BIOZONE

CLASSROOM GUIDE

HSC | BIOLOGY

MODULES 1 - 4

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CLASSROOM GUIDE

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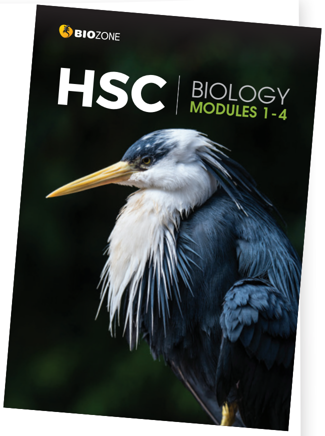
FAQs ABOUT HSC BIOLOGY MODULES 1-4



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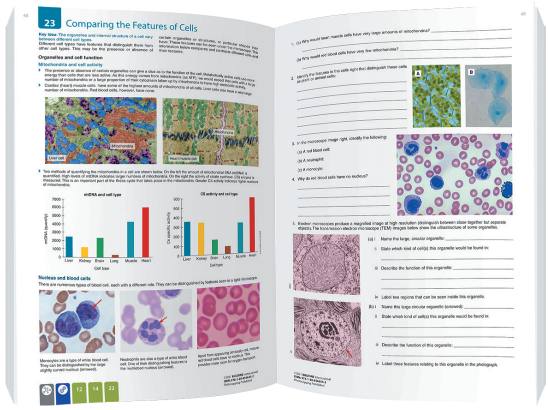
BIOZONE's Pedagogy

A worktext approach



BIOZONE's delivery method is a departure from a traditional textbook. We combine the very best features of a textbook with the utility of a workbook, producing a worktext resource. Importantly, the worktext is owned by the student: it is their own resource to utilise. Whether they are using the print or digital version, students customise their worktext with notes and annotations, checking off their progress in the contents and chapter introductions, and input their answers on the pages as they work through the activities.

Using a highly graphical approach and short blocks of text, we deliver textbook quality information in an accessible and engaging way, ensuring students are not overwhelmed by large amounts of information. As students interact with the stimulus material and work through activities, they are encouraged to input their answers directly onto the page. This simple act reinforces the learning moment and forms a record of work as they progress through the material. Students find revision a breeze because the stimulus material, questions, and their answers are in one place.

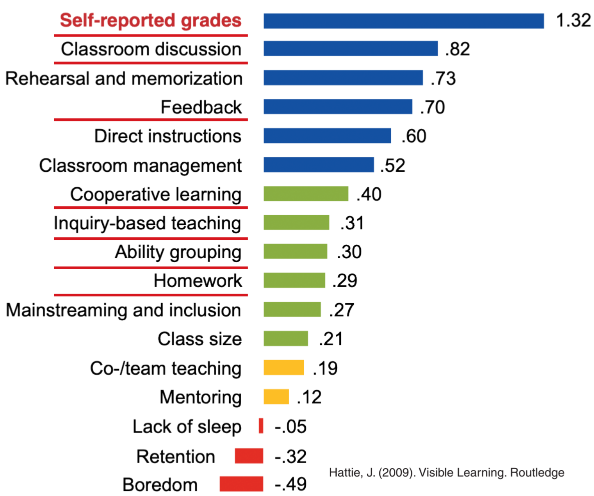
We have included a wide range of activity types in this title. These include practical activities (experimental investigations, modelling, and simulations), research activities, and assessment tasks. The variety of activity types provides flexibility in the way teachers can assign them. For example, work can be assigned to be carried out as homework, completed in class, or set for revision. Teachers can assign students to work on activities individually or set work as a group. The activity based approach simplifies assigning work, and teachers can utilise this approach to set work for substitute teachers in their absence.

Not all answers need to be graded!

Within the activities, there are plenty of opportunities for students to record answers to the questions. This approach reinforces the learning moment, provides space for students to record their work, and acts as a revision tool when students are preparing for assessments. This approach does not mean that teachers are expected to review or grade all student responses. We suggest that only key activities or questions are graded. This might be assessment tasks a the end of each chapter or at the conclusion of a section. You may also choose to grade activities with content that students have traditionally found challenging, or where there is often a misunderstanding of the topic. Teachers can also choose to share answers with students. Sharing the model answers allows students to self report grades: an exercise known to be a powerful pedagogical learning tool (Hattie, 2009). Having access to model answers also allows students to refine their initial response if needed. This provides a powerful second learning moment to consolidate and extend understanding.
Teachers can utilise the show/hide model answer feature in the digital platform to share answers.

Features to accelerate student learning

Student learning can be influenced by many factors. A synthesis of more than 1,400 meta studies by Hattie (2009) involving over 80,000 individual studies and 300 million students has revealed some of the major influences to student learning. Some factors negatively influence student learning (red, right) while others have positive effects (yellow, green, and blue, right). BIOZONE's approach incorporates many of the factors shown to positively influence student learning, these are underlined in red on the diagram (right). By utilising this resource, these factors are organically incorporated into content delivery and enhance the teacher and learner experience.



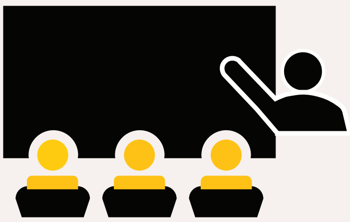
Hattie, J. (2009). Visible Learning. Routledge

Meeting Key Competencies

We want today's biology students to be self-motivated, lifelong learners, to develop a sound grasp of biological knowledge, to plan and evaluate their work, and to think critically and independently. In developing *HSC Biology*, we have put the aims and structure of the **NSW Biology Stage 6 syllabus** first and foremost. This title fully supports scientific investigation, critical and creative thinking, and individual and collaborative approaches to scientific endeavour. An understanding of ethical behaviours, and acknowledgement of the knowledge and cultures of Aboriginal and Torres Strait Islander peoples, are integral to this title. This guide will highlight some of the strategies BIOZONE has used to meet the aims and scope of the study design.

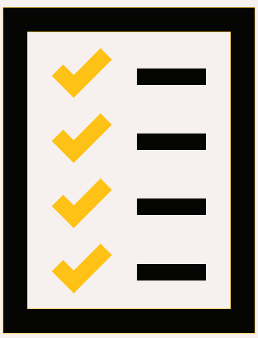
Lesson planning

- The structure of *HSC Biology, Modules 1-4* follows the module structure specified in the **NSW Biology Stage 6 syllabus**. Teachers can be assured that all of the essential components of the syllabus are covered, ensuring easy and efficient lesson planning with no content gaps.
- Use the chapter introductions to assign students work for each lesson.
- Add interest to your lessons by utilising the FREE, curated resources on **BIOZONE's Resource Hub** in your planning. Resources for specific activities are identified on the Resource Hub, saving you time, and extending your range of tools. You can use these to prepare students for upcoming topics, or consolidate understanding after lessons.
- Use the contents pages to help with lesson planning too. A green bullet next to an activity in the contents pages identifies where there is a practical investigation. Incorporate these activities into your schedules.



Teaching

- Teach the content in the order presented in *HSC Biology, Modules 1-4*. This will ensure foundation knowledge is covered before students need to apply the information to more complex topics.
- Have students refer to *Chapter 1: Working Scientifically*, as the need arises, or before attempting an activity that addresses a specific skill (e.g. 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 into groups of mixed abilities when carrying out group research projects or practical investigations.
- Activities that manipulate data using formulas may be supported by spreadsheets on **BIOZONE's Resource Hub**. You can tailor how you use the spreadsheets and students can analyse the data sets provided (including graphs) to save time.
- Extend students' scientific vocabulary by encouraging them to look up unfamiliar words in the **glossary** (Appendix 1).
- Use BIOZONE WORLD to introduce an activity and give any direction required. It can be used to review answers in class or on-line quickly and efficiently. Choose when and how you reveal the answers. To promote student discussion, reveal answers only once the students have shared their ideas. Reveal all the answers if you want the students to self mark their own work.



Assessment

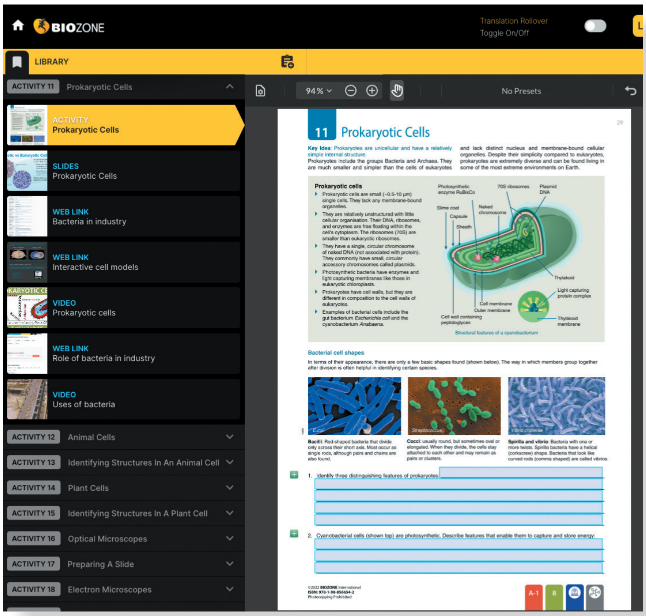
- Provide feedback (formative and summative) to students to update them on their progress. This can highlight areas of strength or areas needing work.
- Use formative assessment to identify areas the class needs to revisit before progressing to the next topic or unit. Methods of formative assessment include reviewing student answers on the chapter reviews, observing students carrying out practical work, or evaluating their contribution and understanding in practical work.
- Use the **Synoptic Assessments** at the end of each module 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.

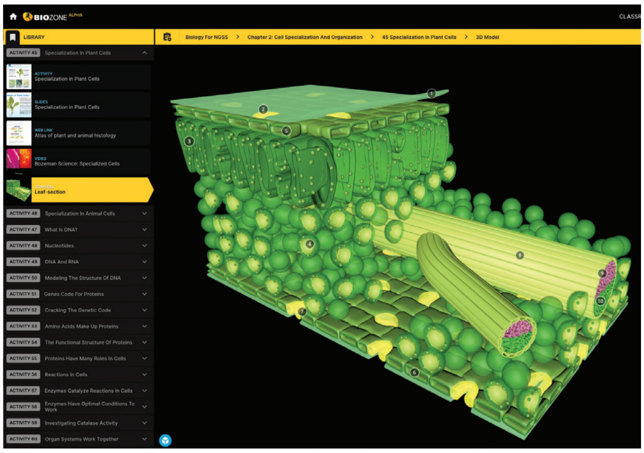
Teacher Support Materials: Teacher Toolkit

BIOZONE's HSC titles are supported by a suite of resources. These additional resources provide flexibility to help you teach remotely or in the classroom, provide online answers (which you can share with students for self assessment if you wish), and use interactively to promote class discussion and efficient review. Some features of these supporting resources are described below.

