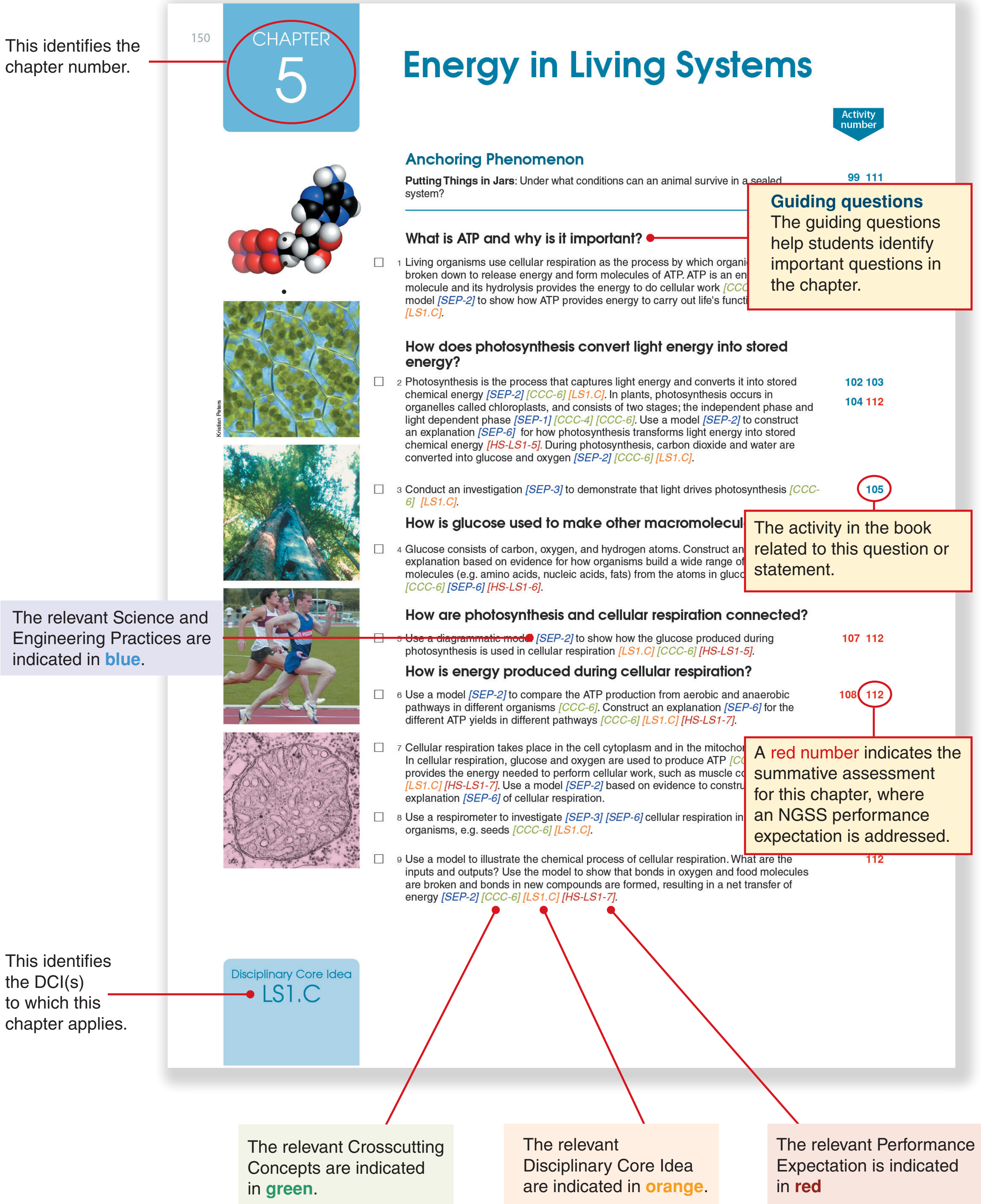
The 9-12 NGSS framework is fluid in terms of the grade in which each program is offered, so in many respects defies a rigid pacing guide. Within grade, other variables contribute to changes in pacing:

- There are opportunities for students to spend longer on some activities, e.g. in improving or refining their design solutions 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 book. To help you, activities including a practical investigation are identified with a green dot (●) in the contents of the student work text.
- For spreadsheet modeling activities, completed models are available on **BIOZONE's Resource Hub** and the Digital Teacher's Edition. If you need to save time, students can use these spreadsheets instead of taking time to construct it themselves.
- 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 math and science practice skills. Have students carry out the activities as homework if you are short on time.

Identifying Learning Intentions and Goals

In developing *Biology for NGSS*, we have embraced the three dimensions of the NGSS framework, emphasizing the application of ideas and skills to new scenarios. The activities in *Biology for NGSS* have been specifically designed to address the **Disciplinary Core Ideas (DCIs), Science and Engineering Practices, and Crosscutting Concepts** in a way that helps students to meet specific **Performance Expectations**.

In the Teacher's Edition and Digital Teacher's Edition, all three dimensions are embedded in the chapter introduction and color coded for easy identification (below). The performance expectations are also identified. It is important to note that *this coding is a tool for the teacher and is not present in the Student Edition*.



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CHAPTER 5

Energy in Living Systems

Activity number

Anchoring Phenomenon

Putting Things in Jars: Under what conditions can an animal survive in a sealed system? — 99 111

What is ATP and why is it important?

1 Living organisms use cellular respiration as the process by which organi... broken down to release energy and form molecules of ATP. ATP is an en... molecule and its hydrolysis provides the energy to do cellular work [CCC... model [SEP-2] to show how ATP provides energy to carry out life's functi... [LS1.C].

How does photosynthesis convert light energy into stored energy?

2 Photosynthesis is the process that captures light energy and converts it into stored chemical energy [SEP-2] [CCC-6] [LS1.C]. In plants, photosynthesis occurs in organelles called chloroplasts, and consists of two stages; the independent phase and light dependent phase [SEP-1] [CCC-4] [CCC-6]. Use a model [SEP-2] to construct an explanation [SEP-6] for how photosynthesis transforms light energy into stored chemical energy [HS-LS1-5]. During photosynthesis, carbon dioxide and water are converted into glucose and oxygen [SEP-2] [CCC-6] [LS1.C]. — 102 103 104 112

3 Conduct an investigation [SEP-3] to demonstrate that light drives photosynthesis [CCC-6] [LS1.C]. — 105

How is glucose used to make other macromolecul...

4 Glucose consists of carbon, oxygen, and hydrogen atoms. Construct an explanation based on evidence for how organisms build a wide range of molecules (e.g. amino acids, nucleic acids, fats) from the atoms in gluc... [CCC-6] [SEP-6] [HS-LS1-6].

How are photosynthesis and cellular respiration connected?

5 Use a diagrammatic model [SEP-2] to show how the glucose produced during photosynthesis is used in cellular respiration [LS1.C] [CCC-6] [HS-LS1-5]. — 107 112

How is energy produced during cellular respiration?

6 Use a model [SEP-2] to compare the ATP production from aerobic and anaerobic pathways in different organisms [CCC-6]. Construct an explanation [SEP-6] for the different ATP yields in different pathways [CCC-6] [LS1.C] [HS-LS1-7]. — 108 112

7 Cellular respiration takes place in the cell cytoplasm and in the mitochon... In cellular respiration, glucose and oxygen are used to produce ATP [C... provides the energy needed to perform cellular work, such as muscle c... [LS1.C] [HS-LS1-7]. Use a model [SEP-2] based on evidence to constru... explanation [SEP-6] of cellular respiration.

8 Use a respirometer to investigate [SEP-3] [SEP-6] cellular respiration in... organisms, e.g. seeds [CCC-6] [LS1.C].

9 Use a model to illustrate the chemical process of cellular respiration. What are the inputs and outputs? Use the model to show that bonds in oxygen and food molecules are broken and bonds in new compounds are formed, resulting in a net transfer of energy [SEP-2] [CCC-6] [LS1.C] [HS-LS1-7]. — 112

Disciplinary Core Idea LS1.C

Scaffolded Learning with the 5 Es

In developing *Biology for NGSS* we have utilized the **5Es Instructional Model** as a basis for developing materials to address all three dimensions of the NGSS framework: Disciplinary Core Ideas (DCIs), Science and Engineering Practices, and Crosscutting Concepts. By successfully completing the activities, students can demonstrate competence in all three dimensions. This is central to meeting the performance expectations for *Biology for NGSS* with confidence.

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.

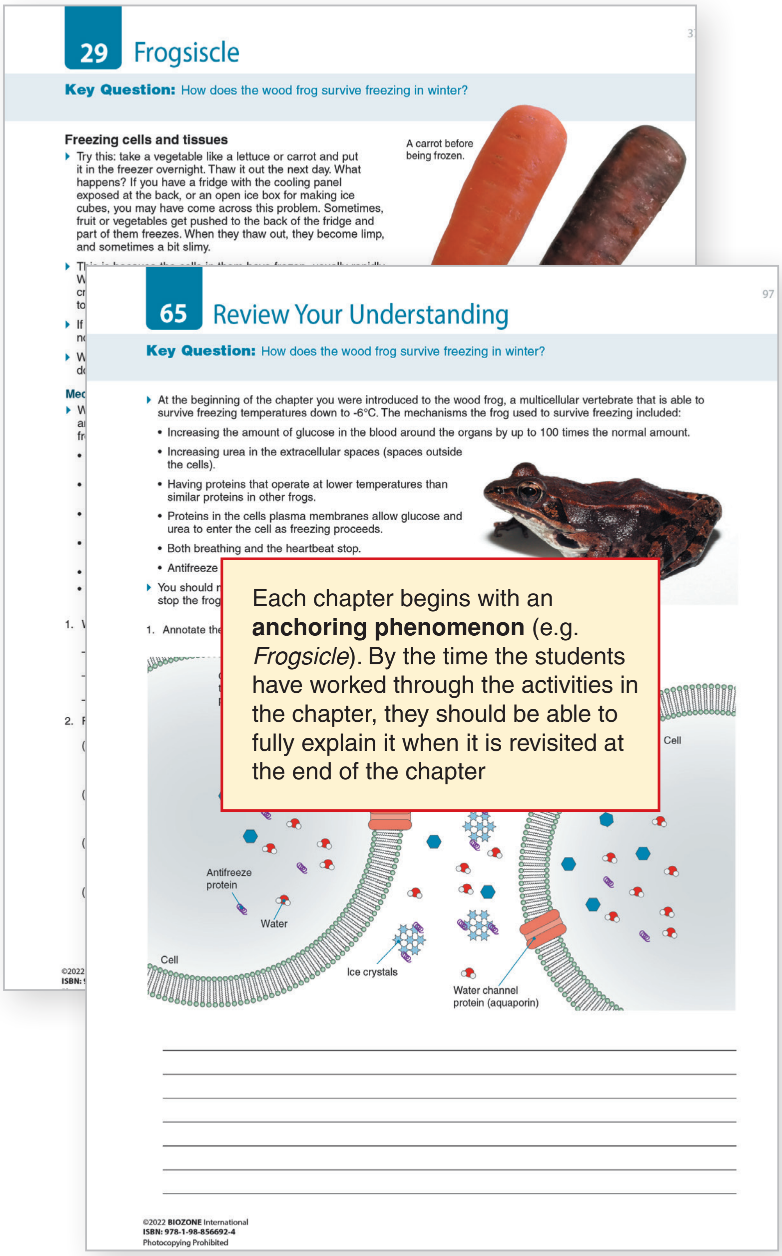
BIOZONE encourages the development of the NGSS learner profile using the 5Es model

BIOZONE's NGSS series is **phenomenon-based**. Students engage with phenomena through their own investigations and observations, through modeling and data analysis, and through collaborative work and discussion.

Using phenomena to drive inquiry promotes discussion and the sharing of ideas. The scaffold approach presents opportunities to look at phenomena from several different perspectives. This allows students of all abilities to expand their thinking and understanding, increasing understanding as they progress through the program.

Each chapter begins with an **anchoring phenomenon** (right). In each instance, we have chosen a phenomenon that the student may be familiar with, but which they cannot explain (or cannot explain fully). Teachers can use this activity to find out what the students already know (or think they know) before delving into the content more fully.

The subsequent activities in a chapter take the students, step by step, through phenomena that explore the ideas inherent in the anchoring phenomenon. By the time students revisit the anchoring phenomenon at the end of the chapter, they should be able to fully explain it.

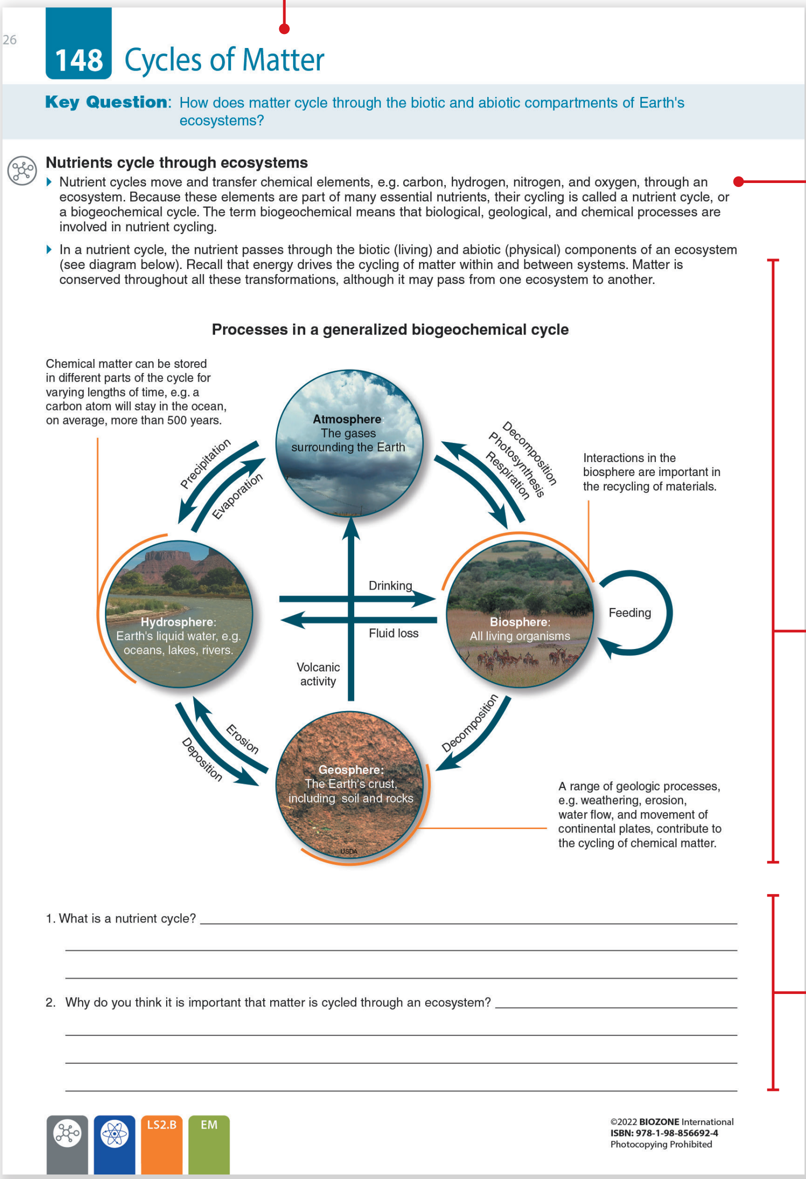


Each chapter begins with an **anchoring phenomenon** (e.g. *Frogsicle*). By the time the students have worked through the activities in the chapter, they should be able to fully explain it when it is revisited at the end of the chapter

The content of the *Biology for NGSS* is organized into 14 chapters based on the DCIs of the High School Life Sciences framework. Chapter 1 addresses basic skills for students in life sciences. Chapters 2 - 14 each begin with an introduction outlining learning goals, which is immediately followed by the anchoring phenomenon. Activities make up the bulk of each chapter, with each one focusing on the student investigating and developing understanding of a phenomenon, 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.

