BIOZONE

EDEXCEL BIOLOGY 1

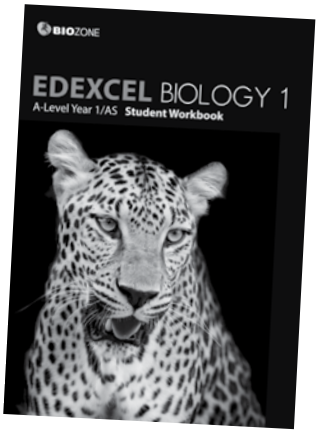
A-Level Year 1/AS

CLASSROOM GUIDE

Contents

Making the most of Edexcel BIOLOGY 1

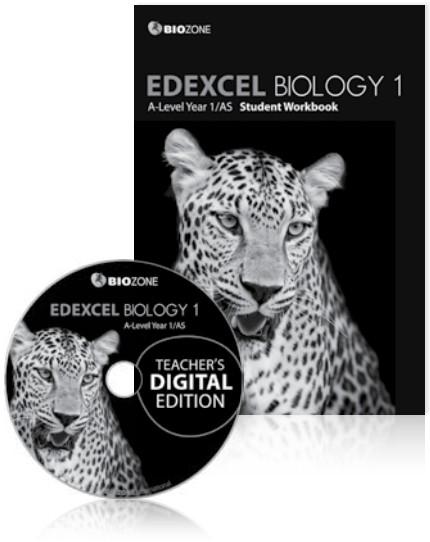
FAQs ABOUT OUR EDEXCEL BIOLOGY 1 STUDENT WORKBOOK



Creating Lifelong Learners

We want today's biology students to be self-motivated, lifelong learners, to develop a sound grasp or biological knowledge, to plan and evaluate their work, and to think critically and independently. In developing the Edexcel Biology series, we have utilised the 5Es instructional model as a basis for developing materials to specifically address the Edexcel Biology syllabus.

By successfully completing the activities, which make up the bulk of the student workbook, students can demonstrate competence in skills and knowledge across the entire scope of the programme. This is central to meeting the requirements of Edexcel AS and A Level Biology.



BIOZONE encourages the development of an engaged and enquiring learner using the 5 Es model