BIOZONE WORLD

- BIOZONE WORLD, our digital science platform, brings our digital worktexts and rich collection of digital resources together in a single location for easy use. Click on an activity to access the additional resources provided. These include: presentation slides, interactive 3D models, and curated videos and weblinks. 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, and submit their work for review or grading. Students have access to the curated collection of digital resources (presentation slides, 3D models, and curated videos and weblinks).
- Teacher access to BIOZONE WORLD includes the features available to students plus teacher-only additional features, including:
  - The ability to view, grade, and give feedback on submitted student work.
  - Forced hand-in feature.
  - Ability to display the content on a shared screen (e.g. interactive whiteboard) to introduce or review an activity, or highlight areas of particular importance, e.g. an important step in a practical investigation.
  - Model answers in place. Show/hide buttons toggle answers on and off; ideal for sharing data or answers with students.
    Students do not have access to model answers on BIOZONE WORLD.
- Find out more: **biozone.com/us/biozone-world**

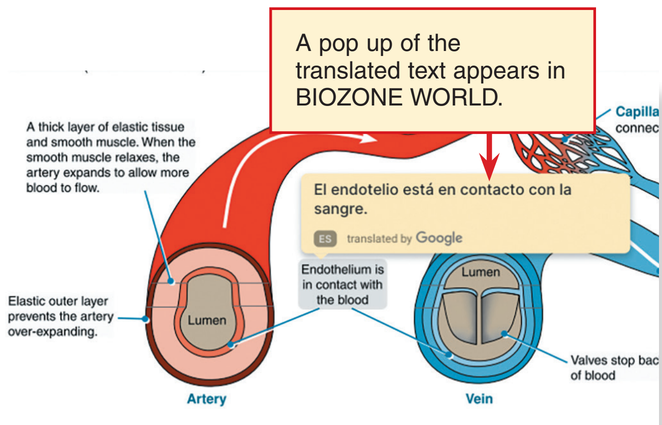




Translation function

BIOZONE WORLD, our digital platform, provides a translation feature to support to students who have English as a second language. The content can be translated into 150 languages.

Simply activate the translation feature, select the language for translation, and roll the cursor over the text to be translated. A pop up box of the translated text appears on the page. The English text is still visible. Having both languages visible supports students with their English language development while having the reassurance of their first language accessible.



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.

Content on the BIOZONE **Resource Hub** can be accessed by both print and digital users. **Print users** can access the material using the QR code in the worktext or bookmark the link provided (below right). For **BIOZONE WORLD users**, these same resources are ingested into the platform and automatically appear with the selected activity.

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.

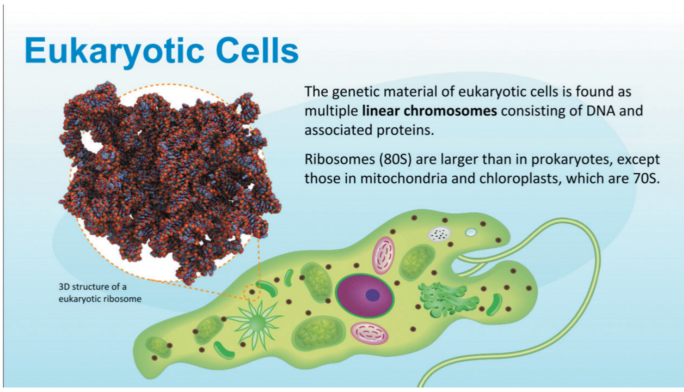
Some components have been tagged as extension material and can be used to extend more capable or gifted students. These types of resources may require more reading or synthesis of information. Our spreadsheet models can be used as is, or you can have students graph the information themselves. You may 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.

www.BIOZONEhub.com

Then enter the code in the text field **HSC11-1-6542**

Or scan this QR code



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.

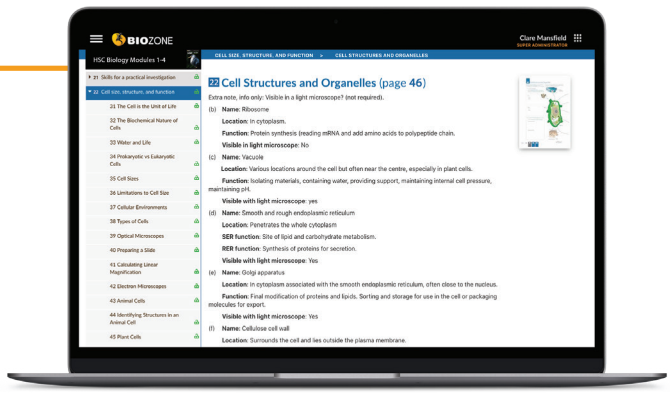
The Presentation Slides are a collection of slides specifically designed to support and enhance the content of the worktext.

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

ONLINE MODEL ANSWERS

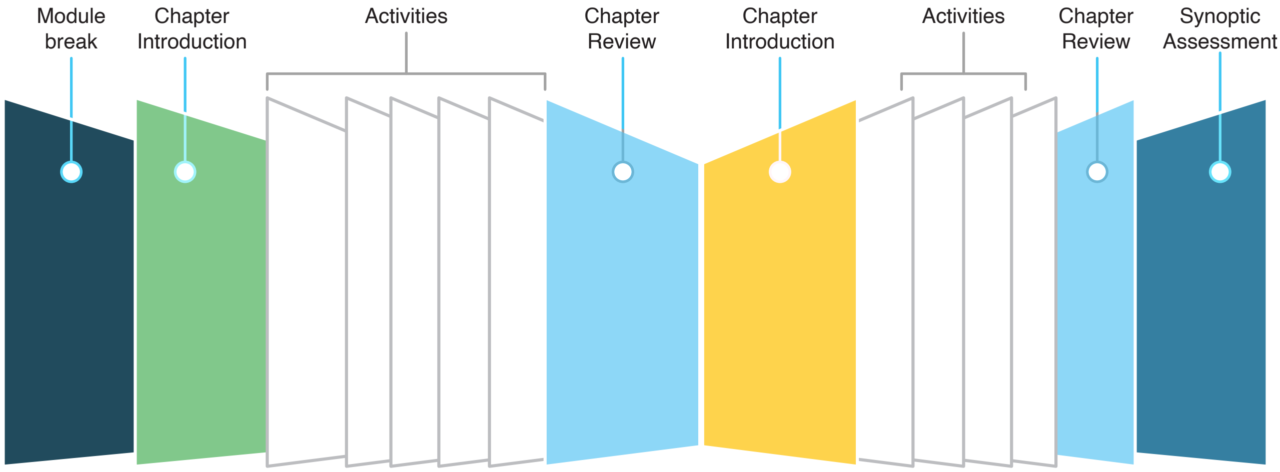
Online Model Answers provide suggested answers to each of the activities, including working where appropriate (e.g. calculations).

Online Model Answers are accessible via a login that is unique to your school. Your access as a teacher means you're able to control how much and when students can view individual answers, making it easier for you to support homework and revision. Controlled access to answers promotes deeper understanding and encourages students to be self critical. The online model answers also provide an effective tool to support your students with remote learning.



Structure of the Worktext

HSC Biology: Modules 1 - 4 has been specifically written to meet the content and skills requirements of the NSW Stage 6 syllabus (Modules 1 - 4). The worktext follows the structure outlined in the Stage 6 syllabus, so it is easy for you to know where you are in the course. The content is organised into 14 chapters, numbered sequentially and nested within their module (below). Module breaks divide the content into sections (the modules) and summarise the student outcomes for each module. Each chapter has an introduction page so you can see the key knowledge and skills requirements for each chapter. The graphic below illustrates the structure of a module and chapters. Use this structure to help navigate through the content.



Chapter introduction

- Inquiry questions are identified.
- A check list of key knowledge.
- A list of key terms.

Activity pages

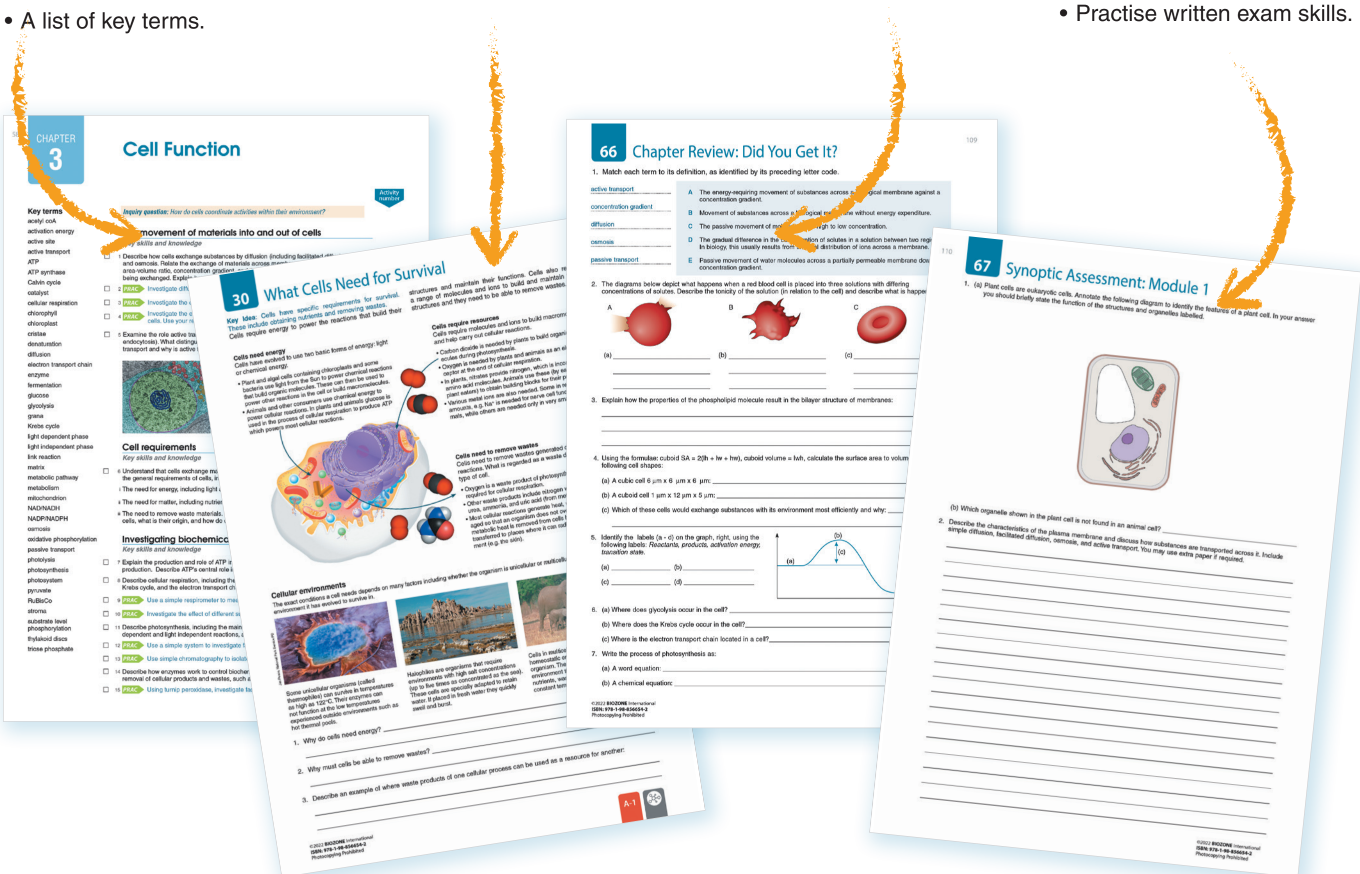
- Contain essential knowledge.
- Questions review the content of the page.

Chapter review

- Test student understanding of the chapter content.
- Develop student scientific vocabulary.