Annotated diagrams and photographs are a major part of most activities, and the student's understanding of the information is evaluated through questions and/or tasks involving data handling and interpretation. Tabs at the bottom of the page identify Crosscutting Concepts, Science and Engineering Practices, and Disciplinary Core Ideas, as appropriate. Resource Hub tabs indicate if the activity is supported via **BIOZONE's Resource Hub**, which provides online teacher and student support for specific aspects of the activity.

Concepts are presented as a logical sequence, which may be divided among several consecutive activities. Understanding is developed progressively through exploration and explanation.



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148 Cycles of Matter

Key Question: How does matter cycle through the biotic and abiotic compartments of Earth's ecosystems?

Nutrients cycle through ecosystems

- Nutrient cycles move and transfer chemical elements, e.g. carbon, hydrogen, nitrogen, and oxygen, through an ecosystem. Because these elements are part of many essential nutrients, their cycling is called a nutrient cycle, or a biogeochemical cycle. The term biogeochemical means that biological, geological, and chemical processes are involved in nutrient cycling.
- In a nutrient cycle, the nutrient passes through the biotic (living) and abiotic (physical) components of an ecosystem (see diagram below). Recall that energy drives the cycling of matter within and between systems. Matter is conserved throughout all these transformations, although it may pass from one ecosystem to another.

Processes in a generalized biogeochemical cycle

1. What is a nutrient cycle? ______

2. Why do you think it is important that matter is cycled through an ecosystem? ______

LS2.B EM

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ENGAGE
The first activity in a related sequence is often an introductory type activity. It may begin with a brief task, observation, or example to engage student thinking.

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. Sometimes students are asked to carry out their own research or investigation.

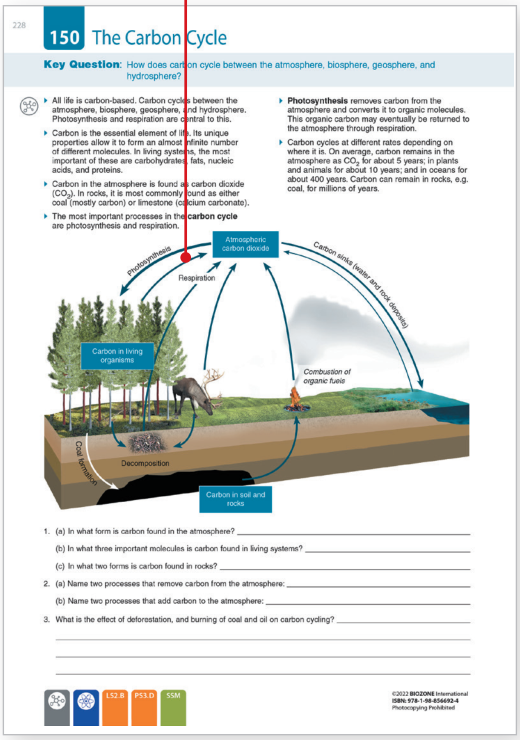
Questions allow students to demonstrate their understanding. By inputting their answers students form a record of work, allowing for easy revision in context with the stimulus information.

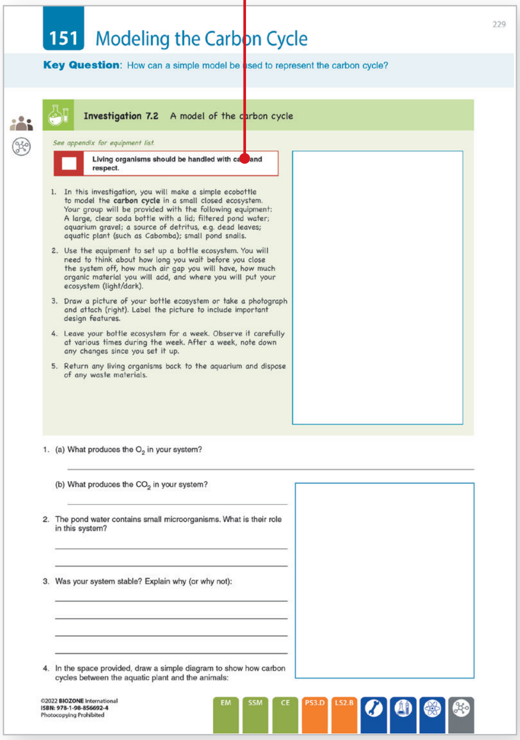
Relevant SEPs, DCIs, and CCCs are identified through the tab system.

This activity also has supporting resources on **BIOZONE's Resource Hub** assigned to it.

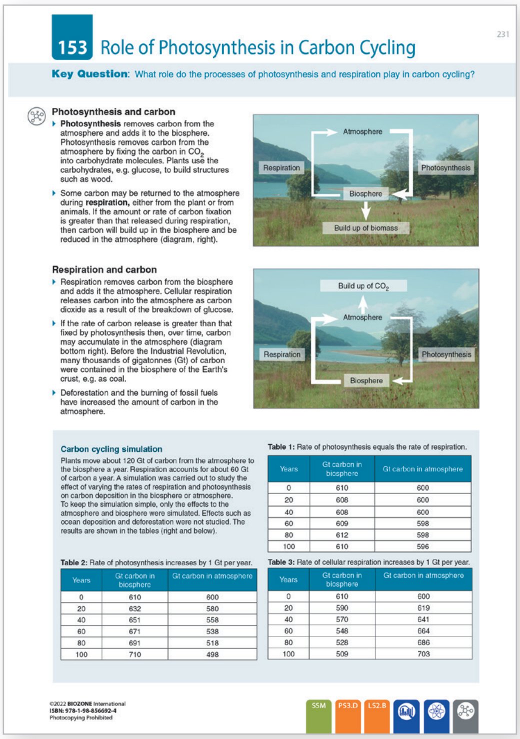
A related sequence of activities allow students to build a deeper understanding of their knowledge as they progress through the activity sequence. Students have already been introduced to biogeochemical cycles, and now begin to **EXPLORE** the carbon cycle.

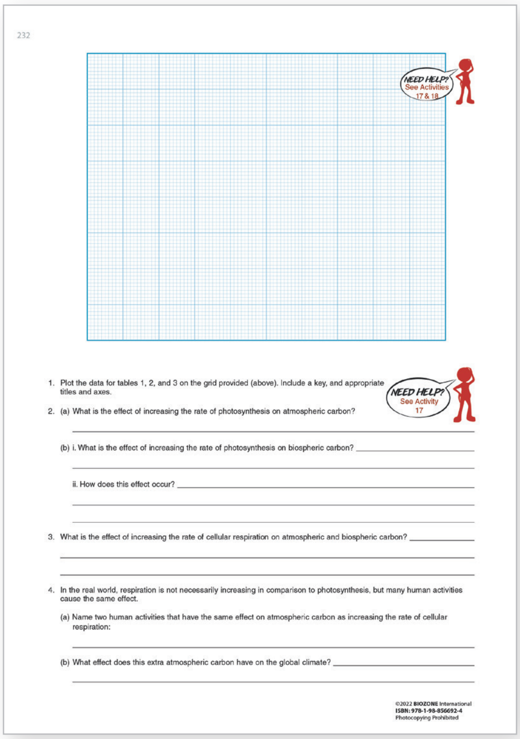
Students may have many opportunities to explore through a variety of activities including practical investigations, creating models, analyzing or using second hand data, or interpreting diagrams. In this example, students have the opportunity to **EXPLORE** the carbon cycle through a simple practical investigation.





Students **EXPLAIN** phenomena by building on what they discovered through exploration. They are encouraged to use scientific principles and logical reasoning to construct explanations and devise solutions to the problems presented to them. After sound explanations of phenomena are developed, students have opportunity to **ELABORATE**, applying their understanding to new phenomena or using their experience to develop or refine engineering solutions to relevant problems. Where incorporated, **EVALUATE** sections can be used for formative assessment if you wish. In this example, students apply their knowledge of photosynthesis and cellular respiration (earlier chapter) to explain how they influence the carbon cycle.





Practical Investigations

Throughout *Biology for NGSS*, students are given opportunities to explore phenomena through experimentation. These **investigative phenomena** 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.

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 together. 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.

The investigations provide students with health and safety information at the start of the investigation.

- Ensure your students read through the procedure fully *before beginning* the investigation.
- Highlight any hazardous or important steps, and make sure the students follow your directions.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33 Studying Cells

Key Question: What techniques are used to prepare and view cells under a light microscope?

- Specimens are usually prepared in some way before viewing in order to highlight features and reveal details. A wet mount is a temporary preparation in which a specimen and a drop of fluid are trapped under a thin coverslip. Wet mounts improve a sample's appearance and enhances visible detail. Sections must be made very thin.

Investigation 2.1 Preparing an onion slide

See appendix for equipment list.

Caution is required when using scalpels or razors. Iodine stains skin and clothes, and irritates the eyes. You should wear protective eyewear.

1. Onions make good subjects for preparing a si[ngl]e wet mount. Cut a square segment from a thick leaf of the bulb using a razor or scalpel.
2. Bend the segment towards the upper epidermi[s] (upper cell layer) unti[l] ... parenchym...
3. Carefully ... snapped le... the upper ...
4. Place the ... slide and ...
5. Carefully ... needle can ... including ...
6. Use a smal... excess water.
7. Place the slide on the microscope tray. Locate the specimen or region of interest at the lowest magnification. Focus using the lowest magnification first (remembering to move the lens away from the slide) before switching to the higher magnifications.
8. After viewing the slide under various magnifications, remove the slide and place it on the bench.
9. At the edge of the coverslip, place a small drop of iodine stain.
10. On the opposite side of the coverslip use a piece of tissue or filter paper to draw the water out from under the coverslip. The iodine will be drawn under the coverslip.
11. Replace the slide on the microscope and view the stained onion peel.

1. Why must sections viewed under a microscope be very thin?
2. Why do you think the specimen is covered with a coverslip?
3. Why would no chloroplasts be visible in an onion epidermis cell slide?

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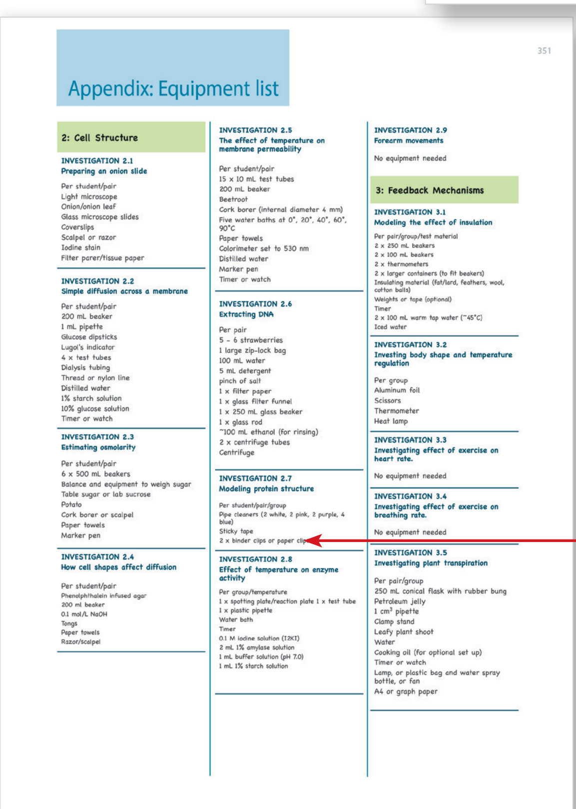
LS1.A

Hazards and required PPE (where applicable) are clearly identified on the investigation.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Appendix: Equipment list

2: Cell Structure

INVESTIGATION 2.1
Preparing an onion slide
Per student/pair
Light microscope
Onion/onion leaf
Glass microscope slides
Coverslips
Scalpel or razor
Iodine stain
Filter parer/tissue paper

INVESTIGATION 2.2
Simple diffusion across a membrane
Per student/pair
200 mL beaker
1 mL pipette
Glucose dipsticks
Lugol's indicator
4 x test tubes
Dialysis tubing
Thread or nylon line
Distilled water
1% starch solution
10% glucose solution
Timer or watch

INVESTIGATION 2.3
Estimating osmolarity
Per student/pair
6 x 500 mL beakers
Balance and equipment to weigh sugar
Table sugar or lab sucrose
Potato
Cork borer or scalpel
Paper towels
Marker pen

INVESTIGATION 2.4
How cell shapes affect diffusion
Per student/pair
Phenolphthalein infused agar
200 ml beaker
0.1 mol/L NaOH
Tongs
Paper towels
Razor/scalpel

INVESTIGATION 2.5
The effect of temperature on membrane permeability
Per student/pair
15 x 10 mL test tubes
200 mL beaker
Beetroot
Cork borer (internal diameter 4 mm)
Five water baths at 0°, 20°, 40°, 60°, 90°C
Paper towels
Colorimeter set to 530 nm
Distilled water
Marker pen
Timer or watch

INVESTIGATION 2.6
Extracting DNA
Per pair
5 - 6 strawberries
1 large zip-lock bag
100 mL water
5 mL detergent
pinch of salt
1 x filter paper
1 x glass filter funnel
1 x 250 mL glass beaker
1 x glass rod
~100 mL ethanol (for rinsing)
2 x centrifuge tubes
Centrifuge

INVESTIGATION 2.7
Modeling protein structure
Per student/pair/group
Pipe cleaners (2 white, 2 pink, 2 purple, 4 blue)
Sticky tape
2 x binder clips or paper clips

INVESTIGATION 2.8
Effect of temperature on enzyme activity
Per group/temperature
1 x spotting plate/reaction plate 1 x test tube
1 x plastic pipette
Water bath
Timer
0.1 M iodine solution (I2KI)
2 mL 1% amylase solution
1 mL buffer solution (pH 7.0)
1 mL 1% starch solution

INVESTIGATION 2.9
Forearm movements
No equipment needed

3: Feedback Mechanisms

INVESTIGATION 3.1
Modeling the effect of insulation
Per pair/group/test material
2 x 250 mL beakers
2 x 100 mL beakers
2 x thermometers
2 x larger containers (to fit beakers)
Insulating material (fat/lard, feathers, wool, cotton balls)
Weights or tape (optional)
Timer
2 x 100 mL warm tap water (~45°C)
Iced water

INVESTIGATION 3.2
Investing body shape and temperature regulation
Per group
Aluminum foil
Scissors
Thermometer
Heat lamp

INVESTIGATION 3.3
Investigating effect of exercise on heart rate.
No equipment needed

INVESTIGATION 3.4
Investigating effect of exercise on breathing rate.
No equipment needed

INVESTIGATION 3.5
Investigating plant transpiration
Per pair/group
250 mL conical flask with rubber bung
Petroleum jelly
1 cm^3 pipette
Clamp stand
Leafy plant shoot
Water
Cooking oil (for optional set up)
Timer or watch
Lamp, or plastic bag and water spray bottle, or fan
A4 or graph paper

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 appendix of the Student Edition.