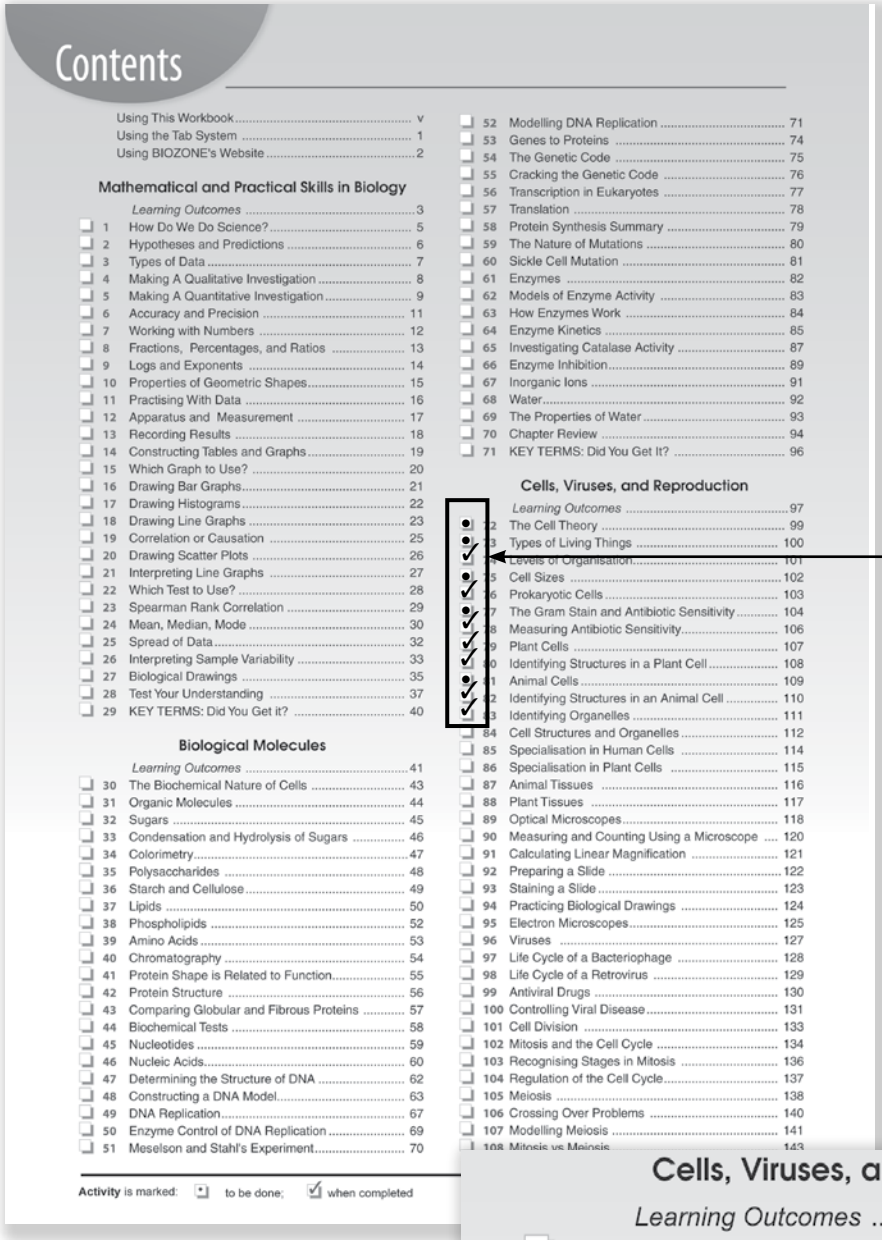
The Five Es

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.

ENGAGE: **Highly visual activities**	Use activities in class to engage a student when introducing a topic, or to consolidate student understanding and summarise the material covered by other methods. Using activities in class provides valuable opportunities for peer-to-peer learning.
ENGAGE: **A connected plan of study**	The check-box format of the contents and the chapter introductions provides a focus for planning achievement. Required learning outcomes are succinctly but comprehensively covered, so students can be confident about their progress through the course content.
EXPLORE: **Independent, self directed study**	Activities are self-contained so students are encouraged to be independent learners and seek the answers to questions posed by the activity. Capable students can work quickly and independently through the core material and can use the time for extension. Less able students can review or finish activities at home. Most activities are supported by web-based resources in the form of animations and video clips.
EXPLAIN: **Communicating is the key to consolidation**	All activities first engage the student with a key idea and a visually inviting delivery of content. Student engagement with this material leads them to the questions in which they must communicate their understanding of the content. Students are encouraged to use appropriate biological terms as referenced in the chapter introduction (key terms).
ELABORATE: **Building up**	Most introductory activities are supported by activities in which students apply their understanding of ideas to a new situation. These 'follow-on' activities often involve data analysis, and support scientific practices.
EVALUATE: **Easy assessment**	Encourage self assessment with chapter reviews (these can be marked if desired) or use specific activities to evaluate a student's skills and understanding or scientific ideas.
WHAT ABOUT HOMEWORK?	Assign activities as homework to review a completed topic, explore a related concept, or introduce a topic prior to in-class practical work or extension.