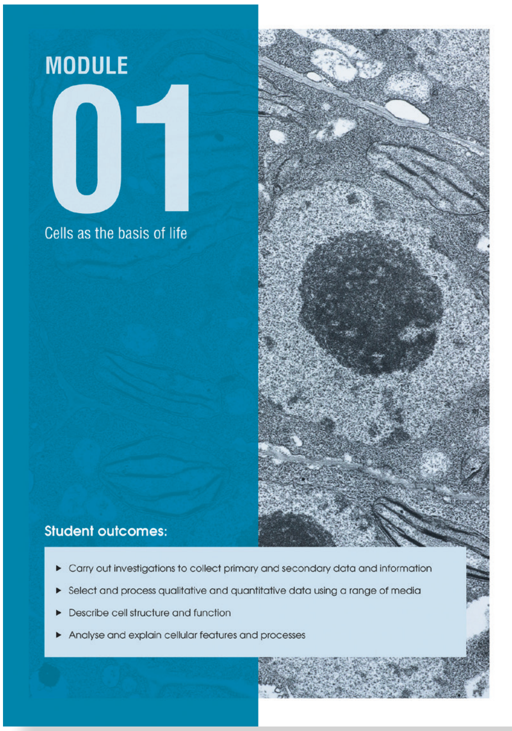
Synoptic assessment

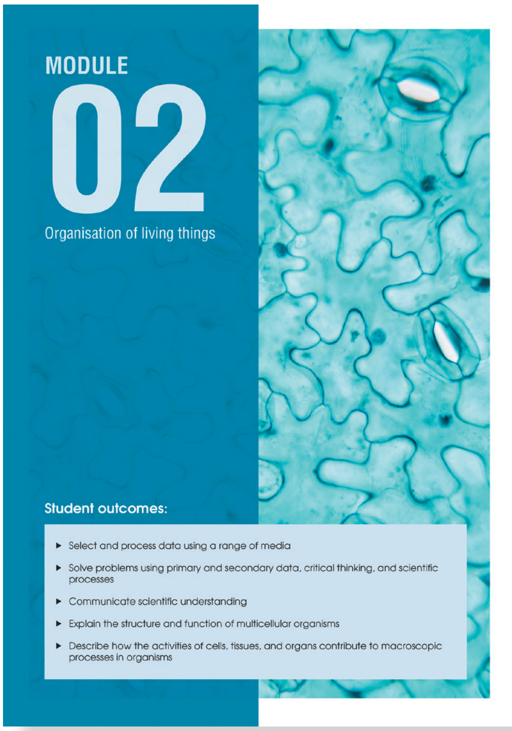
- Synoptic assessments conclude the module of study covered in the workbook.
- Practise written exam skills.

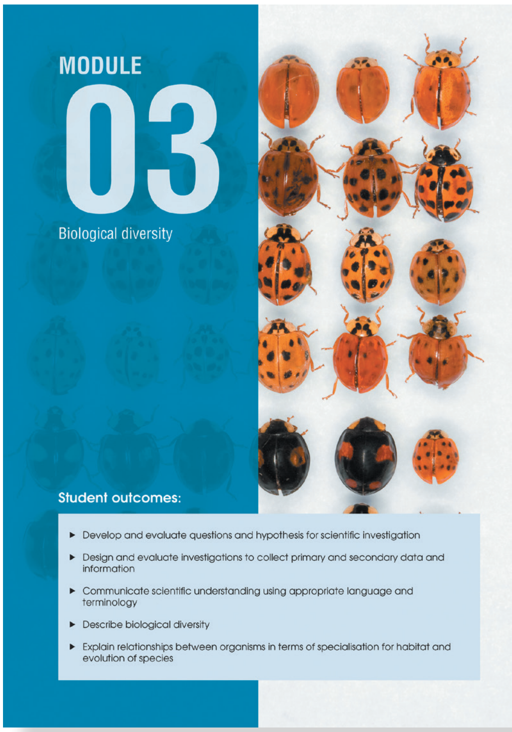


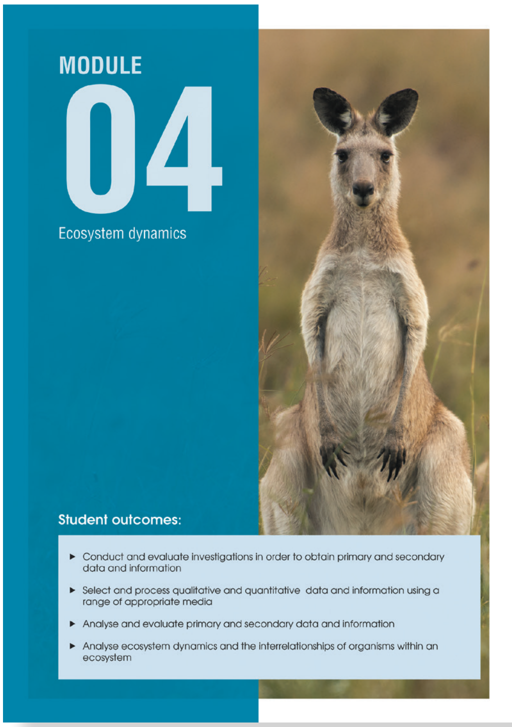
Module Breaks

The content of the *HSC Biology Modules 1-4* is organised into four sections (modules). The module breaks divide the book into four sections covering related material. This structure provides students with a clear indication of where they are in the course. Each unit break summarises the student outcomes covered in each module, so students have a clear idea of what is coming up.



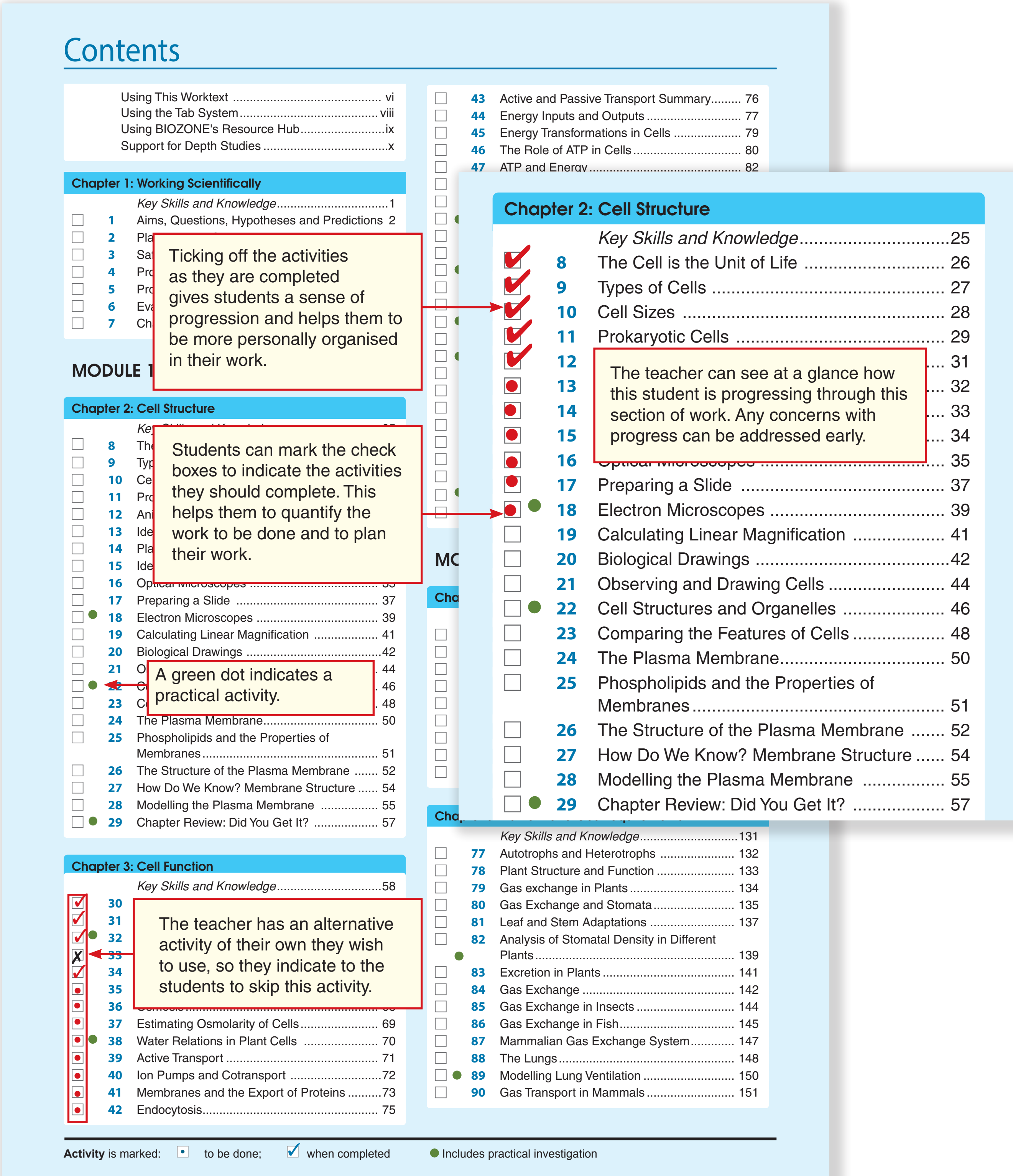






The Contents: A Planning Tool

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



Introducing the Chapter Content

Each chapter is prefaced with a one page introduction, providing students with an overview of the chapter content and organisation. Each of the numbered learning outcomes pertains to a point of key knowledge or a skill, and is matched to one or more activities. A list of key terms for the chapter is also included. The comprehensive, but accessible, list of learning outcomes encourages students to approach each topic confidently. Familiarity with the scientific terms used in each topic is implicit in this. Encourage your students to use the glossary (Appendix 1) to expand their scientific vocabulary.

For ease of navigation, chapters are numbered sequentially throughout the book.

The chapter title corresponds to the section heading in each module.

The relevant inquiry question for each chapter is clearly stated. Encourage students to keep this in mind as they work through the content, and try to relate their learning back to it.

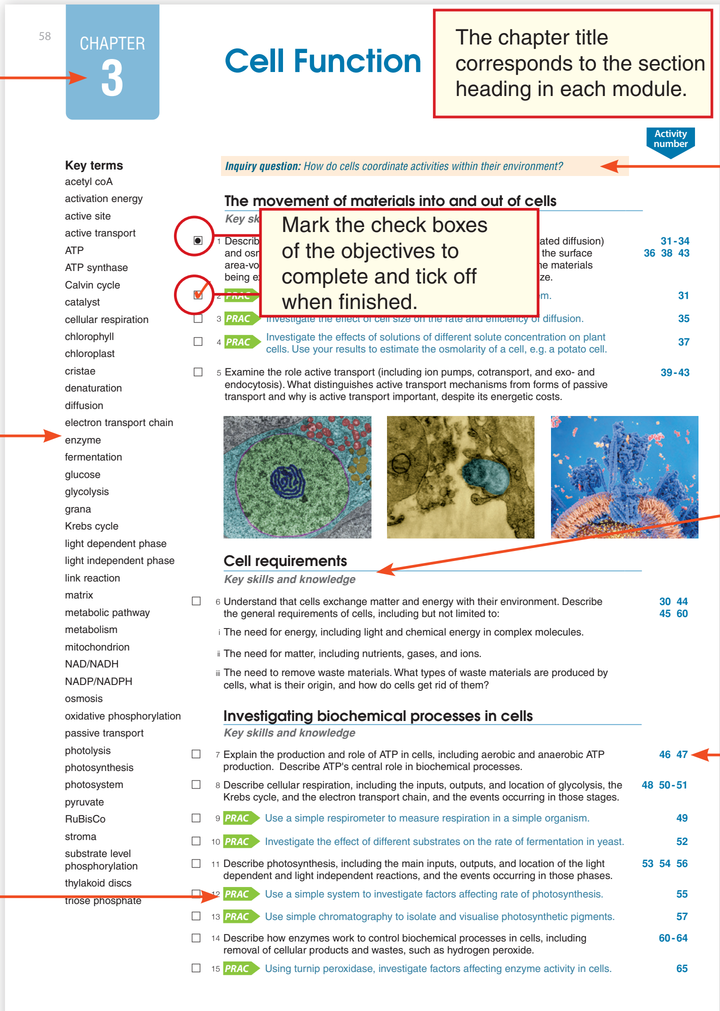
The list of **key terms** highlights important terms to students. They can look them up in the glossary at the back of the book if they are unsure of what they mean. This encourages use of the correct terms when answering questions and builds scientific literacy.