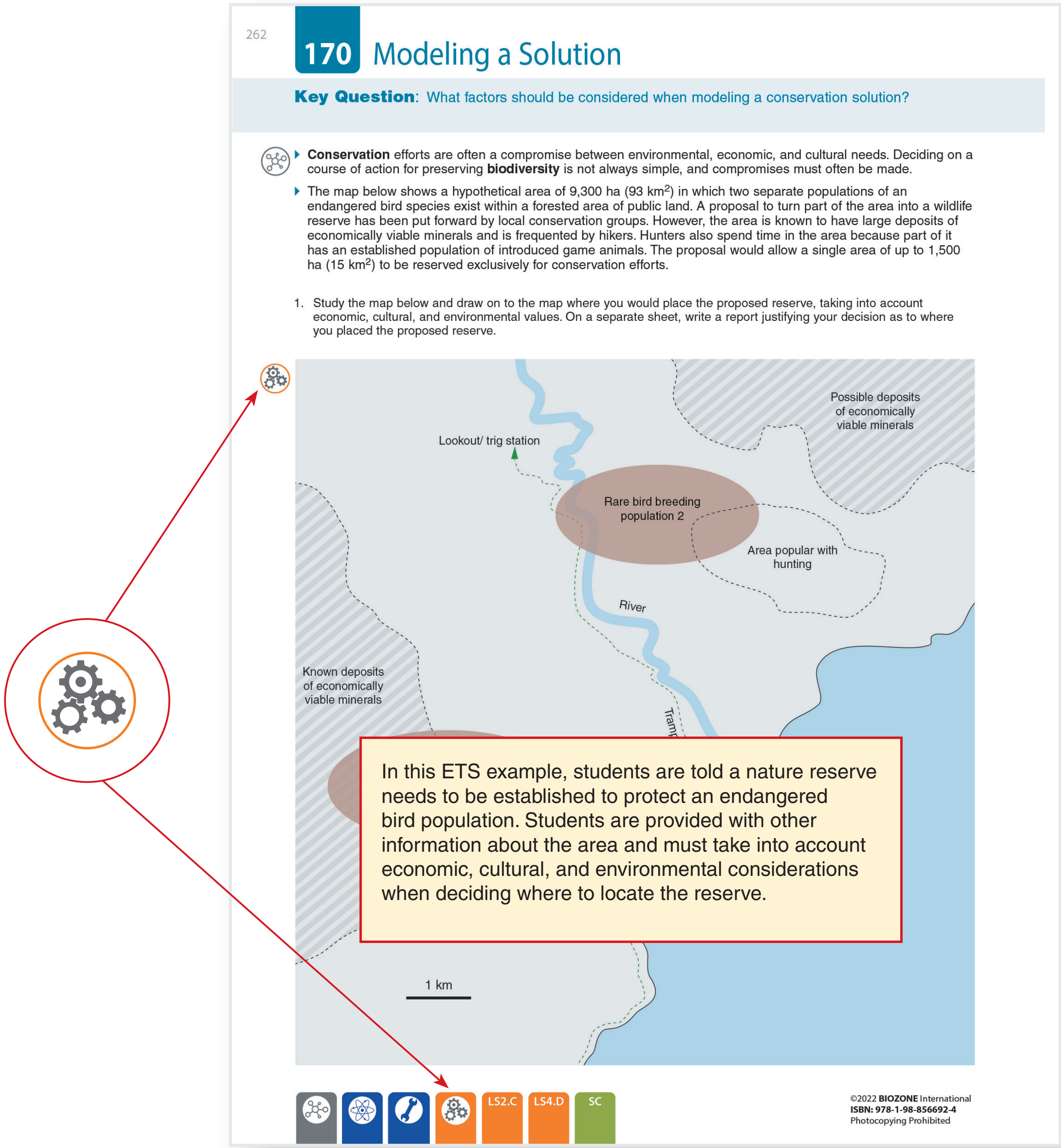
Engineering Design Solutions

At high school, students are expected to analyze major global issues and apply strategic thinking and problem solving to design possible solutions to a specific problem. Often, their solutions include taking into consideration scientific knowledge, the use of technology, and the impact of the solution on society.

Engineering Design (ETS) standards are indicated throughout the NGSS framework. They are incorporated into this title through the integration of engineering and design challenges, where appropriate. Typical Engineering Design tasks include analyzing problems, developing solutions using engineering, evaluating a design solution based on costs and benefits, or modeling a design solution. These activities provide students with a opportunity to apply their knowledge within a design challenge and think outside the box to come up with potential solutions.

The ETS components are indicated in the chapter introduction of the Teacher's Edition and Digital Teacher's Edition, and also in the summary tables in the Classroom Guide. They are also identified through the tab system on the activity itself (bottom of page and margin). Such tasks are usually examples of ELABORATE or EVALUATE as they involve the students applying what they have learned to solve a problem. As such, they also make good tasks for formative or summative assessment.

The ETS icon at the bottom of the page and in the margin identify when an ETS is covered.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170 Modeling a Solution

Key Question: What factors should be considered when modeling a conservation solution?

- **Conservation** efforts are often a compromise between environmental, economic, and cultural needs. Deciding on a course of action for preserving **biodiversity** is not always simple, and compromises must often be made.
- The map below shows a hypothetical area of 9,300 ha (93 km^2) in which two separate populations of an endangered bird species exist within a forested area of public land. A proposal to turn part of the area into a wildlife reserve has been put forward by local conservation groups. However, the area is known to have large deposits of economically viable minerals and is frequented by hikers. Hunters also spend time in the area because part of it has an established population of introduced game animals. The proposal would allow a single area of up to 1,500 ha (15 km^2) to be reserved exclusively for conservation efforts.

1. Study the map below and draw on to the map where you would place the proposed reserve, taking into account economic, cultural, and environmental values. On a separate sheet, write a report justifying your decision as to where you placed the proposed reserve.

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Evaluating Student Performance

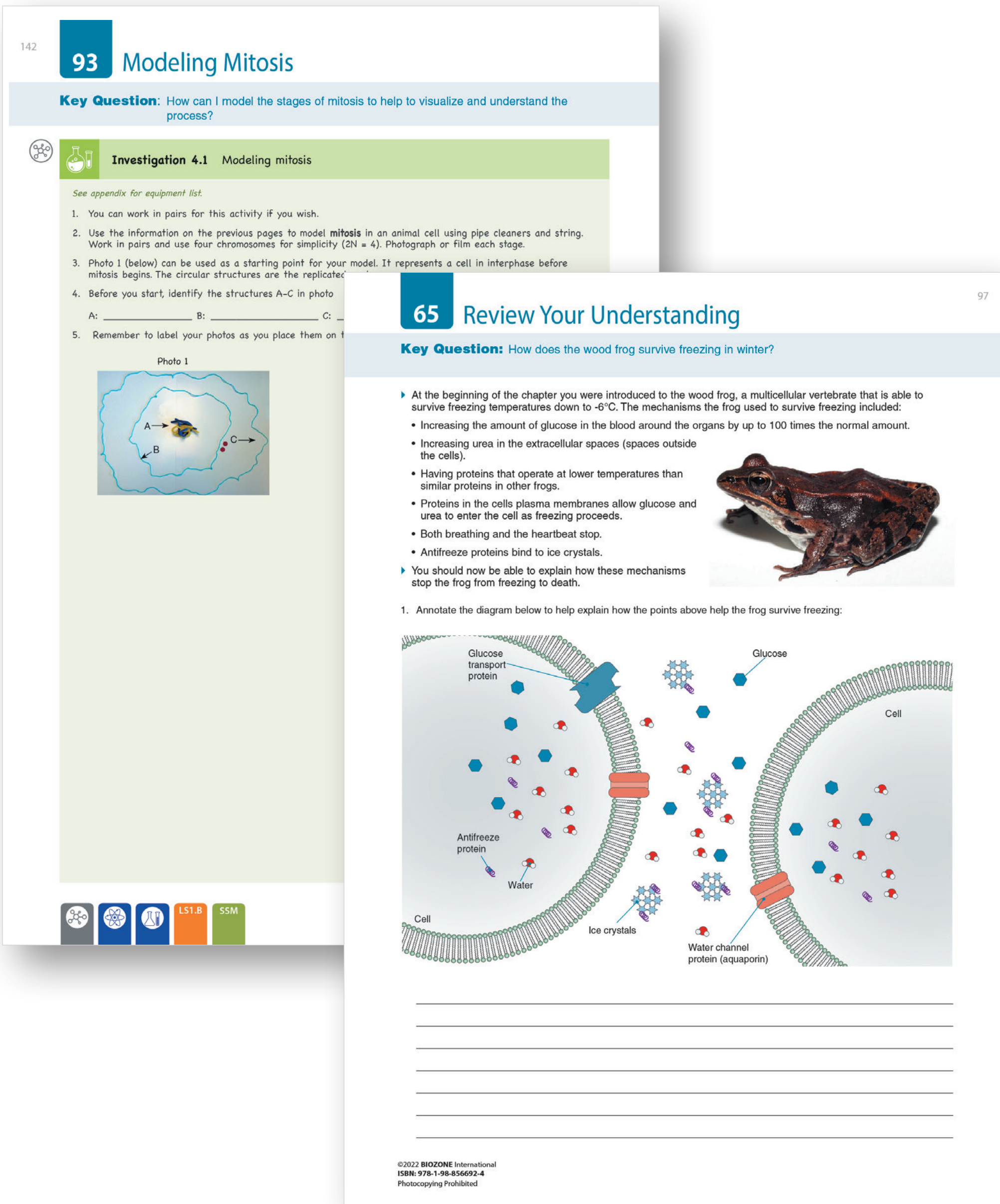
Biology for NGSS provides ample opportunity for students to demonstrate their understanding and proficiency in all three dimensions of the standards. Opportunities for both formative and summative assessment are provided.

Activities and assessments have been designed to be three-dimensional in their approach, with the goal of enabling achievement of specific performance expectations. Performance expectations (PE) are not always met through completion of one activity or assessment, but through completion of a connected suite of tasks (as intended by the framework).

Assessments involve a variety of tasks appropriate to a 3D approach, e.g., constructing models, analyzing and interpreting data, explaining, and communicating understanding through short and long answers, drawings, calculations, group work, design, and problem solving. The structure of the tasks is such that students use specific science and engineering practices and apply relevant crosscutting concepts to demonstrate their understanding of disciplinary core ideas.

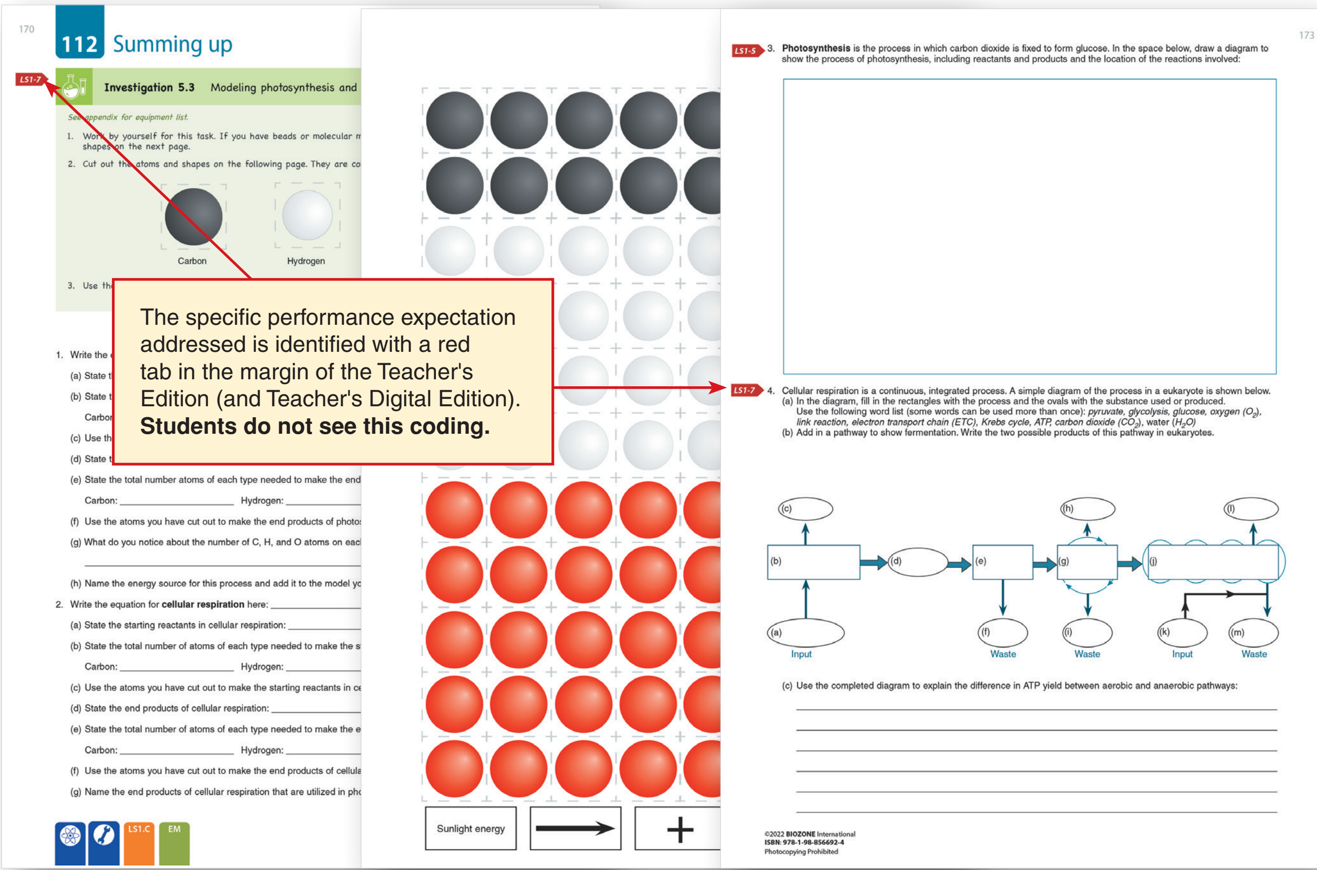
FORMATIVE ASSESSMENT

Formative assessments can be chosen by the teacher to determine how a student's knowledge is progressing within a selected topic. We suggest that ‘ELABORATE’ and ‘EVALUATE’ activities be used for formative assessment. These may incorporate some aspect of a performance expectation, with the goal being to build confidence. Teachers can revise their instruction, revisit material, or set further tasks if a student is having difficulty with the material. Revisiting the Anchoring Phenomenon (Review Your Understanding) near the end of each chapter also provides a way to evaluate student understanding.