The Contents: A Plan of Action

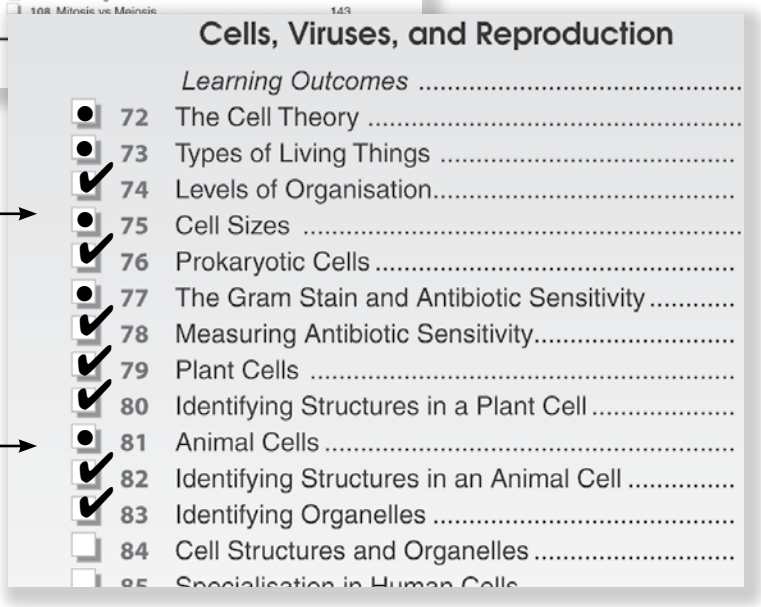
The contents pages are not merely a list of the activities in the workbook. Encourage your students to use them as a planning tool for their programme of work. Students can identify the activities they are to complete and then tick them off when completed. The teacher can also see at a glance how quickly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



Contents

Activity is marked: ☐ to be done; ☑ when completed

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



Cells, Viruses, and Reproduction

Learning Outcomes .....
72 The Cell Theory .....
73 Types of Living Things .....
74 Levels of Organisation .....
75 Cell Sizes .....
76 Prokaryotic Cells .....
77 The Gram Stain and Antibiotic Sensitivity .....
78 Measuring Antibiotic Sensitivity .....
79 Plant Cells .....
80 Identifying Structures in a Plant Cell .....
81 Animal Cells .....
82 Identifying Structures in an Animal Cell .....
83 Identifying Organelles .....
84 Cell Structures and Organelles .....