Mark the check boxes of the objectives to complete and tick off when finished.

Key skills and knowledge are drawn from the syllabus. They are purposefully brief, with enough information to provide a framework, but not so much that students are overwhelmed.

The activities relating to these key knowledge outcomes.

Activities that cover practical skills are identified with a green bookmark and blue text.


58 CHAPTER 3

Cell Function

Activity number

Inquiry question: How do cells coordinate activities within their environment?

Key terms: acetyl coA, activation energy, active site, active transport, ATP, ATP synthase, Calvin cycle, catalyst, cellular respiration, chlorophyll, chloroplast, cristae, denaturation, diffusion, electron transport chain, enzyme, fermentation, glucose, glycolysis, grana, Krebs cycle, light dependent phase, light independent phase, link reaction, matrix, metabolic pathway, metabolism, mitochondrion, NAD/NADH, NADP/NADPH, osmosis, oxidative phosphorylation, passive transport, photolysis, photosynthesis, photosystem, pyruvate, RuBisCo, stroma, substrate level phosphorylation, thylakoid discs, triose phosphate

The movement of materials into and out of cells

3 PRAC Investigate the effect of cell size on the rate and efficiency of diffusion. 35

4 PRAC Investigate the effects of solutions of different solute concentration on plant cells. Use your results to estimate the osmolarity of a cell, e.g. a potato cell. 37

5 Examine the role active transport (including ion pumps, cotransport, and exo- and endocytosis). What distinguishes active transport mechanisms from forms of passive transport and why is active transport important, despite its energetic costs. 39-43

Cell requirements

Key skills and knowledge

6 Understand that cells exchange matter and energy with their environment. Describe the general requirements of cells, including but not limited to: 30 44 45 60

i The need for energy, including light and chemical energy in complex molecules.

ii The need for matter, including nutrients, gases, and ions.

iii The need to remove waste materials. What types of waste materials are produced by cells, what is their origin, and how do cells get rid of them?

Investigating biochemical processes in cells

Key skills and knowledge

7 Explain the production and role of ATP in cells, including aerobic and anaerobic ATP production. Describe ATP's central role in biochemical processes. 46 47

8 Describe cellular respiration, including the inputs, outputs, and location of glycolysis, the Krebs cycle, and the electron transport chain, and the events occurring in those stages. 48 50-51

9 PRAC Use a simple respirometer to measure respiration in a simple organism. 49

10 PRAC Investigate the effect of different substrates on the rate of fermentation in yeast. 52

11 Describe photosynthesis, including the main inputs, outputs, and location of the light dependent and light independent reactions, and the events occurring in those phases. 53 54 56

12 PRAC Use a simple system to investigate factors affecting rate of photosynthesis. 55

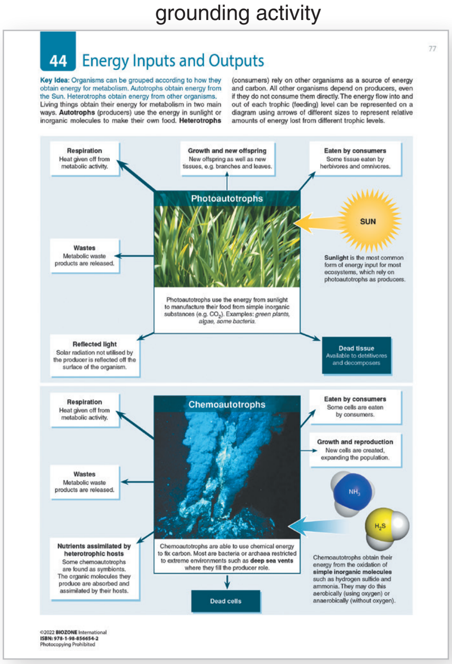
13 PRAC Use simple chromatography to isolate and visualise photosynthetic pigments. 57

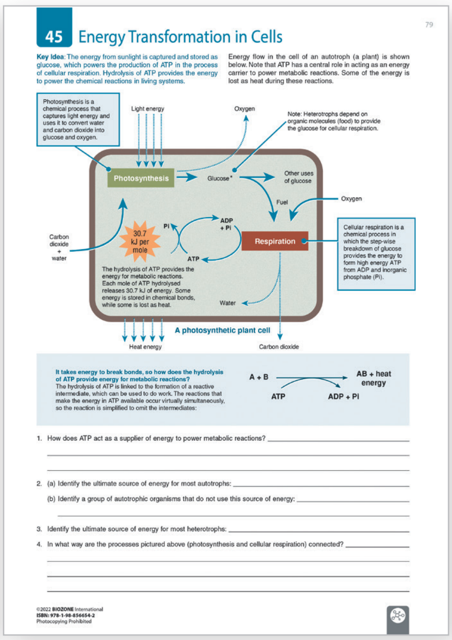
14 Describe how enzymes work to control biochemical processes in cells, including removal of cellular products and wastes, such as hydrogen peroxide. 60-64

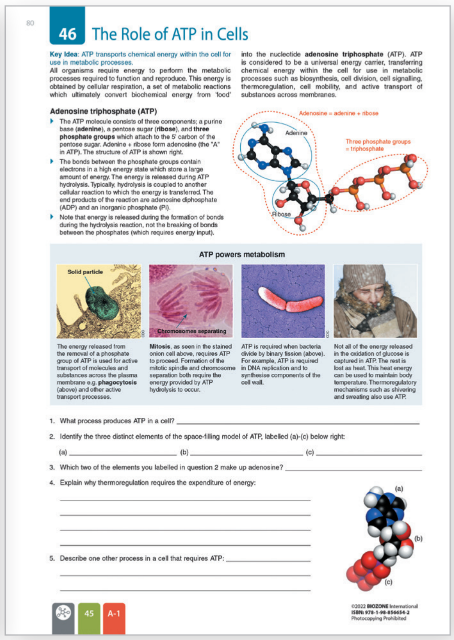
15 PRAC Using turnip peroxidase, investigate factors affecting enzyme activity in cells. 65

Introduce the concept with a grounding activity

Follow with activities exploring that concept







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. Features include short blocks of text so that students do not feel overwhelmed with too much reading, high quality informative graphics, and links to 3D models that 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. Teachers should guide students through the features of the activity pages to ensure that they make the most of the features on offer.

Key Idea: Summarises the primary focus of the activity and provides a clear take-home message.

Key Terms: Words in **bold** are key terms. Definitions for these can be found in the glossary at the back of the worktext.

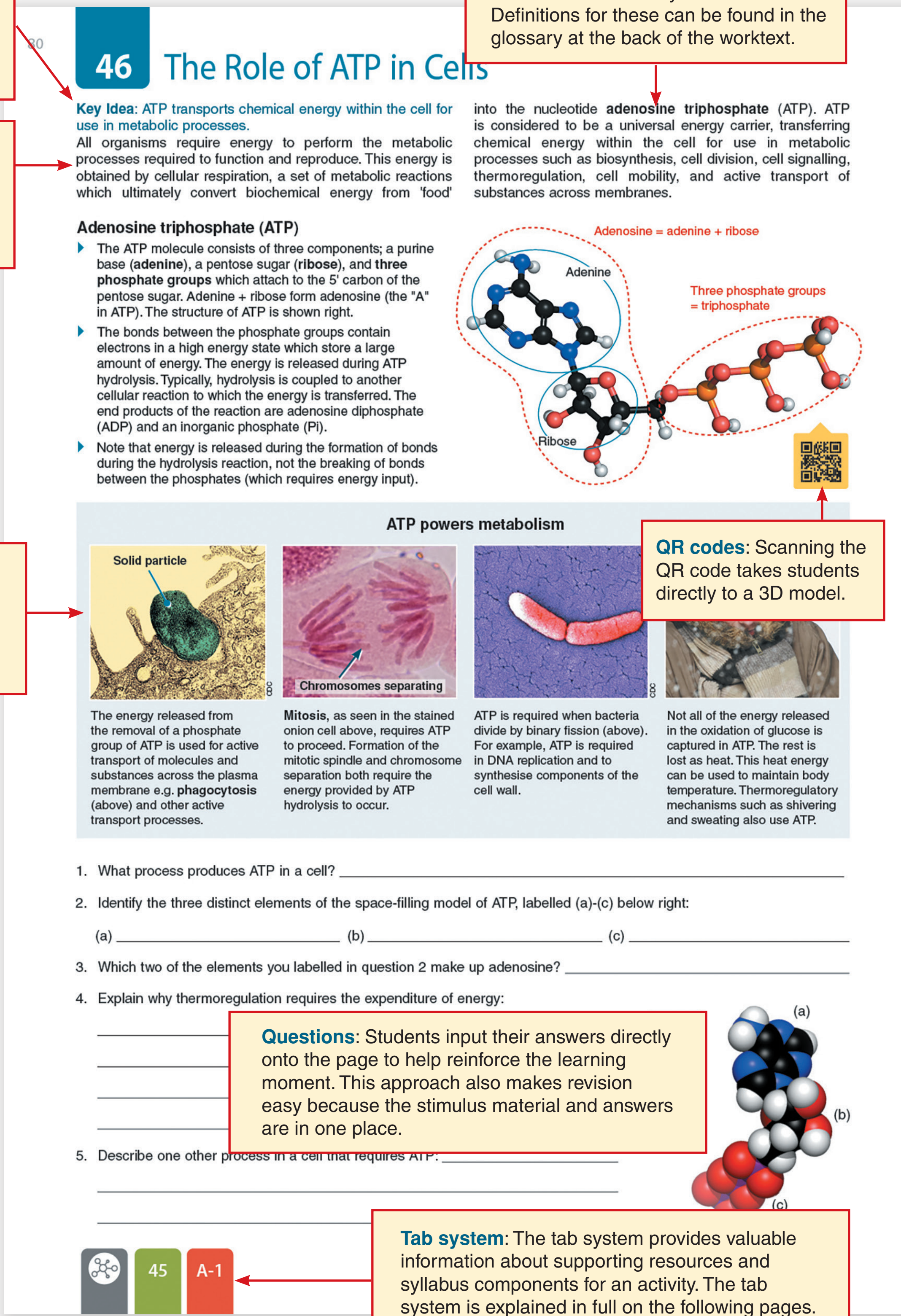
Introductory paragraph: Provides background information and an introduction to the activity.

Diagrams: Full colour diagrams and photos help students visualise important information or concepts.

QR codes: Scanning the QR code takes students directly to a 3D model.

Questions: Students input their answers directly onto the page to help reinforce the learning moment. This approach also makes revision easy because the stimulus material and answers are in one place.

Tab system: The tab system provides valuable information about supporting resources and syllabus components for an activity. The tab system is explained in full on the following pages.



46 The Role of ATP in Cells

Key Idea: ATP transports chemical energy within the cell for use in metabolic processes.

All organisms require energy to perform the metabolic processes required to function and reproduce. This energy is obtained by cellular respiration, a set of metabolic reactions which ultimately convert biochemical energy from 'food' into the nucleotide **adenosine triphosphate** (ATP). ATP is considered to be a universal energy carrier, transferring chemical energy within the cell for use in metabolic processes such as biosynthesis, cell division, cell signalling, thermoregulation, cell mobility, and active transport of substances across membranes.

Adenosine triphosphate (ATP)

- The ATP molecule consists of three components; a purine base (**adenine**), a pentose sugar (**ribose**), and **three phosphate groups** which attach to the 5' carbon of the pentose sugar. Adenine + ribose form adenosine (the "A" in ATP). The structure of ATP is shown right.
- The bonds between the phosphate groups contain electrons in a high energy state which store a large amount of energy. The energy is released during ATP hydrolysis. Typically, hydrolysis is coupled to another cellular reaction to which the energy is transferred. The end products of the reaction are adenosine diphosphate (ADP) and an inorganic phosphate (Pi).
- Note that energy is released during the formation of bonds during the hydrolysis reaction, not the breaking of bonds between the phosphates (which requires energy input).