SUMMATIVE ASSESSMENT

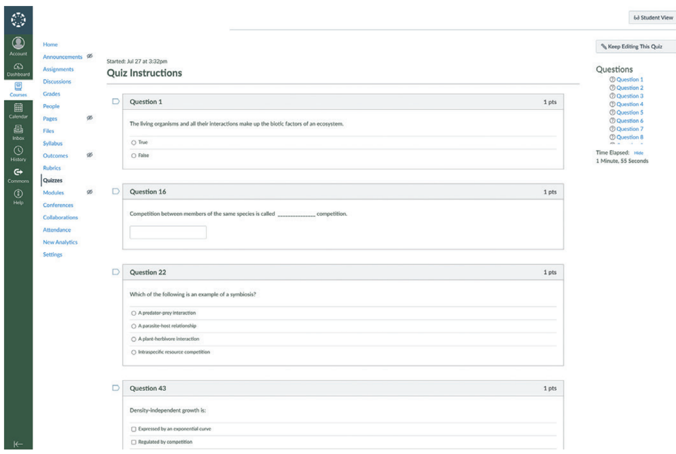
Summing up tasks at the close of each chapter can be used as a formal summative testing moment to evaluate student skills, understanding, and application of knowledge. These tasks are designed to meet part or all of one or more performance expectations. Material to address specific performance expectations is identified with a red tab in the margin throughout the Teacher's Edition. Performance expectations are also identified in the chapter introduction, and in the tables summarizing BIOZONE's 3D approach by chapter earlier in this guide.
Note: All coding associated with assessment is hidden from the student and is available only in teachers' materials.



Summative assessments are three dimensional assessments of student understanding, including but not restricted to:
• Short answer questions • Long answer questions • Graphing • Data analysis and interpretation • Modeling

TEST BANKS

- BIOZONE provide test banks to test student understanding of the DCI content within each chapter.
- These test content knowledge, and take the form of:
  - Multiple choice
  - Modified True/False
  - Matching
  - Yes/No
  - True/False
  - Multiple response
  - Short answer
  - Numeric response
- Test bank questions are formatted for ingestion into test generator software such as ExamView.
- Questions can be edited and can be used in other formats such as Google forms, Quizlet, or Kahoot for variation.

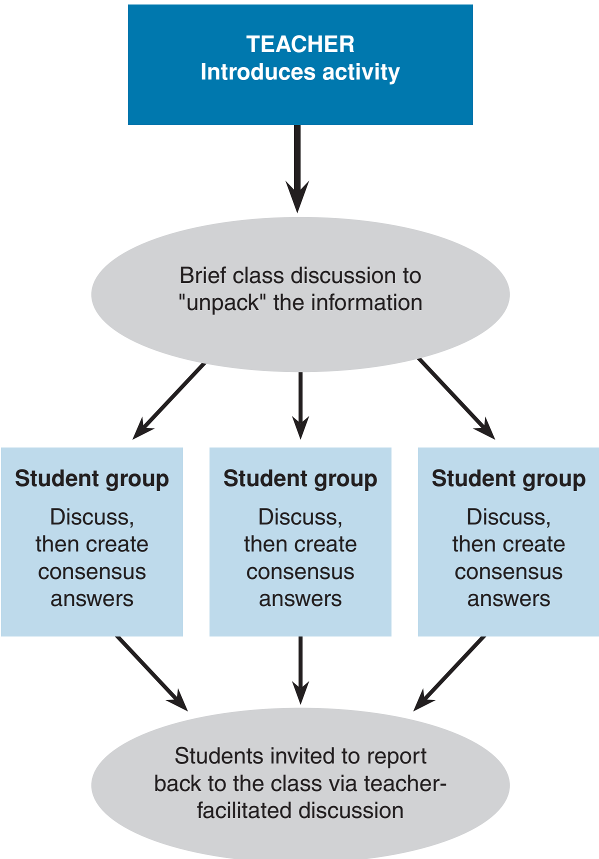


Teaching Strategies for Classroom Use

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 books 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.



Using collaboration to maximize learning outcomes

- The structure of *Biology for NGSS* 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.

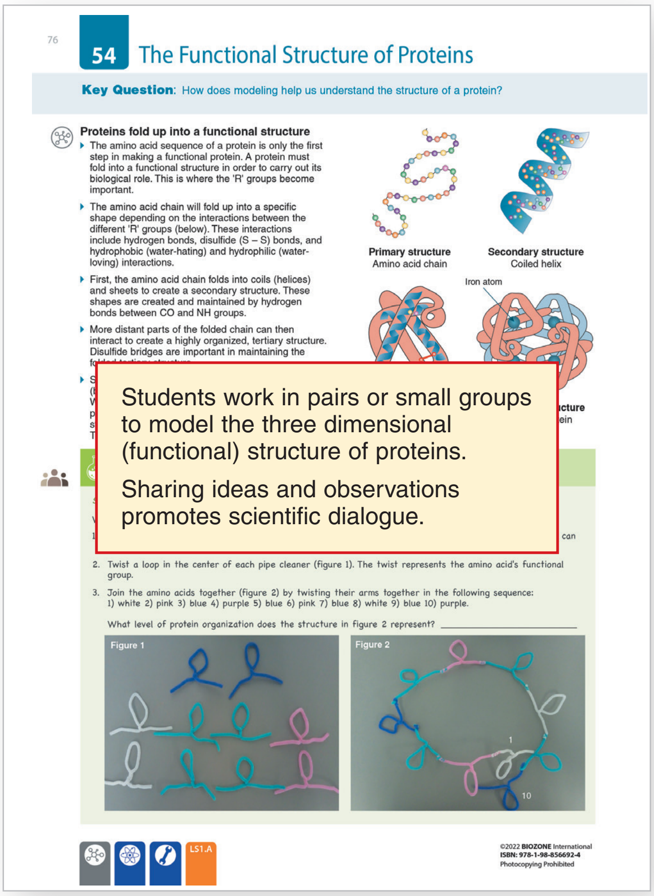
The teacher introduces the topic. They provide structure to the session by providing background information and setting up discussion points and clear objectives. Collaboration is emphasized to encourage participation from the entire group. If necessary, students in a group can be assigned specific tasks.

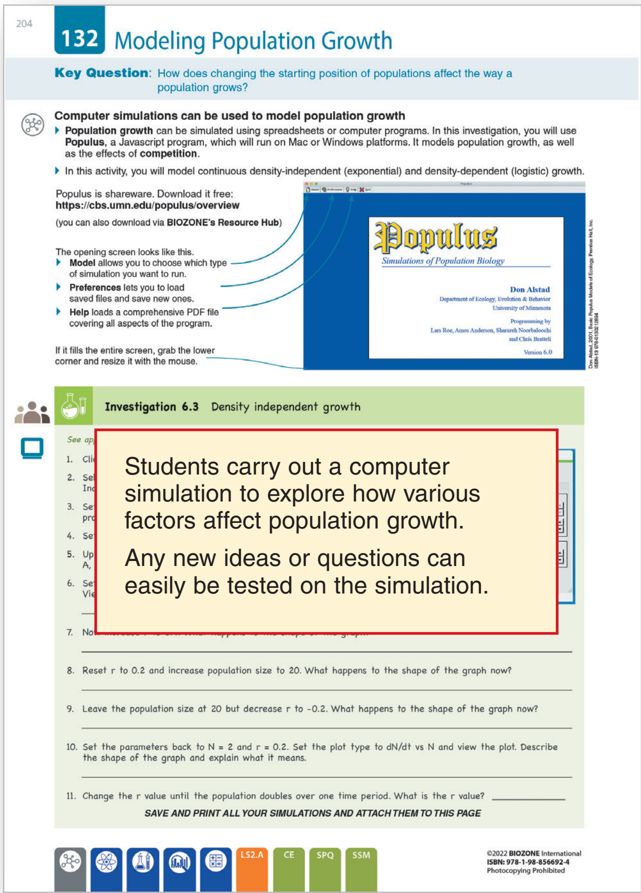
Students work in small groups so that everyone's contribution is heard. They collaborate, share ideas, and engage in discourse. The emphasis is on discussing questions and formulating a consensus answer, not just sharing ideas.

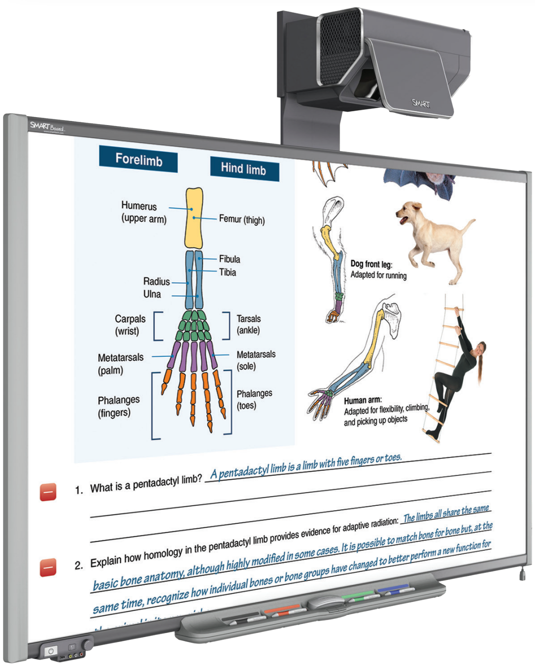
At the end of the session, students report back on their findings. Each student should have enough knowledge to report back on the group's findings. Reporting consists primarily of providing answers to questions, but may involve presenting a report, model, or slide show, or contributing to a debate.

Peer to peer support

- **Peer-to-peer learning** is emphasized throughout the book, 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 a second language can ask their classmates to explain unfamiliar terms and this benefits the understanding of both parties.
- **Practical investigations** are an ideal vehicle for peer-to-peer learning. Students can work together to review their results, ask and answer questions, and describe phenomena. There are also opportunities for students to collaborate using online simulations, e.g. modeling population growth, shown below.







Interactive revision of tasks in class

- The **Digital Teacher's Edition** provides a digital rights managed (DRM) version of the student book as PDF files. It features useful HIDE/SHOW answers, which can be used to review activities in class using a data projector or interactive whiteboard (left).
- Students benefit from the feedback in class, where questions can be addressed, and teachers benefit by having students self-mark their work and receive helpful feedback on their responses.
- This approach is particularly suited to activities with questions requiring a discussion, as students will be able to clarify some aspects of their responses. Stronger students can benefit by contributing to the explanatory feedback and class discussion.

NGSS for collaboration and discovery

- BIOZONE's *Biology for NGSS* provides multiple chances for collaboration and discovery. By working together and sharing ideas, students are exposed to different perspectives and levels of knowledge about phenomena.
- NGSS requires deeper student engagement, with less emphasis on facts and more on understanding. By exploring principles and concepts within a context, students are more easily able to apply these principles to new phenomena.
- BIOZONE's *Biology for NGSS* uses the NGSS 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.

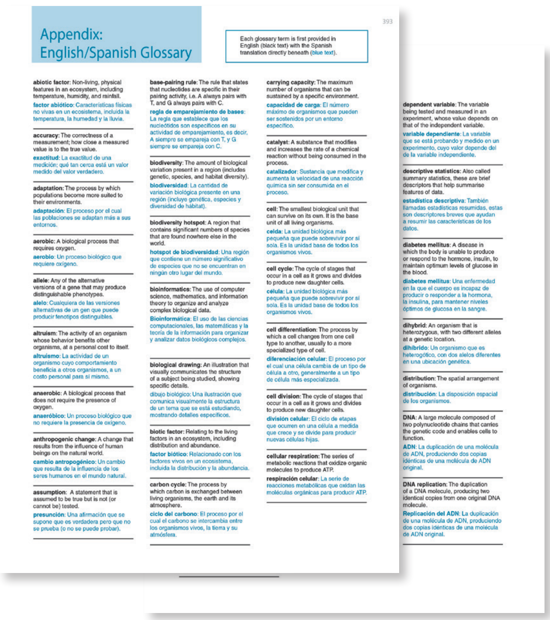
Student A is capable. He helps to lead the discussion and records the discussion in a structured way.