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

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

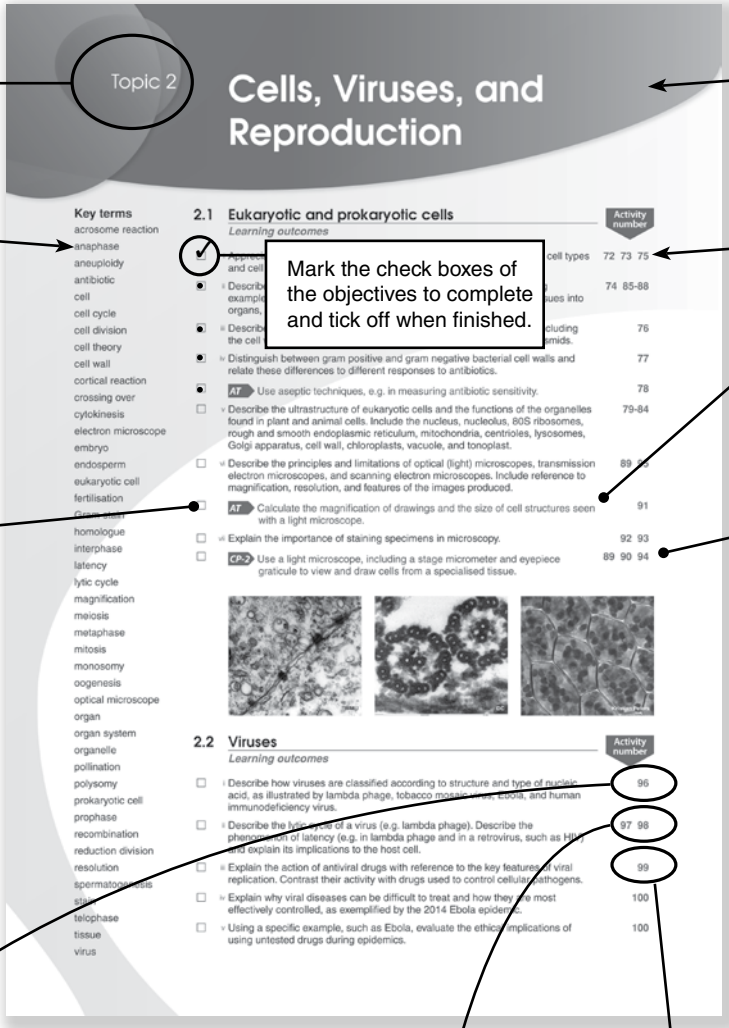
Introducing the Edexcel Biology Content

Each chapter is prefaced with a list of learning outcomes pertaining to the content in the chapter. These represent the skills, knowledge, and understanding requirements for the topic and are supported by a key terms list from which students can compile a glossary. The learning outcomes, generally covered over two pages, are drawn from the syllabus document and encourage students to approach each topic confidently. Familiarity with the scientific terms used in each topic is implicit in this.

This identifies the Edexcel Biology topic to which this chapter applies.

The list of **key terms** can be used to create a glossary for revision and encourages appropriate use of the correct terms when answering questions.

For students:
The learning outcomes are purposefully brief, with enough information to provide a framework, but not so much that students are overwhelmed.



Chapter introductions may cover two pages.

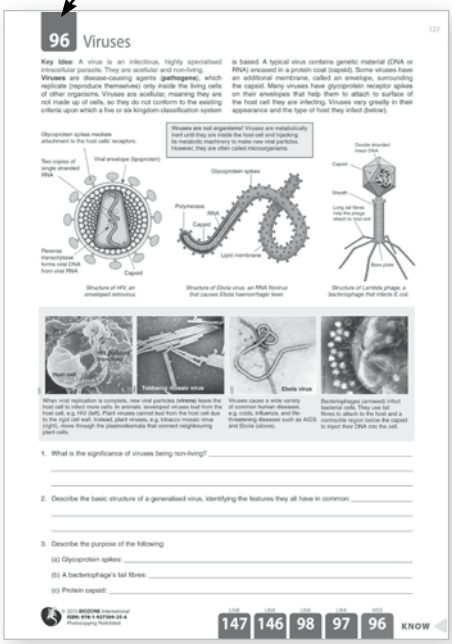
The activities pertaining to the corresponding learning outcomes.

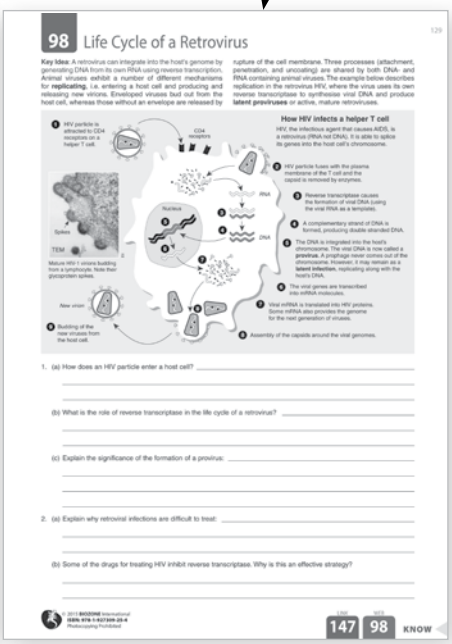
Mathematical skills are addressed in many activities: These are fully outlined in the first chapter and their corresponding activities identified (see page 6).