ATP powers metabolism

The energy released from the removal of a phosphate group of ATP is used for active transport of molecules and substances across the plasma membrane e.g. **phagocytosis** (above) and other active transport processes.

Mitosis, as seen in the stained onion cell above, requires ATP to proceed. Formation of the mitotic spindle and chromosome separation both require the energy provided by ATP hydrolysis to occur.

ATP is required when bacteria divide by binary fission (above). For example, ATP is required in DNA replication and to synthesise components of the cell wall.

Not all of the energy released in the oxidation of glucose is captured in ATP. The rest is lost as heat. This heat energy can be used to maintain body temperature. Thermoregulatory mechanisms such as shivering and sweating also use ATP.

1. What process produces ATP in a cell? ______

2. Identify the three distinct elements of the space-filling model of ATP, labelled (a)-(c) below right:

(a) ______ (b) ______ (c) ______

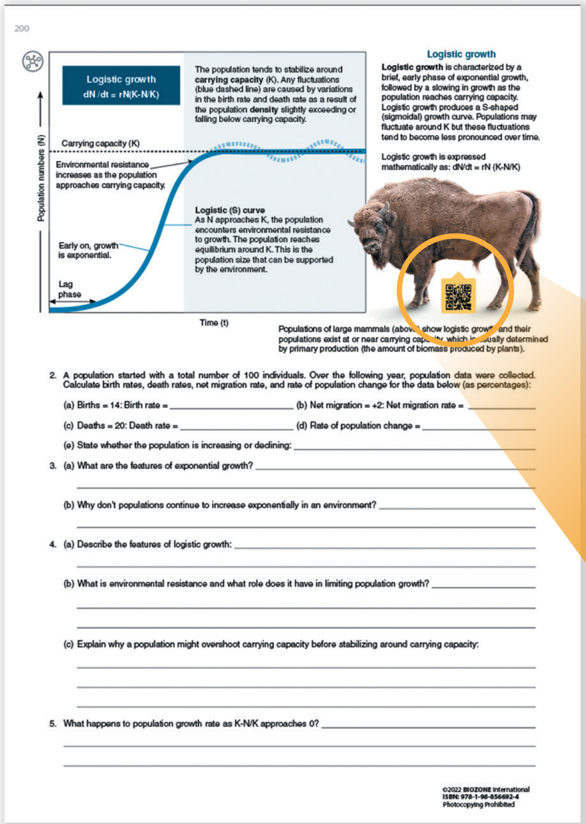
3. Which two of the elements you labelled in question 2 make up adenosine? ______

4. Explain why thermoregulation requires the expenditure of energy:

5. Describe one other process in a cell that requires ATP: ______

45 A-1

Using the QR codes



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.

Using the Tab System

The tab system helps you identify important parts of the HSC Biology course (general capabilities, cross-curriculum priorities, and other curriculum learning areas). The tabs also allow you to see at a glance if online support is provided on BIOZONE's **Resource Hub**, and if there are content links with other activities. A summary of the icon tabs is provided below and a full description is provided on the following page.

Green tabs link to related content.

Orange tabs indicate where other syllabus learning areas are covered within an activity.

The activity is supported with content on **BIOZONE's Resource Hub**

Red tabs are used to refer to relevant appendices (glossary term or equipment list).

Purple tabs identify cross-curriculum priorities.

Blue tabs indicate the general capabilities covered within the activity.

General capabilities

Critical & creative thinking: Develop critical and creative thinking skills through asking questions, making predictions, engaging in practical and secondary-sourced investigations, and anlaysing and evaluating evidence.

Ethical understanding: Apply ethical values and principles to your studies and investigations. Understand the implications of these to others and the environment. Understand reasoning can assist making ethical judgements.

Information & communication technology capability: Use ICT to access information, collect, analyse, and represent data, model and interpret concepts and relationships, process information, and communicate ideas.

Intercultural understanding: Appreciate and respect diverse cultures (yours and others) and understand how cultural perspectives have impacted the developments, breadth and diversity of scientific knowledge and applications.

Literacy: Literacy is the ability to identify, understand, interpret, create and communicate effectively using written, visual, oral, and digital formats. Apply these skills to communicate scientific concepts and findings.

Numeracy: Numeracy involves recognising and understanding the role of mathematics in the world. Develop numeracy skills through measuring, recording, representing, and anlaysing data.

Personal & social capability: Establish positive relationships, make responsible decisions, work effectively (alone and with others) and constructively handle challenging situations during your scientific endeavours.

Cross-curriculum priorities

Aboriginal & Torres Strait Islander histories & cultures: The traditional knowledge and cultural practices of Aboriginal & Torres Strait Islander peoples provide insight into how the environment and natural world work. Traditional knowledge and Western scientific knowledge can be used together in a complementary way.

Asia & Australia's engagement with Asia: The diverse environments of Australia and Asia provide opportunities to study interactions within and between the two environments, including how human activity influences the region, and the significance of these to the rest of the world.

Sustainability: Sustainability is concerned with the ongoing capacity of the Earth to maintain all life. It provides contexts for exploring, investigating, and understanding the interrelatedness and sustainability of Earth's systems, including both natural and human-made environments.

Other learning across curriculum areas

Civics & citizenship: Understand how civics, the understanding of Australian society, and citizenship can be applied to scientific ideas and technological advances.

Difference & diversity: Australian society is diverse in terms of gender, race, and socio-economic circumstances. Working collaboratively provides opportunities to develop an appreciation of the values and ideas of others.

Work & enterprise: Develop and use safe working practices. Identify risks and carry out hazard assessments when working in the laboratory or field.

Other tabs

Grey hub tabs indicate the activity is supported by content on BIOZONE's Resource Hub.
See page ix for details about BIOZONE's Resource Hub.

7 — Green tabs show connections to related activities and content elsewhere in the book.

A-1 — Appendix 1: Glossary of key terms and their definitions

A-2 — Appendix 2: Equipment list for the practical investigations

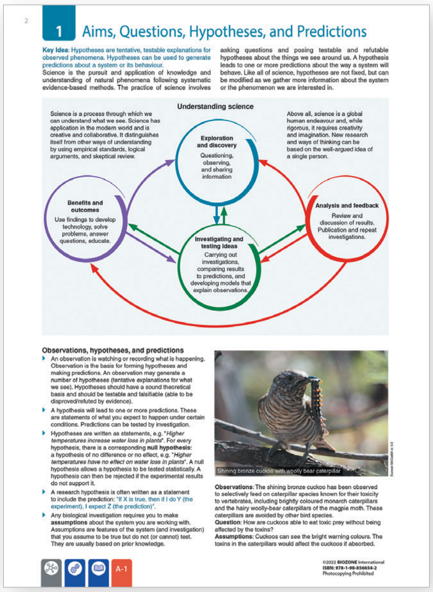
Support for Science Skills and Practical Investigations

The *Working Scientifically Skills* are well supported throughout the worktext. Chapter 1 provides students with a refresher on general science skills they will find useful during their science studies. Throughout the HSC Biology course students practise these skills by applying them in practical situations (opposite). As students work through the content, there are many opportunities for them to develop skills in science practices and apply them within the context of an activity. Regular practise helps students become proficient in using these skills when they encounter them in their assessments.

Working Scientifically: Checklist

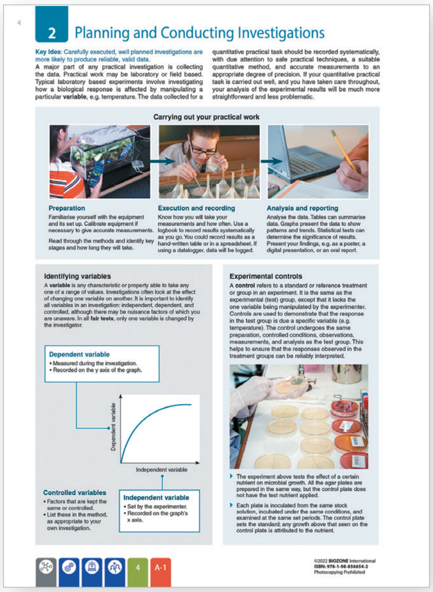
The Chapter 1 introduction provides an overview of the Working Scientifically Skills required in HSC Biology. This checklist will help students ensure they understand the skill requirements.

Aims, questions, hypotheses and predictions



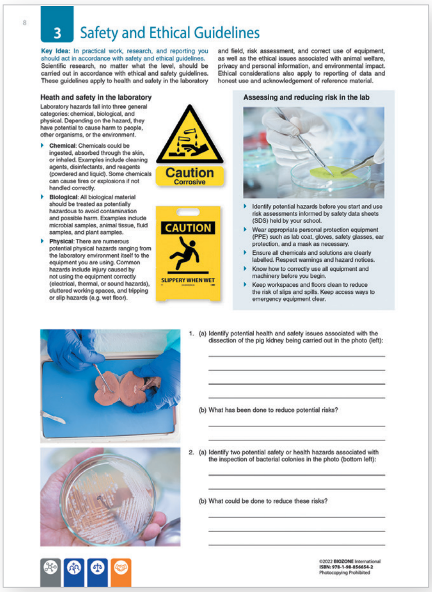
This activity helps students to identify and construct aims and questions for the investigation, formulate hypotheses, and make predictions.

Plan and conduct investigations



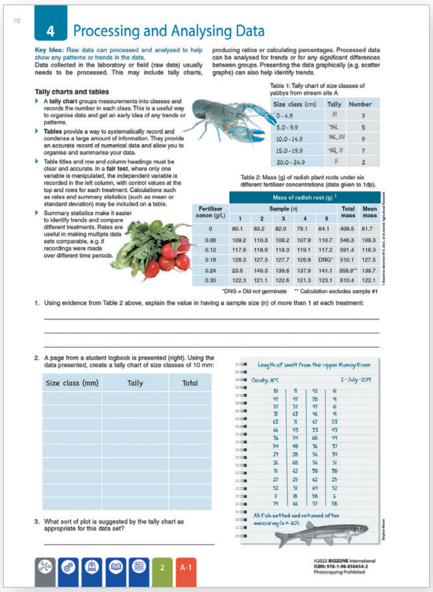
This activity focusses on how to plan and conduct investigations. Information includes selecting equipment, identifying variables, and recording data.

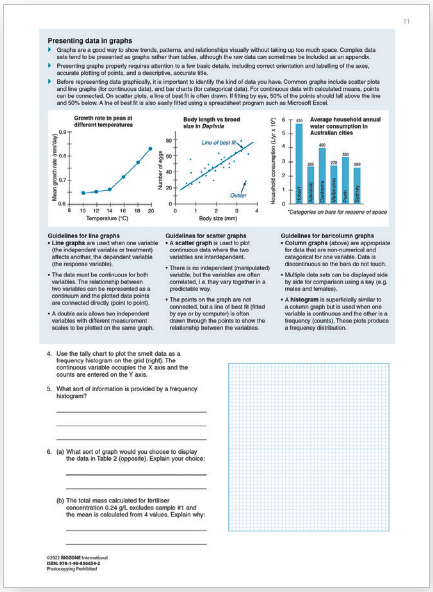
Comply with safety & ethical guidelines



This activity covers basic considerations for ethical science practices, including risk assessment and the importance of honest reporting.