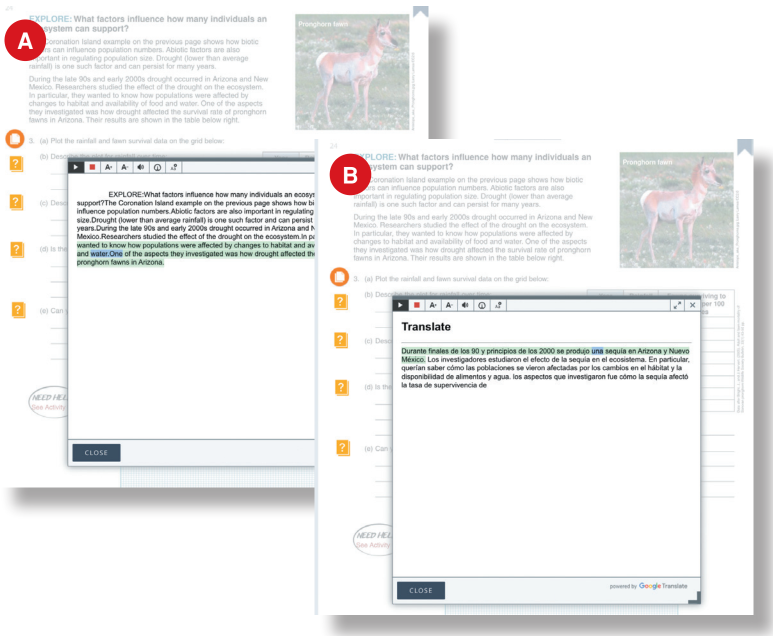
Students B and C are also capable but less willing to lead discussion. They will add ideas to the discussion but need a little direction from A to do so.

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.

How are English Language Learners Supported?

BIOZONE has several support mechanism in place to support English Language Learners (ELLs) in your classroom. In the printed books, a **glossary** of important key terms is provided in English and Spanish. In the eBooks, **text to speech** (read aloud) and **translation** functions support ELLs in their learning journey. More information on these features is provided below.





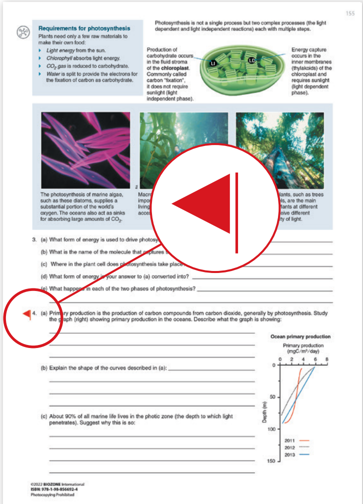
Encourage all students to use the **glossary** to build scientific literacy and become comfortable with using the terms appropriately. The glossary is available in English and Spanish to support Spanish speakers to more easily learn key terms.

Key terms, which have been **bolded** within an activity, are included in the glossary. Key terms are only bolded the first time they appear within an activity.

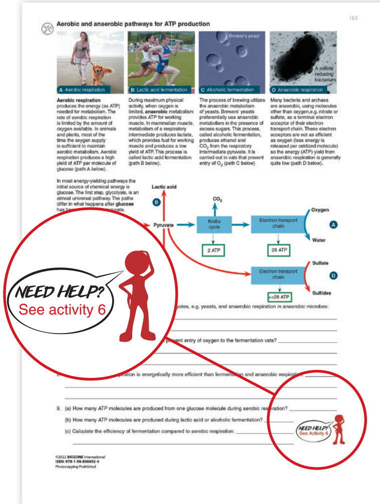
BIOZONE eBooks (CG17) provide support not only for ELLs but students who have difficulty reading. Simply highlight a passage of text and the text will be **read aloud** when the listen button is activated (**A**). Select the **translate function** and the selected text will translated into one of 21 languages (including Spanish). Students can have the translated text read out loud in their selected language too (**B**).
To learn more about using these functions visit:
https://ebookshelp.thebiozone.com/help/text-translation

Differentiated Learning

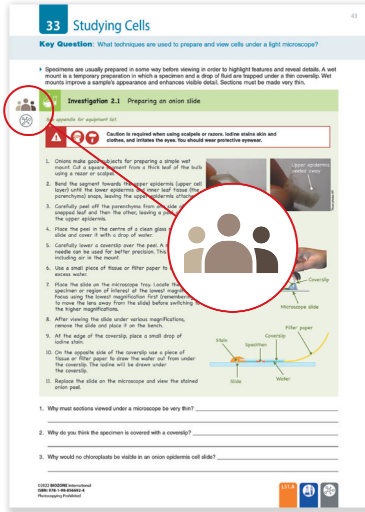
The structure of *Biology for NGSS* promotes differentiated instruction and has been designed to cater for students of all abilities. BIOZONE's collaborative approach to science inquiry encourages students of all abilities to share their ideas and knowledge with their peers, while at the same time broadening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



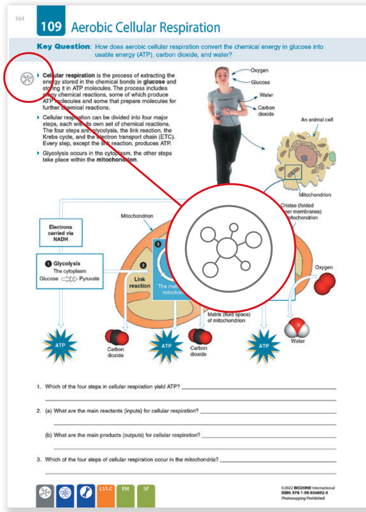
Extension Questions: **Red flag codes** beside a section or question (on the Teacher's Edition or Digital Teacher's Edition) indicate that students may need extra guidance from the teacher. These questions are also suitable as challenges for more able students to tackle on their own.



Need Help? Icon: The red NEED HELP? icon identifies where material is available in the Science Practices chapter to support a particular math or science practice skill. You can set these activities as homework as a refresher before the students attempt the activity needing the skill. Encourage students to refer to the Science Practices chapter often.

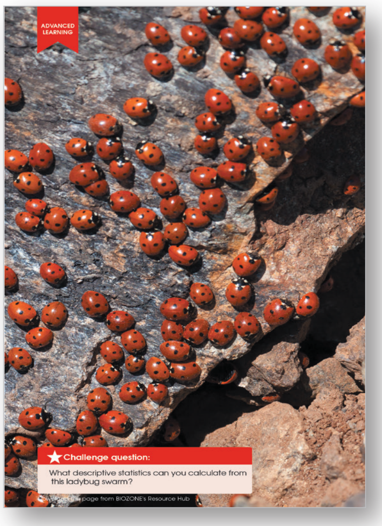


Collaboration Icon: A group symbol indicates where students can work together. Group work provides opportunities for student collaboration and peer-to-peer support to explore phenomena. Working in groups, students can experiences the benefits of collaboration in the scientific process of discovery. By speaking and listening to each other, communication skills and scientific vocabulary are extended.



Resource Hub: the **Resource Hub** supports learners of all abilities and also provides teacher support materials (CG18). Use the videos, games, and animations to help striving learners with their understanding of content. Some material is specifically tagged for gifted and talented students and for teachers.

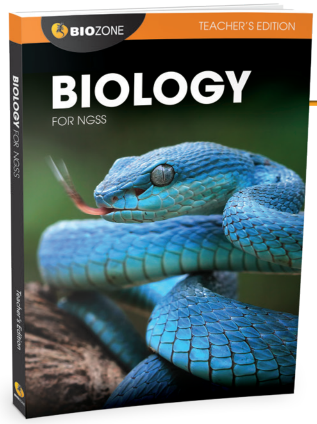
Glossary: Glossaries have been provided to help improve scientific literacy. Encourage students to refer to the glossary whenever they are unsure about the meaning of a key term. Key terms are identified by **bold black text**. The glossary is provided in both English and Spanish (CG15).



Challenge Question: Do you ever need an extra challenge for your more able students? The Teacher's Edition includes challenge questions. These are useful for extending gifted and talented students in particular (or any students keen to have go!). It can be downloaded from BIOZONE's **Resource Hub**, where it is the first link for each chapter.

The Teacher Toolkit

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



TEACHER'S EDITION - PRINT

The *Biology for NGSS* Teacher's Edition is the teacher's companion to the student worktext. Use this resource to gain insight into the features of B*iology for NGSS* and how to use them in your planning, delivery, and assessment.

The Classroom Guide provides a guide to best use of BIOZONE's resources. It includes teacher notes (CG20), covers strategies for teaching in a differentiated classroom, information about the assessment tools, the benefits of collaborative learning, and supporting delivery of the three dimensions and Common Core State Standards. An overview of the Teacher Toolkit is also provided. The Teacher's Edition follows the same flow as the Student Edition, and all suggested model answers are in place. Additional teacher coding identifies G&T material, Common Core State Standards, and Performance Expectations. Long answers requiring more space than is allowed on the page are included at the back of the Teacher's Edition.

EBOOK VERSIONS

BIOZONE eBooks provide a digital replica of the printed worktext, allowing students and teachers to seamlessly transition between both formats in a hybrid delivery situation. eBook material can be incorporated into several learning management systems. You can direct students to the required activity and provide notes and guidance about what you want them to do.

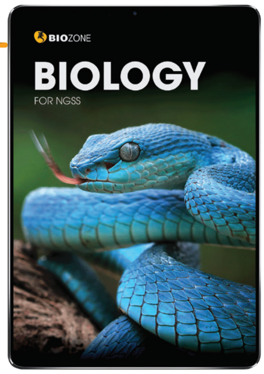
BIOZONE provides three different eBook products:

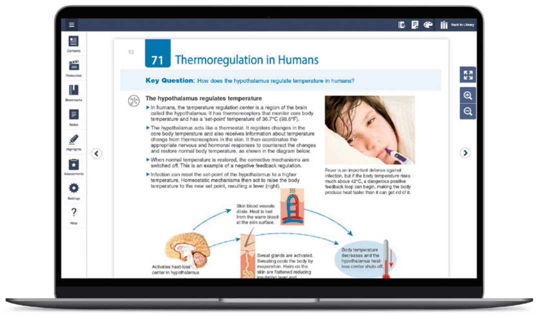
eBook LITE
Students interact with the BIOZONE content using notes, highlights, bookmarks, and some simple drawing tools. Other features include embedded text to speech reader, and text translation into 21 languages.

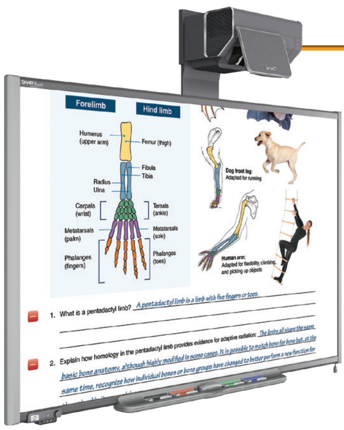
eBook PLUS
Contains all the functionality of eBook Lite plus direct interaction with the BIOZONE **Resource Hub**. Students can also answer and submit responses for review or grading.

eBook Teacher's Edition
Provided free with a classroom purchase, this resource has all the content of the printed Teacher's Edition and the functionality described above (including direct access to BIOZONE's **Resource Hub**).

Learn more about how to use the eBooks:
https://www.thebiozone.com/ebooks/training/
https://ebookshelp.thebiozone.com/help/





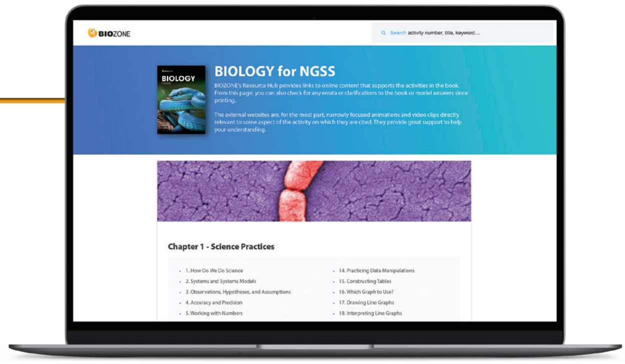


DIGITAL TEACHER'S EDITION

This teacher's resource includes a non-printable PDF version of the Teacher's Edition, with a useful feature to hide and display the suggested answers. You can also find computational spreadsheets and other helpful material within the Digital Teacher's Edition (page CG20). The Digital Teacher's Edition is a DRM product, and sold as a separate product.

Material can be displayed to students through an interactive whiteboard or shared screen. This resource is an excellent way to introduce an activity to the class before having them work on the activity. If working on a practical investigation, you can highlight important steps or identify potential hazards before beginning. Many teachers use the show/hide answer feature to review answers with the class after a group discussion. If you are running short of time you can efficiently review the answers with the entire class to save time. See more about the Digital Teacher's Edition on page CG21).

RESOURCE HUB



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

The **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 material has been tagged as gifted and talented material and can be used to extend 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 gifted 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. Gifted and talented students, or students with a particular interest in the topic can be assigned this material at your discretion.

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. Alternatively, the **Resource Hub** can be accessed directly through the icons (left) in the eBook Plus and eBook Teacher's Edition, the QR code below, or bookmark the following link: **www.BIOZONEhub.com** and the enter the code **NBI3-6924** if they using the printed version.

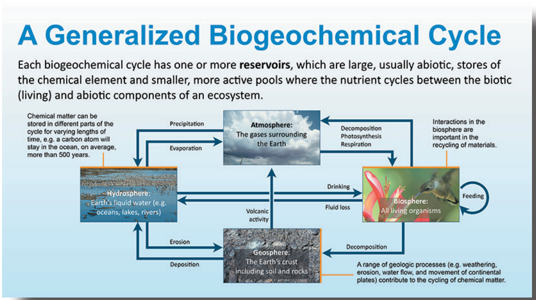
PRESENTATION MEDIA (SLIDES)

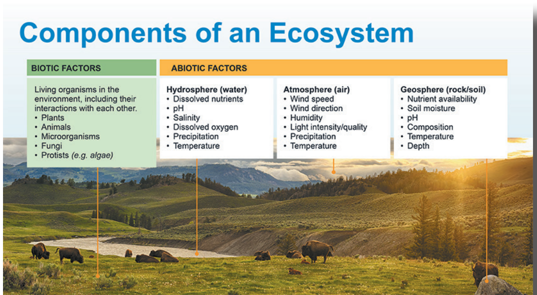
Presentation Media (slides) are a very popular way for teachers to deliver a lesson in a presentation style format, or have students review in their own time. Presentation Slides are a useful delivery tool in both face to face or remote teaching.

The Presentation Slides are a sizeable collection of **fully editable slides** specifically designed to support and enhance the content of the worktext. A set of slides is available for each chapter of *Biology for NGSS*. In some instances, the slide sets contain extra material or examples not contained within the worktext, and are excellent for providing new scenarios for students to work on.