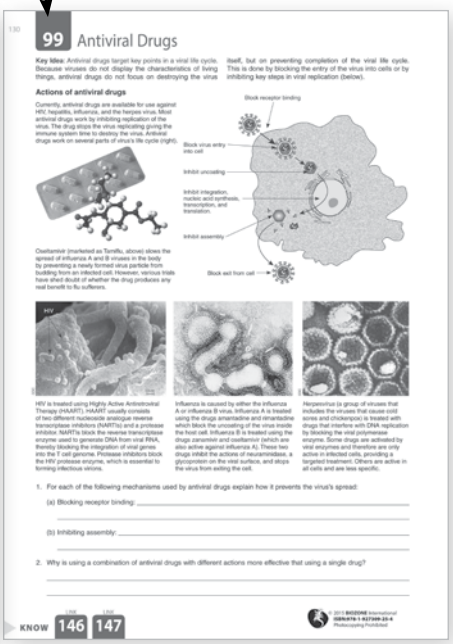
Required core practicals: Activities supporting the required core practicals (1-8 for AS) are clearly identified by the code CP-# (see page 8).

Introduce the understanding with grounding activities

Follow with an activity that builds on that understanding

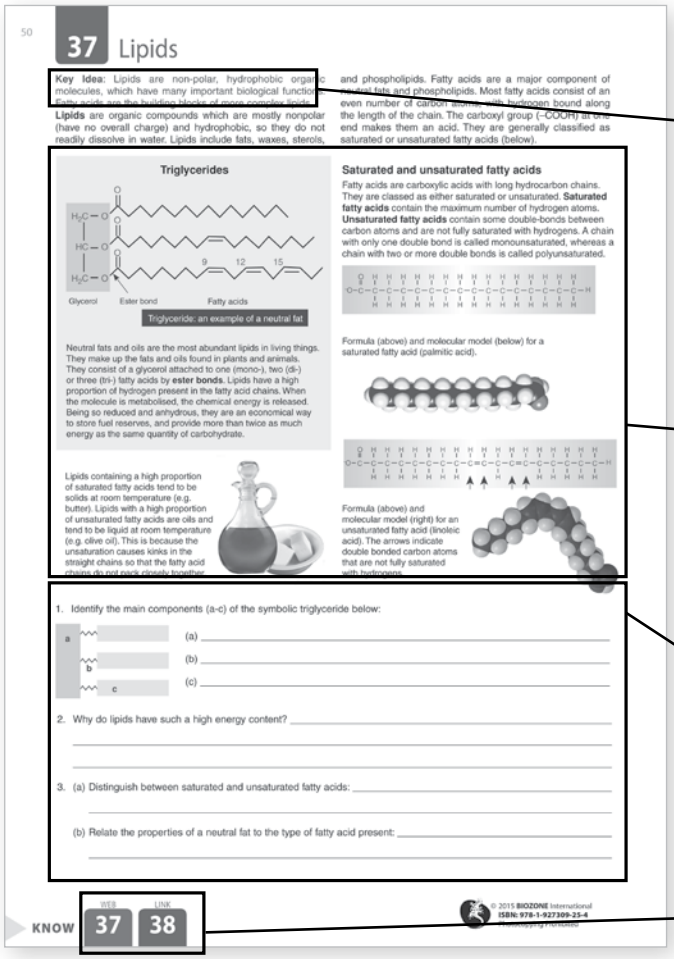


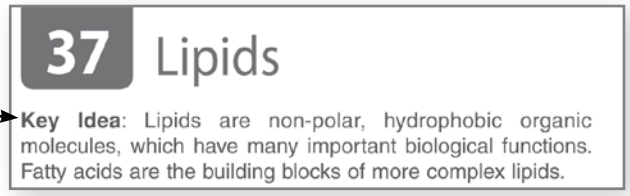




The Activity Page Format

The content of the Edexcel Biology 1 Student Workbook is organised into 5 chapters. Each chapter begins with an introduction and concludes with a student's self-test of understanding and vocabulary. Inviting, concept-based activities make up the bulk of each chapter, with each activity focussing on understanding a fundamental concept or developing a mathematical or practical skill. An important feature of each activity is the **key idea**, which encapsulates the main focus of the content provided. Clear annotated diagrams and photographs are a major part of almost all activities and the student's understanding of the information is tested through a series of questions and/or data handling and interpretation tasks. The tabs for each activity identify the nature of the activity, and identify related material and external weblinks, which provide support for the activity.