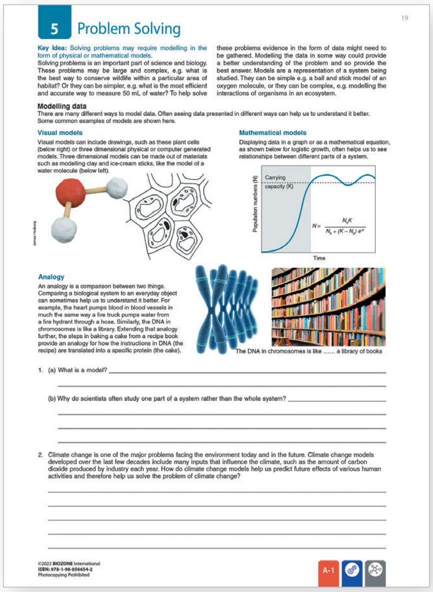
Processing and analysing data





This longer activity covers commonly used data transformation methods students may be asked to carry out during HSC Biology. Information includes how to calculate rates, percentages, ratios, fractions, percentage change, and descriptions of central tendency (mean, median, and mode). Students learn about the reliability of their data, and how to test the reliability of the data themselves using some basic statistical analysis (standard deviation and 95% confidence interval). The value of presenting data in graphs and tables to summarise and identify trends is also covered.

Problem solving


5 Problem Solving

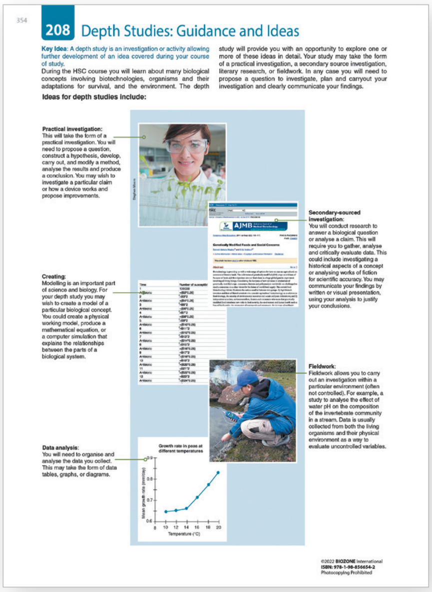
Breaking problems down into smaller components and tackling the more manageable pieces can be a useful strategy for solving complex problems. Models and representations can be used to visualise a problem and help solve problems and predict outcomes.

Evaluating and communicating scientific ideas


6 Evaluating & Communicating Scientific Ideas

This skill requires students to think critically and communicate information to an audience in an appropriate way. Students are introduced to the basic principles here, and have the opportunity to implement them throughout the course and also in their depth study.

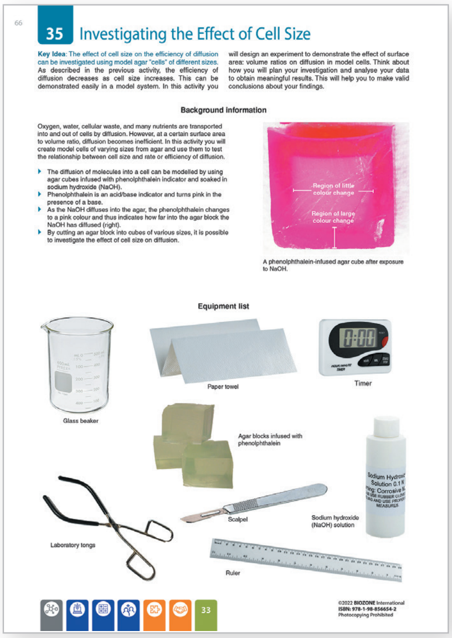
Chapter 14: Depth Studies: Guidance and Ideas

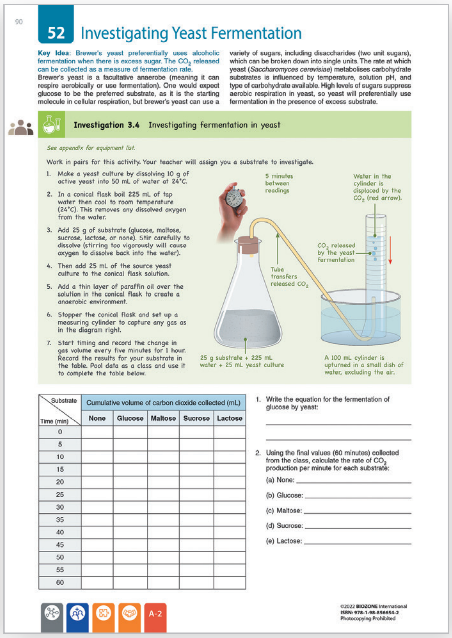

208 Depth Studies: Guidance and Ideas

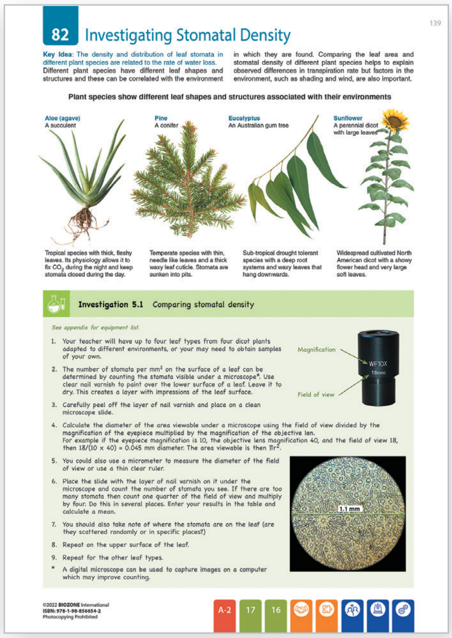
Chapter 14 is dedicated to helping students plan and carry out their depth study. Encourage students to refer to it often as they plan, execute, and report their findings for their chosen topic.

Practical Investigations and activities in Context

Practical investigations and hands on activities appear in context throughout the book. The practical investigations provide opportunities for students to develop many of their essential science skills. Working in groups promotes collaboration and the development of communication skills. Stronger students can mentor and support those who are less confident, providing benefit for both sets of students. A list of equipment for each investigation is provided in Appendix 2.



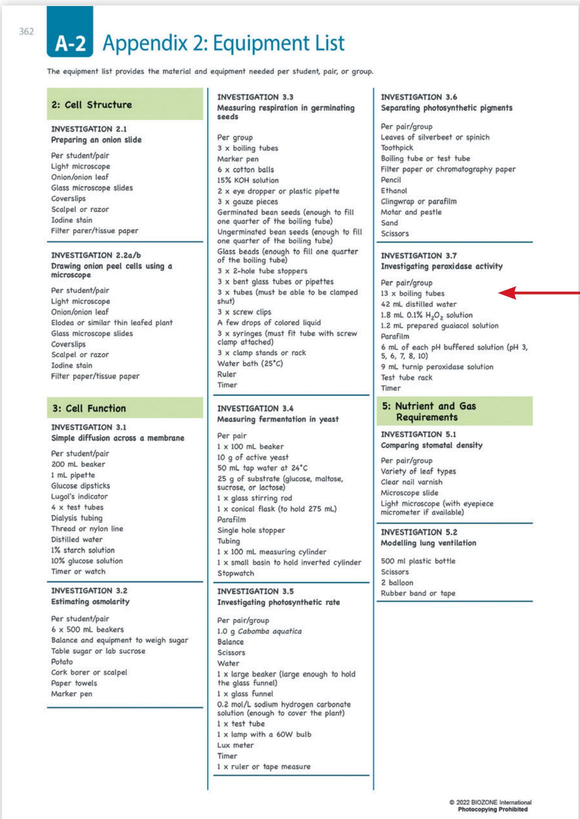




Some "practical" activities are not investigations in the true sense, but give students a place to develop their skills in planning and designing an experiment.

Almost all investigations require students to use a number of science skills. They encourage collaboration, problem solving and attention to detail, as well as the analysis and evaluation of data.

The practical investigations may involve setting up and carrying out an experiment (above), or could involve a paper practical or modelling activity (e.g. making a model of the plasma membrane).



No kits are required for the investigations.

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

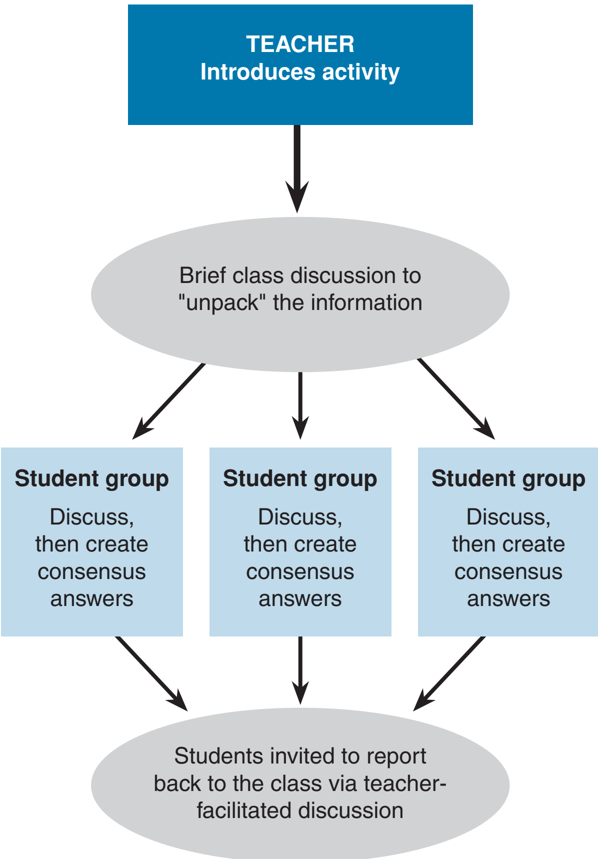
A list of the equipment and reagents required for each investigation is provided in appendix 2.

Teaching Strategies for Classroom Use

Achieving effective differentiated 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 differentiated 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 maximise learning outcomes

- The structure of *HSC Biology Modules 1-4* 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 maximise 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 get 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).

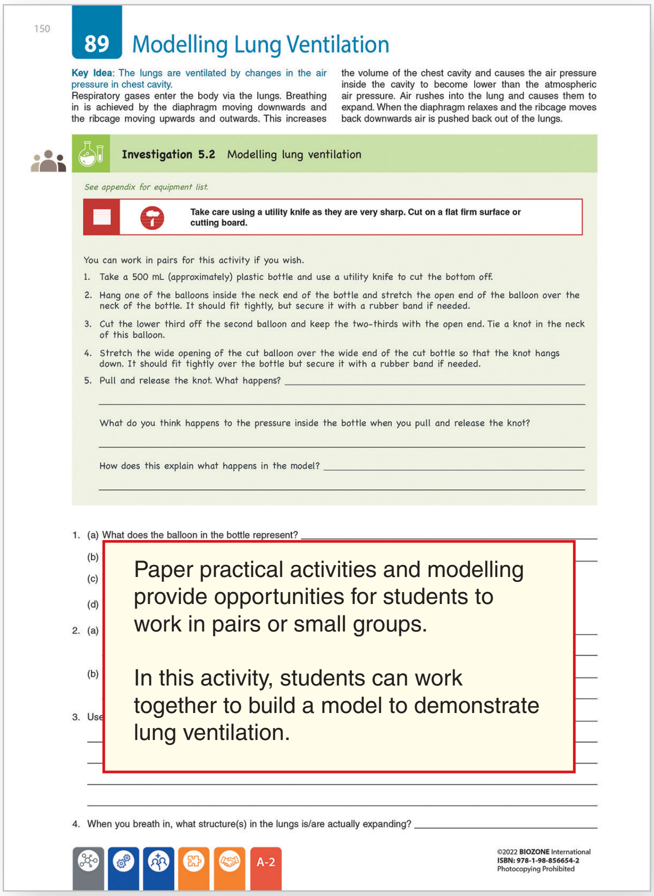
The teacher introduces the topic. They provide structure to the session by providing background information and setting up discussion points and clear objectives. Collaboration is emphasised to encourage participation from the entire group. If necessary, students in a group can be assigned specific tasks.