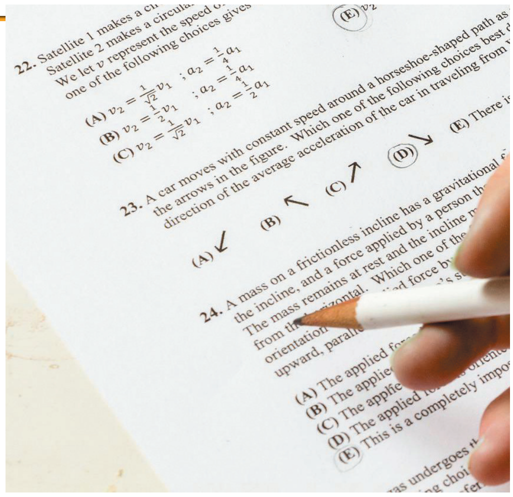
The sets are fully editable, allowing teachers to customize slides for lessons or to suit student ability. Select a range of slides to support the content you are delivering and use them as they are or edit the slides. Add your own text or images, delete, add, or move slides around. The slides can be printed out for students to make their own notes on; then they can review their notes in context with the material. Presentation Slides are easily be ingested into your LMS.

Slides are provided in both PowerPoint and Keynote formats.





TEST BANKS

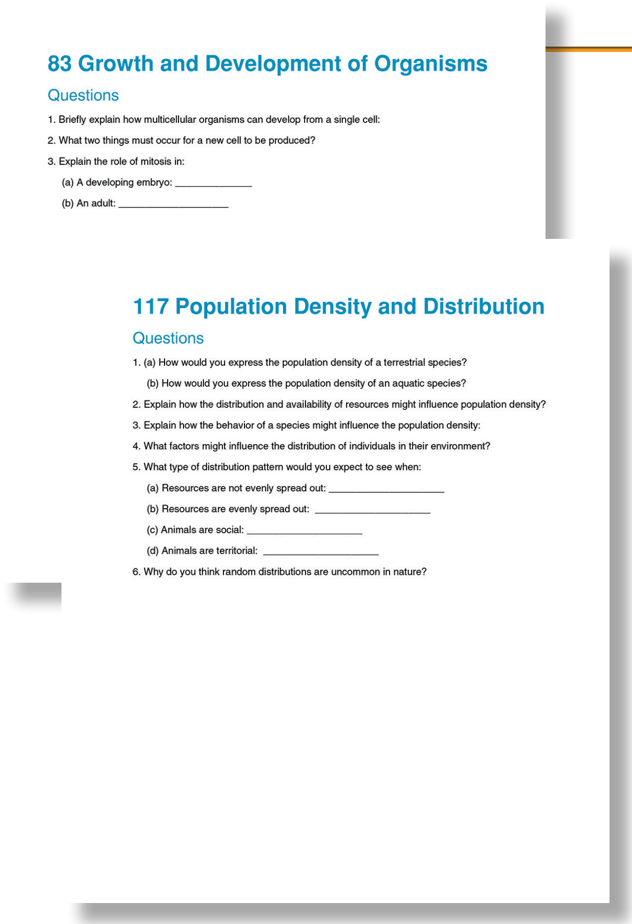


Assessments within *Biology for NGSS* have been designed on the most part to be fully three dimensional, to assess the Performance Expectations specified in the NGSS framework. However, we understand that a variety of assessment tools are useful within a differentiated classroom. A range of opportunities to test student understanding enables teachers to identify gaps and misconceptions and to be able to address these before a formal assessment moment.

BIOZONE's Test Banks have been specifically curated to test student understanding of the DCI content of the material. The test bank questions are not three dimensional, however they complement the three dimensional assessments with the worktext.

A range of question types is available (CG16). The Test Banks are 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 ingested into test generator software such as Illuminate and ExamView.
- Encourage student participation by converting the questions into a Kahoot or Quizlet format. Students can work individually, in pairs, or small groups to learn and share ideas in a fun environment. Multiple choice and true/false questions are easily converted to Kahoot quizzes. Review the answers with the class for a quick refresher of key ideas and correct any commonly occurring misconceptions.
- Questions can be easily ingested into LMS in a number of formats, e.g. Google forms, or a Google or word document.
- 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.



83 Growth and Development of Organisms

Questions

1. Briefly explain how multicellular organisms can develop from a single cell:
2. What two things must occur for a new cell to be produced?
3. Explain the role of mitosis in:
   (a) A developing embryo: ____________
   (b) An adult: ________________

117 Population Density and Distribution

Questions

1. (a) How would you express the population density of a terrestrial species?
   (b) How would you express the population density of an aquatic species?
2. Explain how the distribution and availability of resources might influence population density?
3. Explain how the behavior of a species might influence the population density:
4. What factors might influence the distribution of individuals in their environment?
5. What type of distribution pattern would you expect to see when:
   (a) Resources are not evenly spread out: ________________
   (b) Resources are evenly spread out: ________________
   (c) Animals are social: ________________
   (d) Animals are territorial: ________________
6. Why do you think random distributions are uncommon in nature?

QUESTION LIBRARY

The Question Library provides all of the questions from the Student Edition worktext in a format which 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.

Teacher's Notes

Extended teacher's notes are found at the front of each chapter in the Teacher's Edition and Digital Teacher's Edition of *Biology for NGSS*. These notes provide context for the material and additional detail for the learning points (matched point for point). Where appropriate, opportunities to incorporate group work, practical activities, or design challenges are explained. Suggestions for differentiated instruction are also provided, including ways to support striving learners, e.g. through peer-to-peer support. 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 in the margin of 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.

Chapter number and name

The **anchoring phenomenon** provides a context for the chapter. We have included some questions you may wish to ask your students to engage them in the topic, and ideas for student engagement.

The **guiding questions** and **numbering of learning aims** is the same as in each chapter introduction of the Student Edition and Teacher's Edition (learning aims are matched point for point).

Important **learning aims** are specified.

Material for **gifted and talented students** is identified.

Opportunities for **group work** are identified. They provide opportunities for collaboration and can be used to develop ELA/ELD skills such as speaking and listening, developing language, and research and presentation skills.

Your attention is drawn to materials on the **Resource Hub** when the resource is integral to the delivery of the activity or provides an alternative delivery option.

Practical investigations or design challenges are identified. These can be used to deepen a student's understanding of a concept or idea. Practical activities are essential for developing competency over a range of science skills and help students to become comfortable working in a STEM environment.

150

Teacher's Notes

5. Energy in Living Systems

Anchoring phenomenon

The anchoring phenomenon *"Putting Things in Jars"* uses Joseph Priestley's famous mouse in a jar experiment to demonstrate gases used and produced by living organisms. Students are asked to develop a model to explain why a mouse can survive in a closed system when a plant is present, but perishes in the absence of a plant. Students revisit a larger scale version of the phenomenon at the end of the chapter (the man in the box experiments) and refine their earlier model. They serve as a simple pretest and are revisited at the end of the chapter.

What is ATP and why is it important?

1. ATP is a phosphorylated nucleotide and stores its energy in the form of a high energy phosphate bond. Students should understand that hydrolysis of ATP is exergonic and releases free energy (crosscutting to HS-PS3.B, HS-PS3.D). (HS-LS1-7). ATP is used to drive metabolic processes such as cell transport, cell division, and thermoregulation. Without ATP, an organism will die. Draw student attention to the mitochondrion as an organelle in involved in ATP production.

How does photosynthesis convert light energy into stored energy?

2. The graphic allows students of all abilities to recognize the inputs and outputs of photosynthesis and that atoms can recombine to form new molecules (HS-LS1-5). Photosynthesis converts light energy into stored chemical energy. This is a good time to remind students energy is not created nor destroyed, simply transformed (HS-LS1-5, crosscutting to HS-PS3.B). Photosynthesis is an endothermic redox

stroma of the chloroplast. Students should appreciate that the systems that capture the light are membrane-bound in chloroplasts and the importance of chloroplast structure in compartmentalizing the reactions (HS-LS1-5). Use the 3D model on BIOZONE's Resource Hub to help students visualize the 3D structure of a chloroplast. Challenge gifted students with the extension questions in activity 102.

Pair students of mixed abilities together, capable students reinforce their understanding by explaining to striving learners. Pose questions to get them to discuss what they see (e.g. what happens to bubble production at low/high light intensity? What might the composition of the bubbles be?). If a practical investigation is not possible, utilize the simulation on BIOZONE's Resource Hub.

How is glucose used to make

involved in making different types of molecules from glucose.

How are photosynthesis and cellular respiration connected?

5. Cellular respiration is a catabolic, energy yielding pathway, whereas photosynthesis is an anabolic process that transforms sunlight energy into chemical energy. ATP is central to these energy transformations in cells, being the universal energy carrier in cells (crosscutting to HS-PS3.B, HS-PS3.D) (HS-

6. Students should describe glycolysis as the major anaerobic pathway in cells with a net yield of 2ATP and $2NADH_2$. In the absence of oxygen, various anaerobic pathways (alcoholic fermentation, lactic acid fermentation) metabolize the pyruvate, but the ATP yield is much lower than via aerobic processes. Students should understand that cellular respiration in the mitochondrion is an aerobic process, which yields ATP and produces carbon dioxide. Oxygen is the terminal oxygen acceptor. More able students will recognize that the production of reducing power in glycolysis and the Krebs cycle is central to the stepwise oxidation of glucose (HS-LS1-7).

7. Students should recognize that glycolysis occurs in the cytoplasm and that pyruvate enters the mitochondrion. They should associate regions of the mitochondrion with specific parts of the cellular respiration process: the link reaction and Krebs cycle in the matrix, and ETC in the cristae. (HS-LS1-7). Use the 3D model on BIOZONE's Resource Hub to help students visualize the 3D structure of a mitochondrion.

8. Remind students appropriate PPE and care must be taken during this experiment because of the use of caustic substances. Check setups before the students begin their experiment as incorrect assembly will affect results. Have students predict results beforehand, were their predictions correct? Ask them to think about the purpose of the

The Digital Teacher's Edition

The *Digital Teacher's Edition* is a DRM product, sold separately, and aimed primarily at extending the pedagogical tools at a teacher's disposal. Many of the features of this resource have been developed in response to requests from teachers themselves.

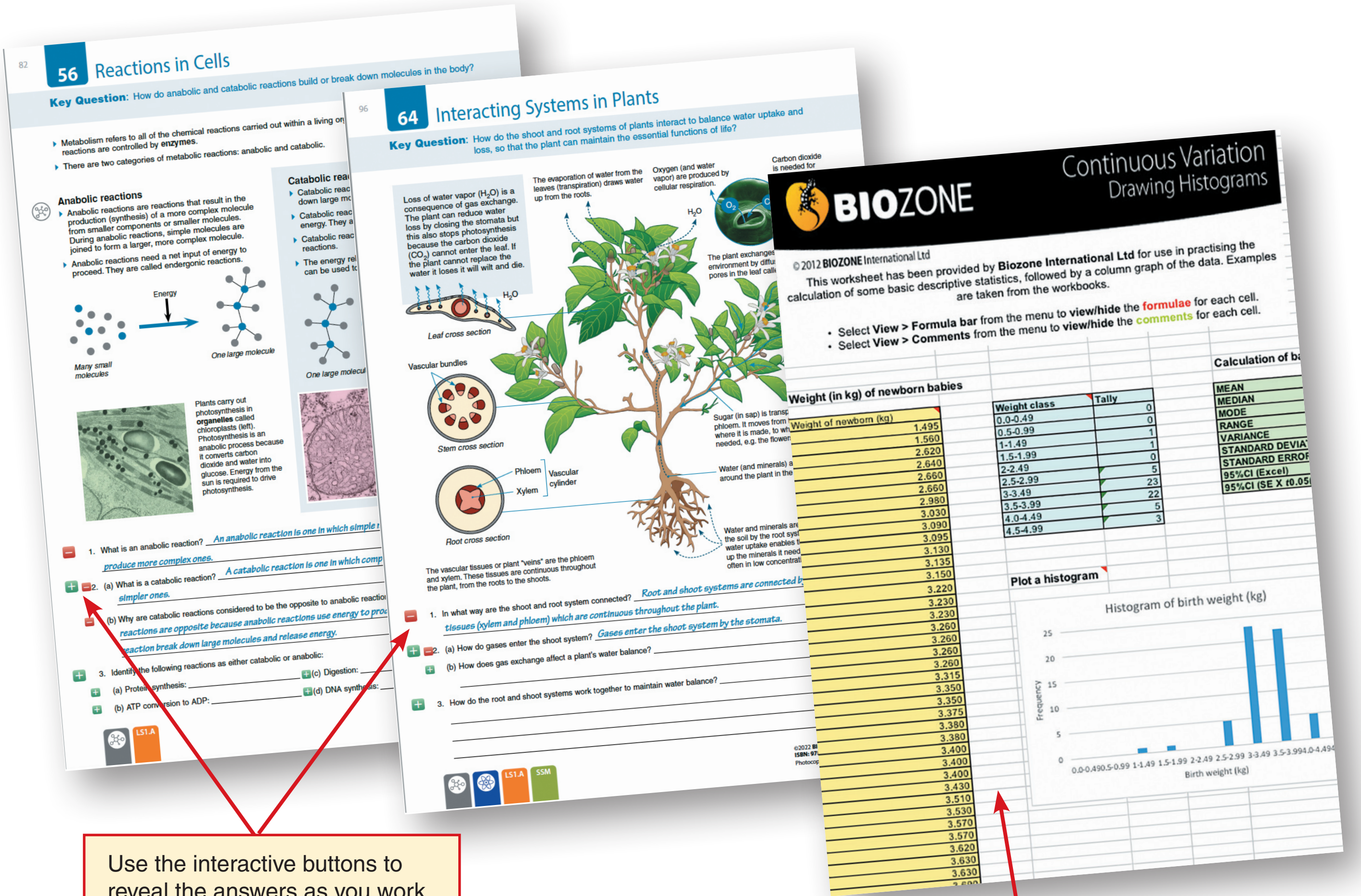
The **Classroom Guide** is provided as a printable PDF.

A digital (PDF) version of the Teacher's Edition (non-printable) is provided. Use the interactive buttons to HIDE or SHOW the answers.

Access BIOZONE's **Resource Hub** directly from this link for a range of resources to support the activities.

Link to ***Excel***® **spreadsheets** for selected activities with a data analysis or computer modeling component.

A **BONUS** sample copy from the planned presentation media for *Biology for NGSS*. It is fully editable.



Use the interactive buttons to reveal the answers as you work through the activity on-screen.

Activities that manipulate data using formulae are supported by spreadsheets. These include all data and comments on graphical analysis.