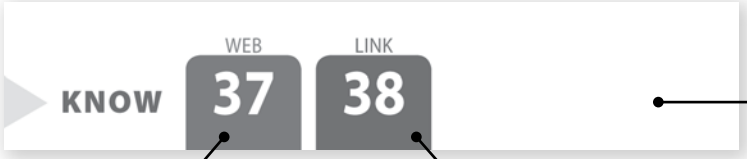


The **key idea** provides a focus for each activity. It summarises the focus of the activity and provides a clear take-home message for the student.

Annotated diagrams, sometimes including photo panels, explain the content of the page, providing the information necessary to complete the activity.

Understanding of content is tested through questions,data handling, analysis, prediction, or summary. Students are often required to apply their understanding to a new scenario or make connections to related content. Students must interact with the information on the page in order to complete the activity. It is this interaction that provides the valuable learning experience and reinforcement and explanation of the key idea.

Related content is identified through the tab system. This activity also has a weblink assigned to it (see below).



Weblinks

Bookmark the weblinks page:
www.biozone.co.uk/Edx-1-9254

Access the external URL for the activity by clicking the link.
See page 14 for more details.

Links

This tab indicates activities that provide content which is related to or builds on the content on the page.

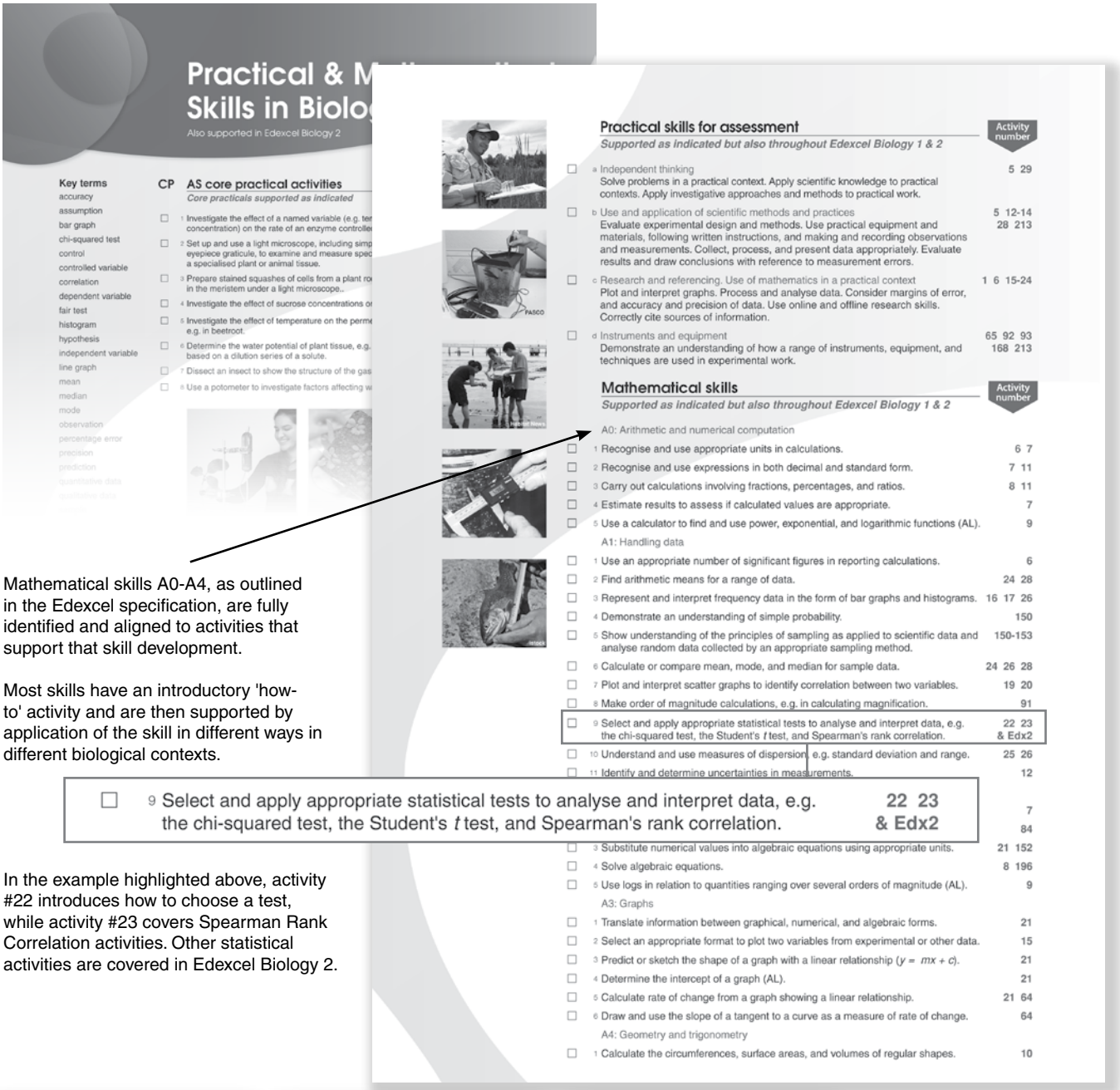
THE TASK CODE

This indicates the main focus of the activity:

- ***COMP*** = comprehension of text
- ***DATA*** = data handling and interpretation
- ***KNOW*** = content you need to know
- ***PRAC*** = a paper practical or a practical focus
- ***REFER*** = reference - use this for information
- ***REVISE*** = review the material in the section
- ***TEST*** = test your understanding
- ***VOCAB*** = learning your biological vocabulary

Addressing Mathematical Requirements

The mathematical requirements of Edexcel AS and A Level Biology are met through activities in an introductory chapter and throughout the workbook, applied in the context of the relevant biology. Students are provided with numerous ways in which to develop competence in computation, algebra, graphing, and data handling and analysis. Having an introduction to basic skills provides a reference for students needing to refresh their memory with respect to any particular skill. The following examples provide just a sample of those written to address each of the skills identified.