Students work in small groups so that everyone's contribution is heard. They collaborate, share ideas, and engage in discourse. The emphasis is on sharing ideas, discussing questions, formulating answers. Students may even come up with additional questions and discussion points.

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. Students can revise their original answers providing a powerful second learning moment.

Peer to peer support

- **Peer-to-peer learning** is emphasised 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.
- **Practical activities, investigations** and **group research projects** are an ideal vehicle for peer-to-peer learning. Students can work together to review and discuss their results, ask and answer questions, and describe phenomena.


150

89 Modelling Lung Ventilation

Key Idea: The lungs are ventilated by changes in the air pressure in chest cavity.

Respiratory gases enter the body via the lungs. Breathing in is achieved by the diaphragm moving downwards and the ribcage moving upwards and outwards. This increases the volume of the chest cavity and causes the air pressure inside the cavity to become lower than the atmospheric air pressure. Air rushes into the lung and causes them to expand. When the diaphragm relaxes and the ribcage moves back downwards air is pushed back out of the lungs.

Investigation 5.2 Modelling lung ventilation

See appendix for equipment list.

Take care using a utility knife as they are very sharp. Cut on a flat firm surface or cutting board.

You can work in pairs for this activity if you wish.

1. Take a 500 mL (approximately) plastic bottle and use a utility knife to cut the bottom off.
2. Hang one of the balloons inside the neck end of the bottle and stretch the open end of the balloon over the neck of the bottle. It should fit tightly, but secure it with a rubber band if needed.
3. Cut the lower third off the second balloon and keep the two-thirds with the open end. Tie a knot in the neck of this balloon.
4. Stretch the wide opening of the cut balloon over the wide end of the cut bottle so that the knot hangs down. It should fit tightly over the bottle but secure it with a rubber band if needed.
5. Pull and release the knot. What happens? ____

What do you think happens to the pressure inside the bottle when you pull and release the knot? ____

How does this explain what happens in the model? ____

1. (a) What does the balloon in the bottle represent? ____

(b)

(c)

(d)

2. (a)

(b)

3. Use

4. When you breath in, what structure(s) in the lungs is/are actually expanding? ____

A-2

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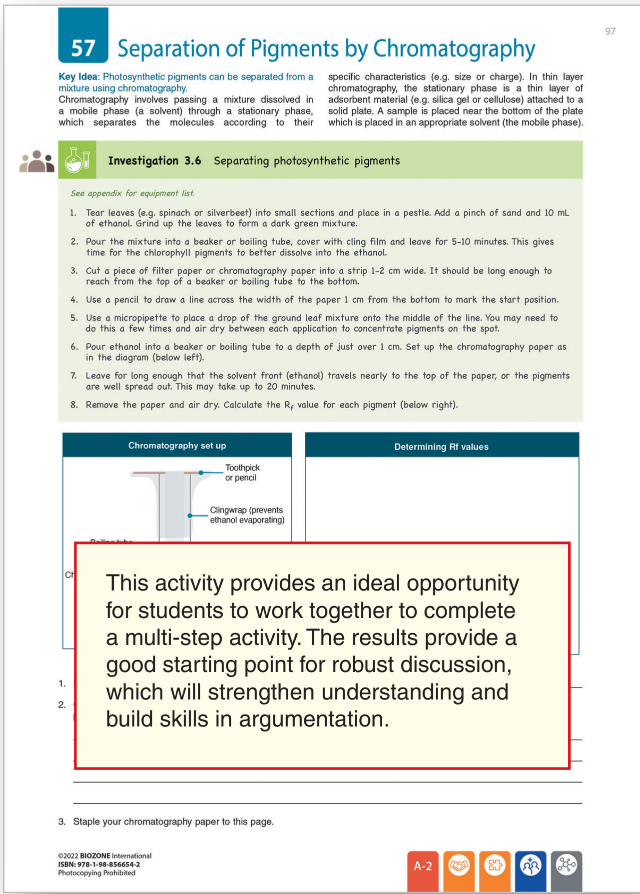
Paper practical activities and modelling provide opportunities for students to work in pairs or small groups.

In this activity, students can work together to build a model to demonstrate lung ventilation.


97

57 Separation of Pigments by Chromatography

Key Idea: Photosynthetic pigments can be separated from a mixture using chromatography.

Chromatography involves passing a mixture dissolved in a mobile phase (a solvent) through a stationary phase, which separates the molecules according to their specific characteristics (e.g. size or charge). In thin layer chromatography, the stationary phase is a thin layer of adsorbent material (e.g. silica gel or cellulose) attached to a solid plate. A sample is placed near the bottom of the plate which is placed in an appropriate solvent (the mobile phase).

Investigation 3.6 Separating photosynthetic pigments

See appendix for equipment list.

1. Tear leaves (e.g. spinach or silverbeet) into small sections and place in a pestle. Add a pinch of sand and 10 mL of ethanol. Grind up the leaves to form a dark green mixture.
2. Pour the mixture into a beaker or boiling tube, cover with cling film and leave for 5-10 minutes. This gives time for the chlorophyll pigments to better dissolve into the ethanol.
3. Cut a piece of filter paper or chromatography paper into a strip 1-2 cm wide. It should be long enough to reach from the top of a beaker or boiling tube to the bottom.
4. Use a pencil to draw a line across the width of the paper 1 cm from the bottom to mark the start position.
5. Use a micropipette to place a drop of the ground leaf mixture onto the middle of the line. You may need to do this a few times and air dry between each application to concentrate pigments on the spot.
6. Pour ethanol into a beaker or boiling tube to a depth of just over 1 cm. Set up the chromatography paper as in the diagram (below left).
7. Leave for long enough that the solvent front (ethanol) travels nearly to the top of the paper, or the pigments are well spread out. This may take up to 20 minutes.
8. Remove the paper and air dry. Calculate the R_f value for each pigment (below right).

Chromatography set up | Determining Rf values

Toothpick or pencil

Clingwrap (prevents ethanol evaporating)

1.

2.

3. Staple your chromatography paper to this page.

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A-2

This activity provides an ideal opportunity for students to work together to complete a multi-step activity. The results provide a good starting point for robust discussion, which will strengthen understanding and build skills in argumentation.

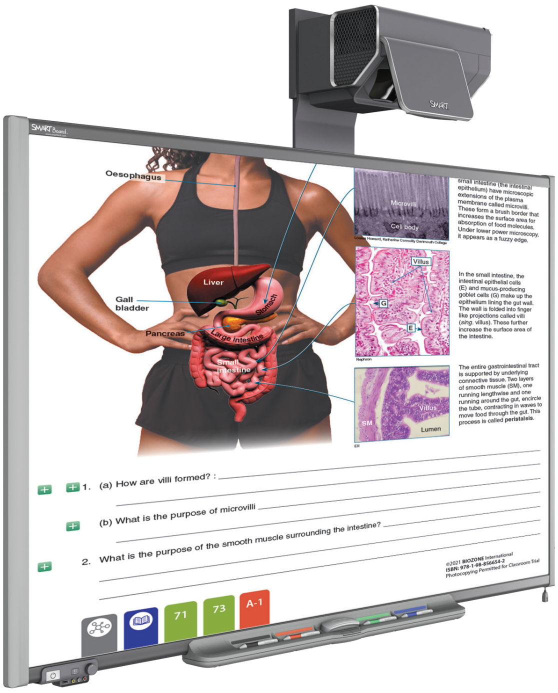
Collaboration and discovery

- BIOZONE's *HSC Biology Modules 1-4* allows for collaboration and discovery. By working together and sharing ideas, students are exposed to different perspectives and levels of knowledge about biological concepts.
- BIOZONE's *HSC Biology Modules 1-4* builds student understanding by providing a range of activities. These include getting 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.



Interactive revision of tasks in class

Review answers in class via BIOZONE WORLD
The teacher view in BIOZONE WORLD has model answers which can be toggled on and off using the show/hide buttons on an activity page.

View activities in BIOZONE WORLD on a shared screen and reveal the answers as required. This is ideal for:

- Providing a concise model answer after a group or class discussion.
- Self marking by students. Students can amend their answer if necessary, providing a powerful secondary learning moment.
- Providing a quick review of answers if time is short.

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.

Support for the Depth Study

The depth study is an important and exciting component of the HSC syllabus for students, allowing them to explore in detail a topic which interests them. However, it can also be overwhelming for them as they decide (with your guidance) which topic area to study and how best to carry out their investigation. While teacher input is very important to ensure students choose a suitable topic which meets all of the assessment requirements, we have provided resources to help students plan and carry out their depth study with confidence.

Chapter 14 is dedicated to helping students with their depth study. The material has been designed to get students thinking about their study and what exactly they will need to do to be successful. Topics include:

Choosing a depth study

- What types of studies, projects, or investigations can be used for a depth study?
- What type of study is most appropriate for the topic the student wants to study?
- What are the differences between a primary practical investigation and a secondary-sourced investigation?

Planning a depth study

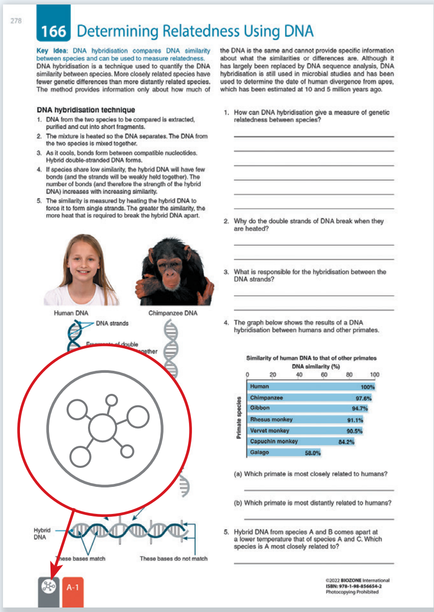
- What does the planning process look like?
- What needs to be considered when planning a depth study?
- What does the student want to find out from their study?
- What type of data should be collected and how will it be analysed?
- What equipment is needed? Is the equipment available?
- Can the study be completed within the time frame?

Sharing findings

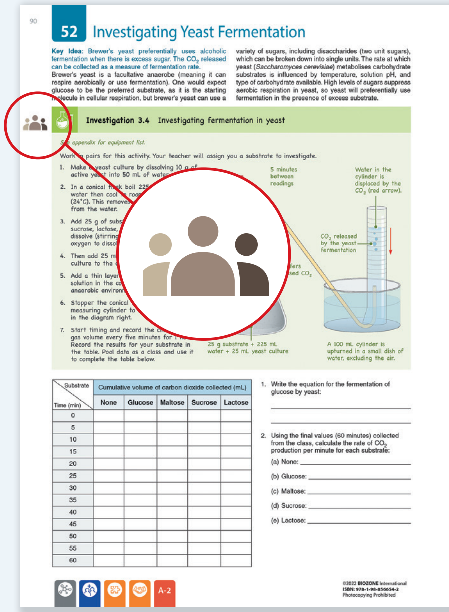
- What style of communication should be used to share the findings?
- What structure should be used when the student delivers their findings?
- How is the work of others acknowledged?