Identifying CCCs and SEPs by Number

CROSSCUTTING CONCEPTS (CCCs)

CCCs are unifying ideas that apply across all disciplines of science. A CCC connects topics where the same unifying concept underpins the content. A statement for each numbered CCC is provided below. CCCs are identified by number in the tables following and in the embedded coding in the chapter introductions (Teacher's Edition). Statements are paraphrased.

1: Patterns
In grades 9-12, students observe patterns in systems at different scales and cite patterns as evidence for causality in supporting explanations of phenomena. They recognize that classifications or explanations at one scale may need revision using a different scale, thus requiring improved investigations and experiments. They identify and analyze patterns, and use analysis to re engineer and improve designed systems.

2: Cause and effect
In grades 9-12, students understand that empirical evidence is required to differentiate between cause and correlations and to make claims about cause and effect. They suggest cause and effect relationships to explain and predict behaviors in natural and designed systems. They also propose causal relationships by examining what is known about smaller-scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.

3: Scale, proportion, and quantity
In grades 9-12, students understand that the significance of a phenomenon depends on the scale, proportion, and quantity at which it occurs. They recognize that patterns observable at one scale many not be observable or exist at other scales and that some systems can only be studied indirectly. Students use orders of magnitude to understand how a model at one scale relates to a model at another scale. They use algebraic thinking to examine scientific data and predict the effect of a change in one variable on another.

4: Systems and system models
In grades 9-12, students investigate or analyze a system by defining its boundaries and initial conditions, as well as its inputs and outputs. They use models to simulate the flow of energy, matter, and interactions within and between systems at different scales. They also use models and simulations to predict the behavior of a system and recognize why these predictions have limited precision and reliability. They also design systems to do specific tasks.

5: Energy and matter
In grades 9-12, students learn that the total amount of energy and matter in closed systems is conserved. They can describe changes of energy and matter in a system in terms of energy and matter flows into, out of, and within that system. They also learn that energy cannot be created or destroyed, only transferred and transformed. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.

6: Structure and function
In grades 9-12, students investigate systems by examining the properties of different materials, the structures of different components, and their interconnections to reveal a system's function and/or solve a problem. They infer the functions and properties of natural and designed objects and systems from their structure, the way their components are shaped and used, and the molecular substructures of their various materials.

7: Stability and change
In grades 9-12, students understand that much of science deals with constructing explanations of how things change and how they remain stable. They quantify and model changes in systems over short or very periods of time. They see that some changes are irreversible and that negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize that systems can be designed for more or less stability.

SCIENCE & ENGINEERING PRACTICES (SEPs)

SEPs for NGSS are overlapping and interconnected practices that students should know and understand. A statement for each numbered SEP is provided below. SEPs are identified by number in the tables following and in the embedded coding in the chapter introductions (Teacher's Edition).

1: Asking questions and defining problems
"Asking questions and defining problems in 9-12 builds on K-8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations."

2: Developing and using models
"Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s)."

3: Planning and carrying out investigations
"Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual mathematical, physical, and empirical models".

4: Analzying and interpreting data
"Analyzing data in 9-12 builds on K-8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data."

5: Using mathematics and computational thinking
"Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and non-linear functions, including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simulations are created and used based on mathematical models of basic assumptions."

6: Constructing explanations and designing solutions
"Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories".

7: Engaging in argument from evidence
"Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science."

8: Obtaining, evaluating, and communicating information
"Obtaining, evaluating, and communicating information in 9-12 builds on K-8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs."

Summary of BIOZONE's 3D Approach By Chapter

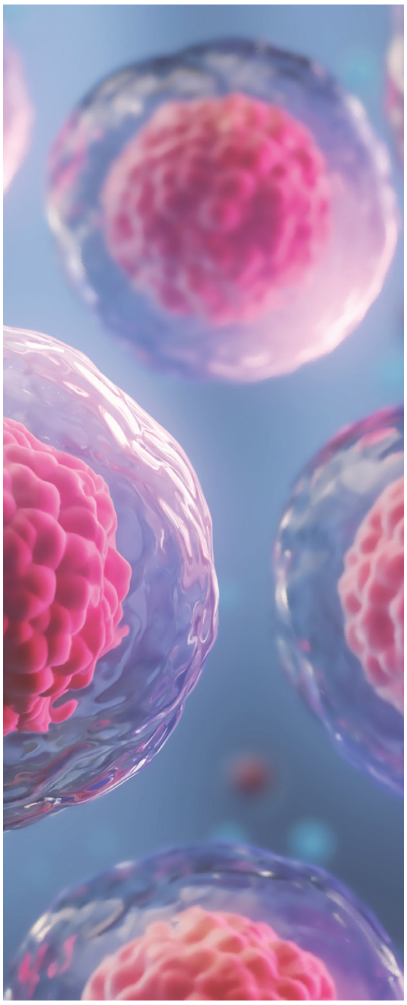
Science and Engineering Practices (SEPs), Crosscutting Concepts (CCCs), Disciplinary Core Ideas (DCIs), and Performance Expectations (PEs) for each chapter of *Biology for NGSS* are listed in the tables following. An introductory "Science Practices" chapter is also included. Performance Expectations are met within the chapter and/or the *Summing Up* activity.

1: SCIENCE PRACTICES

Activity	SEP	DCI	CCC	PE
1	1, 8	NA	4	NA
2	2	NA	4	NA
3	1	NA		NA
4-8	5	NA		NA
9	3,5	NA		NA
10-13	3	NA		NA
14	5	NA		NA
15-17	4	NA		NA
18	5	NA	1	NA
19	4	NA		NA
20	4,6	NA	2	NA
21-22	4	NA		NA
23-25	4,5	NA		NA
26-27	2	NA	4	NA
28	4,5,6,7	NA		NA

2: CELL SPECIALIZATION AND ORGANIZATION

Activity	SEP	DCI	CCC	PE
30	2	LS1.A		
32	3	LS1.A		
33	3	LS1.A	1	
34-35	2	LS1.A	6	
36		LS1.A	6	
37	2	LS1.A	4,6	
38	3,4,6	LS1.A	6	
39	3,4,5,6	LS1.A	6	
40	5	LS1.A	6	
41	3,4,6	LS1.A		
42	3,5,6	LS1.A		
44-46		LS1.A	6	
47	3,6	LS1.A		
48-49		LS1.A	6	
50	2	LS1.A	4,6	
51	2	LS1.A	6	
52	2,6	LS1.A	6	
53		LS1.A	6	
54	2,6	LS1.A		
55	2	LS1.A	6	
57		LS1.A	6	
58	3,4,6	LS1.A		
59	3,5,7	LS1.A	4	
60-64	2	LS1.A		
66		LS1.A		HS-LS1-1, HS-LS1-2



3: FEEDBACK MECHANISMS

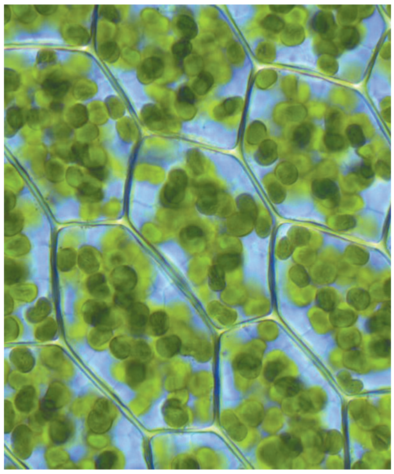
Activity	SEP	DCI	CCC	PE
68-69	2	LS1.A	7	
70	2,4	LS1.A	7	
71		LS1.A	7	
72		LS1.A	5	
73	2,3,4	LS1.A	5	
74	2	LS1.A	7	
75	1,2,3,4,5	LS1.A	5,7	
76-77		LS1.A	7	
78	4,5	LS1.A	7	
79	3,4,5,8	LS1.A	7	HS-LS1-3
80	2	LS1.A	7	
81	2,3,4,5	LS1.A	7	

4: GROWTH AND DEVELOPMENT

Activity	SEP	DCI	CCC	PE
85		LS1.B		
86-87	2	LS1.B	4	
88	2,8	LS1.B	4	
89		LS1.B		
90	2	LS1.B	4	
91-92	2	LS1.B	4	HS-LS1-4
93	2,3	LS1.B	4	HS-LS1-4
94	2	LS1.B	4	
95	2	LS1.B	6	
96		LS1.B	6	
98		LS1.B		HS-LS1-4

5: ENERGY IN LIVING SYSTEMS

Activity	SEP	DCI	CCC	PE
100	5	LS1.C	5,6	
101-102	2	LS1.C	5	
103	1	LS1.C	5,6	
104	2	LS1.C	5,6	HS-LS1-5
105	3,4	LS1.C	5	
106	6	LS1.C	5	HS-LS1-6
107	2	LS1.C	5	HS-LS1-5
108	2,6	LS1.C	5	HS-LS1-7
109	2,6	LS1.C	5,6	HS-LS1-7
110	3,4,6	LS1.C	5	
112	2,6	LS1.C		HS-LS1-5, HS-LS1-7



Kristian Peters

6: INTERDEPENDENCE IN ECOSYSTEMS

Activity	SEP	DCI	CCC	PE
113		LS2.A	2	
114		LS2.A		
115		LS2.A	3	
116		LS2.A		
117	4,6	LS2.A		
118		LS2.A	3	
119-120		LS2.A		
121		LS2.A	2,3	
122	2	LS2.A		

6 CONTINUED: INTERDEPENDENCE IN ECOSYSTEMS

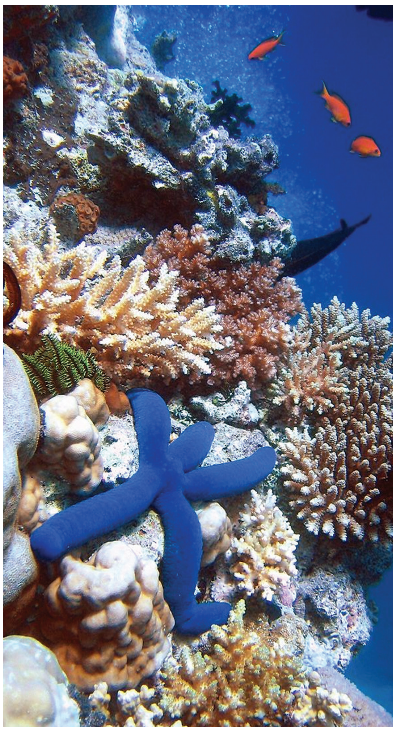
Activity	SEP	DCI	CCC	PE
123	6	LS2.A	2	
124	4,6	LS2.A	2	
125	5	LS2.A	3	
126		LS2.A	3	
127	3,4,5	LS2.A	2,4	HS-LS1-1, HS-LS2-2
128		LS2.A		
129	2,3,4,5	LS2.A	3,4	
130	2,5	LS2.A		
131	5	LS2.A		HS-LS2-1, HS-LS2-2
132	2,3,4,5	LS2.A	2,3,4	HS-LS2-1, HS-LS2-2
133	4,5	LS2.A	2,3	

7: ENERGY FLOW AND NUTRIENT CYCLES

Activity	SEP	DCI	CCC	PE
137	2, 7	LS2.B	5	
138	2, 6	LS2.B	5	HS-LS2-3
139		LS2.B	4, 5	
140	2	LS2.B	5	
141		LS2.B	5	
142-143	2	LS2.B	5	
144	1,2	LS2.B	5	
145	2,5	LS2.B	4, 5	HS-LS2-4
146	2	LS2.B	4, 5	HS-LS2-4
147	2,5,6,8	LS2.B	5	HS-LS2-4
148	2	LS2.B	5	
149	2	LS2.B	7	
150	2	LS2.B, PS3.D	4	HS-LS2-5
151	2,3,6	LS2.B, PS3.D	2,4,5	HS-LS2-5
152	2	LS2.B	4, 5	
153	2,4	LS2.B, PS3.D	4	HS-LS2-5
154	2	LS2.B	4, 5	
156	4,5	LS2.B	5	HS-LS2-4

8: THE DYNAMIC ECOSYSTEM

Activity	SEP	DCI	CCC	PE
158	2,4	LS2.C	3,7	
159	4	LS2.C	7	
160	2,4	LS2.C	7	
161	7	LS2.C	7	
162	2,4	LS2.C	7	
163	4,7	LS2.C	7	
164	2,3,4,6	LS2.C, LS4.D ETS1.B	7	HS-LS2-7
165	2	LS2.C, LS4.D	7	
166	1,6,8	LS2.C, LS4.D	7	
167	2,3,4,5,6	LS2.C, LS4.D ETS1.B	7	HS-LS2-7
168	6,7	LS2.C, LS4.D ETS1.B	7	HS-LS2-7
169	2,4,6,7,8	LS2.C, LS4.D	7	HS-LS2-7
170	2,6,7,9	LS2.C, LS4.D ETS1.B		HS-LS2-7
171		LS2.C, LS4.D		HS-LS2-6, HS-ETS1-3
172	2,6			HS-LS2-6



Richard Ling cc 2.5, 3.0

9: SOCIAL BEHAVIOR

Activity	SEP	DCI	CCC	PE
174		LS2.D	2	
175	2	LS2.D	2	
176	4,7	LS2.D	2	HS-LS2-8
177		LS2.D		
178	4	LS2.D	2	HS-LS2-8
179		LS2.D	2	
180	4	LS2.D	2	
181	7	LS2.D	2	
182		LS2.D	2	
184	4,5,7	LS2.D	2	HS-LS2-8

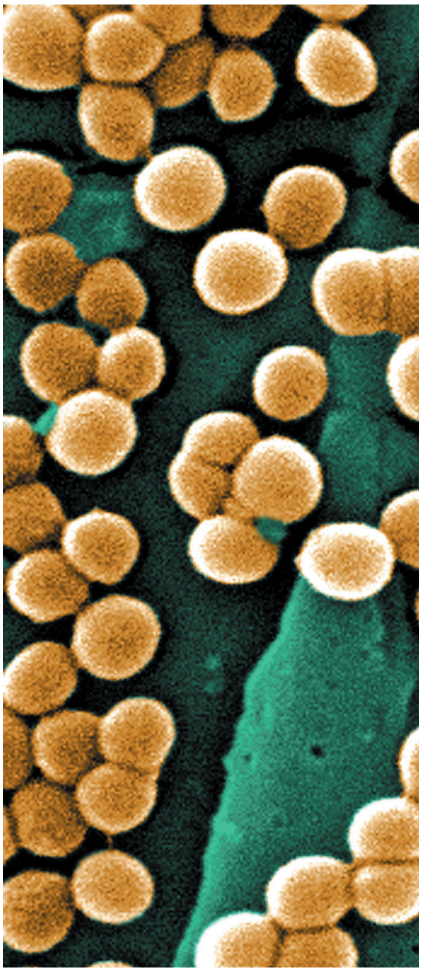
10: INHERITANCE OF TRAITS

Activity	SEP	DCI	CCC	PE
186	2	LS3.A		
187	1,2	LS3.A	2	HS-LS3-1
188	1,2	LS3.A	2	
189	2	LS3.A	2	
190	2	LS3.A		
191	1	LS3.A	2	