Differentiated Learning

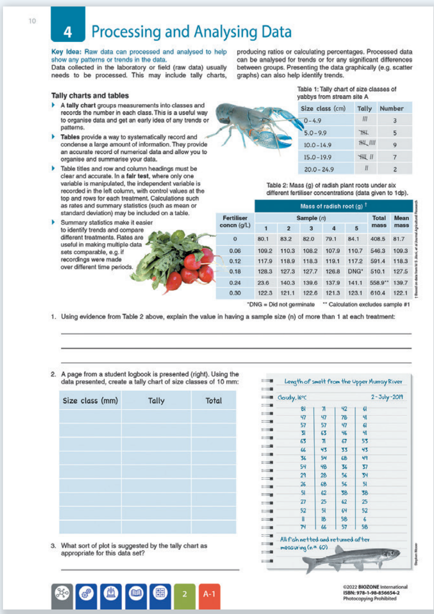
Tools for differentiated instruction within *HSC Biology Modules 1-4* help teachers to support students all skill levels. BIOZONE's collaborative approach to science inquiry encourages students to share their ideas and knowledge with their peers while reinforcing their own understanding. There are several ways to use the resources in a differentiated classroom:



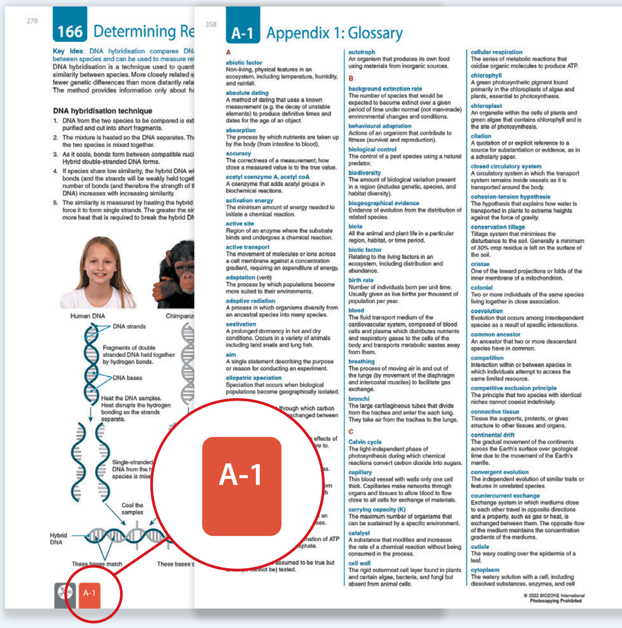
BIOZONE's Resource Hub provides curated content to support the activities in the book. Videos, animations, simulations, and 3D models support students of all abilities, while some resources (interactive spreadsheets, fact sheets, and reference papers) may be used as part of group work or extension. A grey hub tab at the bottom of the page indicates the activity has online support.



A group symbol indicates where students can work together. Group work provides opportunities for student collaboration and peer-to-peer support to explore the principles and concepts they are engaged with in their course. Working in groups, students can experience the benefits of collaboration in the scientific process of discovery. By speaking and listening, they develop and extend their communication skills and scientific vocabulary.



Students requiring extra support with using the working scientifically skills should be encouraged to refer to Chapter 1 as often as they need to. Building familiarity with these skills will enable students to apply them confidently within the context of the activities.



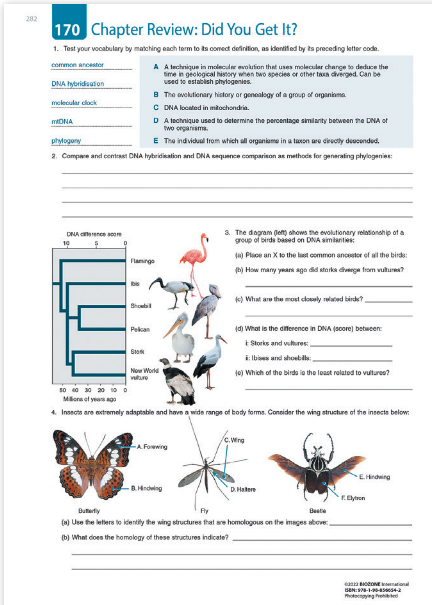
The list of key terms in the chapter introduction provides students with a list of scientific terms they should be familiar with. Encourage students to refer to the glossary (Appendix 1) when they are unsure about the meaning of a scientific term they are unfamiliar with. A glossary tab at the bottom of a page indicates where a term within the activity has been defined. These strategies build scientific literacy and encourage students to use scientific terms with confidence.

Formative and Summative Assessments

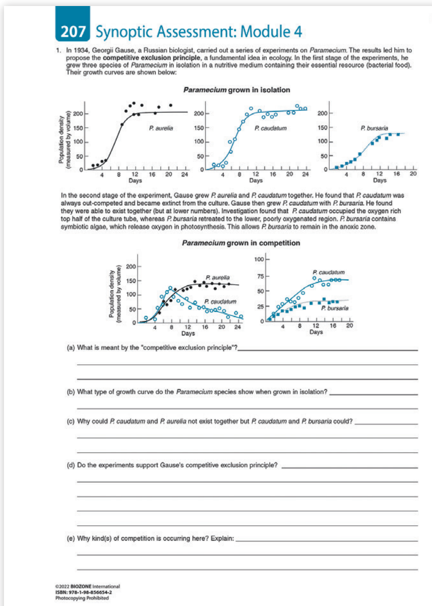
BIOZONE's *HSC Biology Modules 1-4* provides many opportunities to assess your students' progress as they work through the course. The *Contents* check-box list provides a list of activities completed, and the students' own self-tests in the review activities at the end of each chapter provide opportunity to address any misconceptions or lack of understanding. A summary of formative and summative assessments is provided in the tables below. You may also choose to assess practical work as you move through the course.

	Module 1: Cells as the Basis of Life	
CHAPTER 1 Working Scientifically No formal assessment required	CHAPTER 2 Cell Structure	CHAPTER 3 Cell Function
FORMATIVE Activity 7. Chapter Review	FORMATIVE Activity 29. Chapter Review	FORMATIVE Activity 66. Chapter Review SUMMATIVE Activity 67. Synoptic Assessment

Module 2: Organisation of Living Things		
CHAPTER 4 Organisation of Cells	CHAPTER 5 Nutrient and Gas Requirements	CHAPTER 6 Transport
FORMATIVE Activity 76. Chapter Review	FORMATIVE Activity 96. Chapter Review	FORMATIVE Activity 115. Chapter Review SUMMATIVE Activity 116. Synoptic Assessment



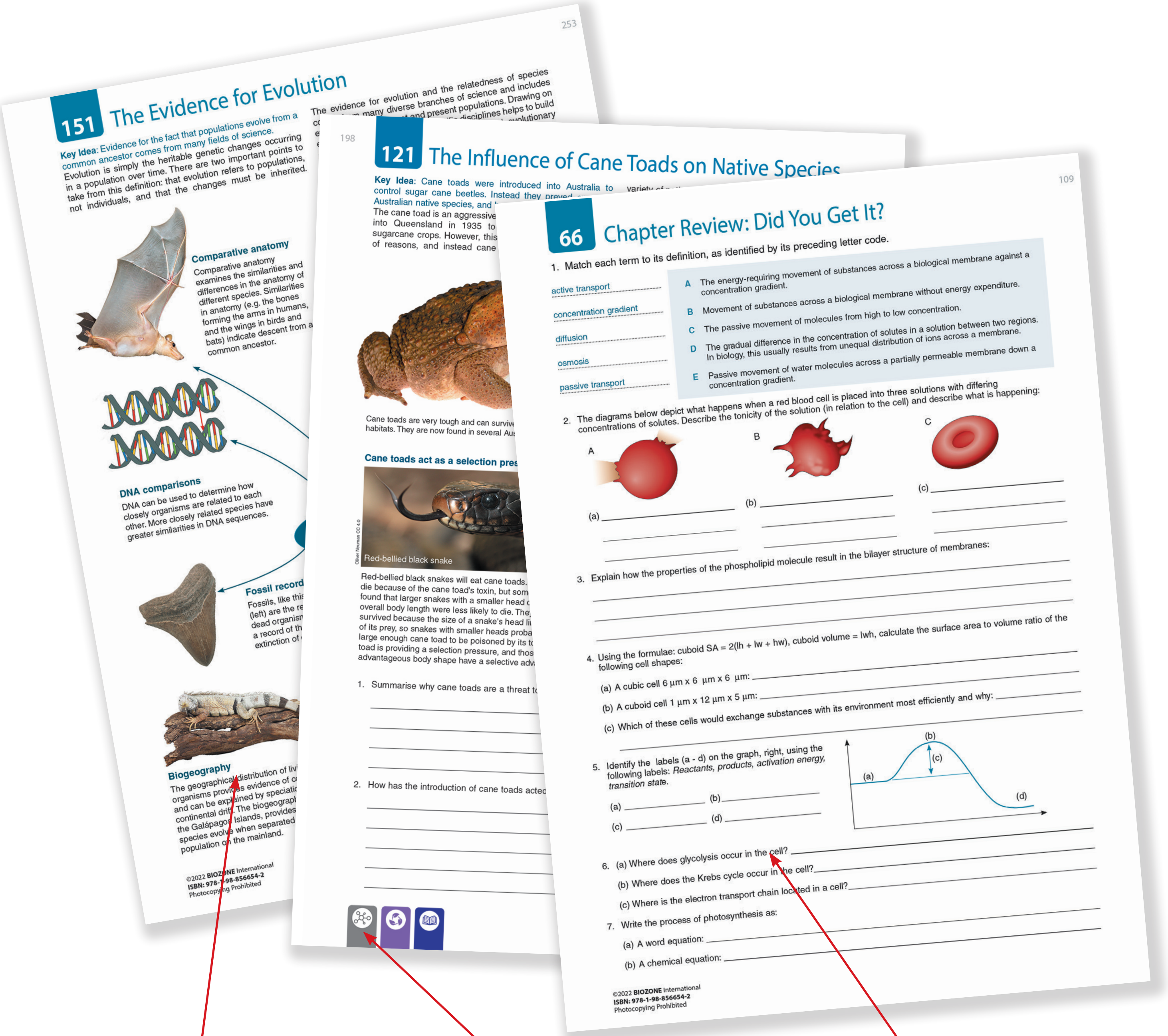
Module 3: Biological Diversity			
CHAPTER 7 Effects of the Environment on Organisms	CHAPTER 8 Adaptations	CHAPTER 9 Theory of Evolution by Natural Selection	CHAPTER 10 Evolution - The Evidence
FORMATIVE Activity 122. Chapter Review	FORMATIVE Activity 133. Chapter Review	FORMATIVE Activity 150. Chapter Review	FORMATIVE Activity 170. Chapter Review SUMMATIVE Activity 141. Synoptic Assessment



Module 4: Ecosystem Dynamics			
CHAPTER 11 Population Dynamics	CHAPTER 12 Past Ecosystems	CHAPTER 13 Future Ecosystems	CHAPTER 14 Depth Studies: Guidance and Ideas
FORMATIVE Activity 197. Chapter Review	FORMATIVE Activity 202. Chapter Review	FORMATIVE Activity 206. Chapter Review SUMMATIVE Activity 207. Synoptic Assessment	Assessed by teacher

Choosing Activities for Home Study

Many of the book's activities are ideal for homework or as vehicles for a quick formative assessment. End of chapter review activities are ideal as homework. They provide a way to review a topic that has recently been completed, while at the same time facilitating consolidation by presenting the material in a slightly different way. The information for review activities can be found within the chapter, although stronger students may not need to refer back to source material to complete the set work. Generally, homework activities should revise completed topics or provide a basic entry-level introduction.



The first few pages of an activity can be useful to set the scene for a chapter. In this activity, students are introduced to the many lines of evidence for evolution. As the progress through the chapter, they analyse specific examples.

Most students will have access to the internet. Sometimes a homework activity might involve the student reviewing the resources on **BIOZONE's Resource Hub** for the next day's activity.

Review activities are ideal as homework because they involve a self-test of the student's own understanding of completed work. In this activity, students apply their understanding of cell function to complete the activity. Such activities allow the teacher to address any misconceptions before formal assessment.