Sam Fentress CC 2.0

11: VARIATION OF TRAITS

Activity	SEP	DCI	CCC	PE
195	2	LS3.B	2	
196	2	LS3.B		
197	2	LS3.B	2	
198		LS3.B		
199	3,4	LS3.B		
200	2	LS3.B		
201	2	LS3.B		HS-LS3-2
202	2,3,4	LS3.B	2	
203	2	LS3.B	2	HS-LS3-2
204		LS3.B	2	
205	2,3,4	LS3.B	2	
206		LS3.B	2	
207	2	LS3.B	2	
208		LS3.B		
209		LS3.B	2	HS-LS3-2
210	4	LS3.B	2	
211	2,4	LS3.B	3	HS-LS3-3
212	2, 4	LS3.B		HS-LS3-3
213	2,4	LS3.B		
214	2,4	LS3.B	3	
215	4	LS3.B		
216	4,5	LS3.B	3	HS-LS3-3
217	2	LS3.B	2,3	HS-LS3-1
219	2,4,7	LS3.B		HS-LS3-2, HS-LS3-3



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12: EVIDENCE FOR EVOLUTION

Activity	SEP	DCI	CCC	PE
221		LS4.A	1	
222-224	2,4	LS4.A	1	
225-227		LS4.A	1	
228	2,4	LS4.A	1	
229	2	LS4.A	1	
230	4	LS4.A	1	
232	2,7	LS4.A	1	HS-LS4-1

13: NATURAL SELECTION AND ADAPTATION

Activity	SEP	DCI	CCC	PE
234	2	LS4.B, LS4.C	2	
235	2,3,4,6	LS4.B, LS4.C	2	HS-LS4-2
236	6	LS4.B, LS4.C	2	
237	6	LS4.B, LS4.C	1,2	
238		LS4.B, LS4.C		HS-LS4-2, HS-LS4-3
239	4,5,6	LS4.B, LS4.C	1,2	HS-LS4-4
240	2,4	LS4.B, LS4.C	1,2	HS-LS4-3 HS-LS4-3
241	2	LS4.B, LS4.C	1,2	
242	2,4,5,6	LS4.B, LS4.C	1,2	HS-LS4-3
243	2	LS4.B, LS4.C	1	
244-246	2,6	LS4.B, LS4.C	1	
247	2,4,7	LS4.C	2	HS-LS4-5
248	2,4,7	LS4.C	2	HS-LS4-5
249	4,7			
250	6,7	LS4.B, LS4.C	2	


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14: BIODIVERSITY

Activity	SEP	DCI	CCC	PE
252	2,4,5,6	LS4.C, LS4.D ETS1-B	2	HS-LS4-6
253	7	LS4.D	2	
254	2,8	LS4.D	2	
255	4,7	LS4.D	2	
256	6	LS4.D	2	
257	1,2,4,8	LS4.C, LS4.D	2	
258	1,4,8	LS4.C, LS4.D	2	
259	4	LS4.D	2	
261	6,8	LS4.D, ETS1-B	2	

Identifying Common Core State Standards Connections

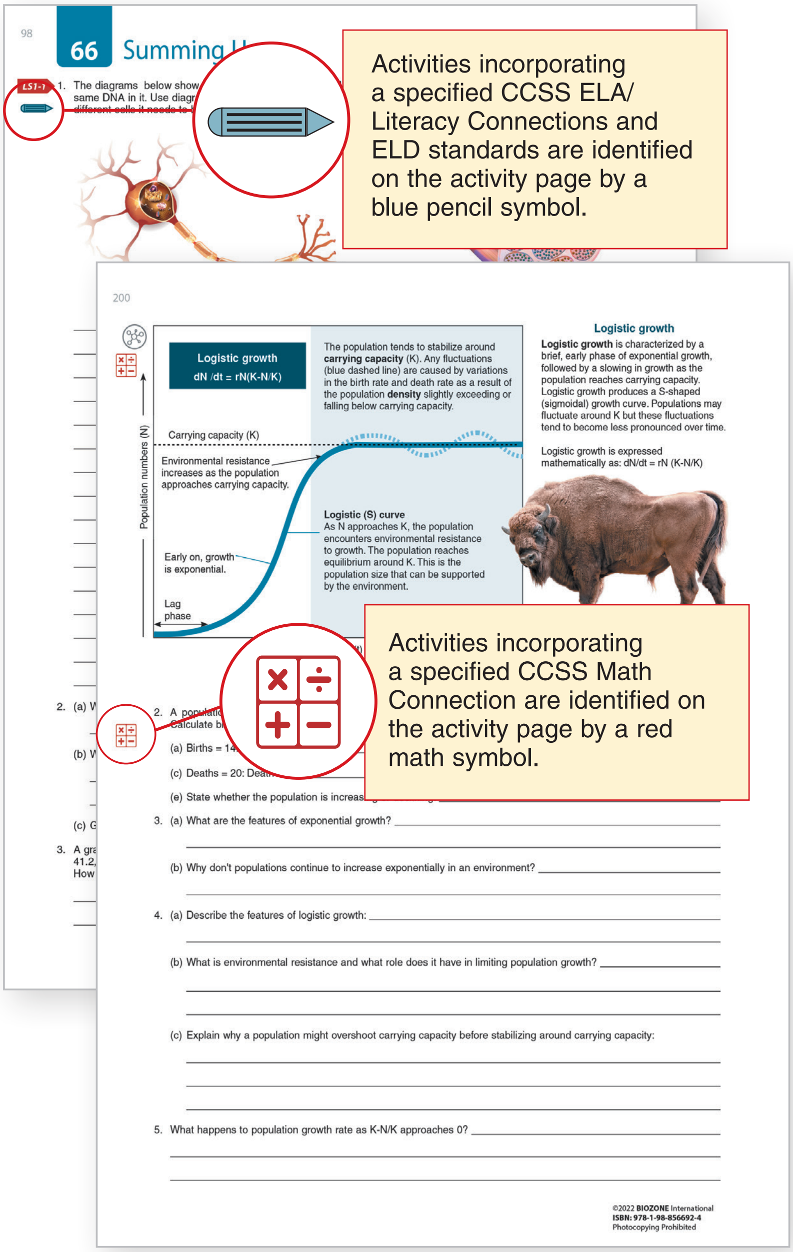
The activities in *Biology for NGSS* provide many opportunities to address the **Common Core State Standards** (CCSS) for numeracy, and literacy, and English language development (ELD). The incorporation of these standards allows students to practice and develop these key skills while exploring science.

Activities incorporating representative citations of the CCSS Math Connections, ELA/ literacy, and ELD Connections specified in the NGSS Science Framework are identified by codes (right) in the **Teacher's Edition** and **Teacher's Digital Edition**. Note that this coding is a tool for the teacher and is not present in the Student Edition.

- A red calculator indicates a math connection.
- A blue pencil indicates an ELA/literacy or ELD connection.

A list of the specific Math Connections, ELA/ Literacy Connections and ELD Standards addressed in the NGSS framework can be found in the tables at the bottom of this page and on the following pages.

BIOZONE recognizes that ELD Standards are not to be used in isolation, and are intended to be implemented in conjunction with ELA/Literacy and other academic content standards. This is why you will see them appearing along with the relevant ELA/literacy connection in the following tables.



1: SCIENCE PRACTICES

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
1	The Nature of Science		WHST.9-12.2,
5,8	Working With Numbers / Large Numbers	MP.4	
17, 19, 21, 22	Drawing Graphs	MP.4, HSS.ID.A.1, HSS-ID.B.6	
23, 24, 25, 28	Mean, Median, Mode; Statistics; Standard Deviation; Sample Bias, Data	MP.4, HSS.ID.A.1, HSS.ID.A.2, HSS.IC.A.1	

2: CELL SPECIALIZATION AND ORGANIZATION

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
32	Microscopes and Magnification	MP.4	
38	Diffusion in Cells		RST.9-10.3, RST.11-12.3, SL9-10.1.C, SL,11-12.1.B
39-40	Osmosis in Cells; Diffusion and Cell Size	MP.4, HSF-IF.C7	, RST.11-12.3, SL,11-12.1.B
41,42	Diffusion in Cells; Membrane Permeability		, RST.11-12.3, SL,11-12.1.B
54	The Functional Structure of Proteins		RST.11-12.3, SL,11-12.1.B
58, 59	Enzymes' Optimal Conditions; Catalase	MP.4, HSF-IF.C7	RST.11-12.3, SL,11-12.1.B

3: FEEDBACK MECHANISMS

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
73	Thermoregulation	MP.2, MP.4	WHST.11-12.8, WHST.9-12.7, RST.11-12.3, SL,11-12.1.B
75	Body Shape and Heat Loss	HSS-ID.A.1	RST.11-12.3, SL,11-12.1.B
78	Homeostasis During Exercise	MP.4	
79, 81	Effect of Exercise; Measuring Transpiration in Plants	MP.4, HSS-ID.A.1	RST.11-12.3, SL,11-12.1.B

4: GROWTH AND DEVELOPMENT

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
88	Modeling DNA Replication	MP.4	
90, 91	The Eukaryotic Cell Cycle, Mitosis		RST.11-12.2
93	Modeling Mitosis		RST.11-12.3, SL,11-12.1.B
98	Summing Up	MP.4, HSN-Q.A.1,	

5: ENERGY IN LIVING SYSTEMS

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
102	Introduction to Photosynthesis		RST.9-10.7
105	Investigating Photosynthetic Rate	MP.4, MP.5, N-Q.A.1	RST.11-12.3, SL,11-12.1.B
108	Energy from Glucose	MP.5	
109	Aerobic Cellular Respiration, Measuring Respiration	MP.4, MP5, N-Q.A.1	

6: INTERDEPENDENCE IN ECOSYSTEMS

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
124	Predator Prey Relationships	HSS-ID.A.1	
127	Carrying Capacity Simulation	HSS-ID.A.1	RST.11-12.3, SL,11-12.1.B
129	Population Growth	MP.4, HSN-Q.A.2,HSN-Q.A.3 HSS-ID.A.1	RST.11-12.3, SL,11-12.1.B
130	Plotting Bacterial Growth	MP.4, HSN-Q.A.1, HSS-ID.A.1	
131	Investigating Bacterial Growth	HSS-ID.A.1	RST.11-12.3, SL,11-12.1.B

7: ENERGY FLOW AND NUTRIENT CYCLES

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
141	Food Chains		RST.11-12.2
145	Energy Flow in Ecosystems	HSN-QA3	
146	Ecological Pyramids	HSN.Q.A.1, HSN.Q.A.2	
147	Investigating Ecological Pyramids	MP.2	WHST.11-12.2.E, RST.11-12.3, SL,11-12.1.B
153	Role of Photosynthesis in Carbon Cycling	HSS-ID.A.1	
156	Summing Up	HSN.Q.A.1, HSN.Q.A.2, HSN.Q.A.3	

8: THE DYNAMIC ECOSYSTEM

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
160, 161	A Case Study in Ecosystem Resilience; Keystone Species	HSF-IF.C.7	
164, 167	Human Impacts: Ecosystems; Fish Stocks	MP.4	RST.11-12.3, SL,11-12.1.B
168	Evaluating a Solution to Overfishing		WHST.9-12.7
169, 170	Deforestation; Modelling a Solutionl		SL,11-12.1.B, WHST.9-12.7
171	Review Your Understanding		SL,11-12.1.B, WHST.9-12.7

9: SOCIAL BEHAVIOR

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
178	How Social Behavior Improves Survival	MP.2	
180	Cooperative Defense	MP.2	
181	Cooperative Attack	MP.4	
184	Summing Up	MP.2, MP.4, HSS.ID.A.1	

10: INHERITANCE OF TRAITS

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
187	DNA Carries the Code		RST.11-12.8, WHST.11-12.9
188	DNA Packaging and Control of Transcription		RST.11-12.1, WHST.11-12.9
189	Changes after Transcription and Translation	MP.4	

11: VARIATION OF TRAITS

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
199	Examples of Genetic Variation	MP.4, HSS.ID.A.1, HSN.Q.A.1	RST.11-12.3 WHST.9-12.2, SL,11-12.1.B
202	Modeling Meiosis	MP.4	RST.11-12.3, SL,11-12.1.B
205	Evolution of Antibiotic Resistance		RST.11-12.3
210	Genes and Environment Interact	MP.4, HSS.ID.A.1, HSN.Q.A.1	
211-215	Predicting and Practising mono- and dihybrid, and test crosses	MP.4	RST.11-12.4
216	Testing the Outcome of Genetic Crosses	HSS-IC.A.2	RST.11-12.4
217-219	Pedigree Analysis ; Review Your Understanding; Summing Up	MP.4	RST.11-12.4

12: EVIDENCE FOR EVOLUTION

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
228	DNA Evidence for Evolution		RST.11-12.4
231	Review Your Understanding		RST.11-12.4
232	Summing Up		RST.11-12.4, WHST.11-12-2

13: NATURAL SELECTION AND ADAPTATION

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
235	Modeling Natural Selection		RST.11-12.3, SL,11-12.1.B
238	Natural Selection in Finches	MP.2, HSN.Q.A.1, HSS.ID.A.1	
239	Natural Selection in Rock Pocket Mice	MP.2, HSN.Q.A.1, HSS.ID.A.1	
240	Natural Selection in Deer Mice		RST.11-12.3, SL,11-12.1.B
242	Gene Pool Simulation	MP.4	RST.11-12.3, SL,11-12.1.B
247	Extinction is a Natural Process	MP.4	

14: BIODIVERSITY

Activity number	Activity	CCSS Math connection	CCSS ELA/Literacy & ELD connection
252	Biodiversity	MP.2, HSA.SSE.A.1.A, HSA.CED.A.4	RST.11-12.3, SL,11-12.1.B
254	Biodiversity Hotspots		RST.11-12.5, WHST.11-12.7
257	*In-Situ* Conservation		WHST.9-12.7
258	Conservation and Genetic Diversity		WHST.9-12.7
260	Review Your Understanding		WHST.9-12.7
261	Summing Up		SL.11-12.5