Practical & M
Skills in Biolo
Also supported in Edexcel Biology 2

Key terms
accuracy
assumption
bar graph
chi-squared test
control
controlled variable
correlation
dependent variable
fair test
histogram
hypothesis
independent variable
line graph
mean
median
mode
observation
percentage error
precision
prediction
quantitative data
qualitative data

CP AS core practical activities
Core practicals supported as indicated

1 Investigate the effect of a named variable (e.g. ter
concentration) on the rate of an enzyme controlle
2 Set up and use a light microscope, including simp
eyepiece graticule, to examine and measure spec
a specialised plant or animal tissue.
3 Prepare stained squashes of cells from a plant ro
in the meristem under a light microscope..
4 Investigate the effect of sucrose concentrations o
5 Investigate the effect of temperature on the perme
e.g. in beetroot.
6 Determine the water potential of plant tissue, e.g.
based on a dilution series of a solute.
7 Dissect an insect to show the structure of the gas
8 Use a potometer to investigate factors affecting w

Practical skills for assessment — *Supported as indicated but also throughout Edexcel Biology 1 & 2* — Activity number

a Independent thinking — 5 29
Solve problems in a practical context. Apply scientific knowledge to practical contexts. Apply investigative approaches and methods to practical work.

b Use and application of scientific methods and practices — 5 12-14 28 213
Evaluate experimental design and methods. Use practical equipment and materials, following written instructions, and making and recording observations and measurements. Collect, process, and present data appropriately. Evaluate results and draw conclusions with reference to measurement errors.

c Research and referencing. Use of mathematics in a practical context — 1 6 15-24
Plot and interpret graphs. Process and analyse data. Consider margins of error, and accuracy and precision of data. Use online and offline research skills. Correctly cite sources of information.

d Instruments and equipment — 65 92 93 168 213
Demonstrate an understanding of how a range of instruments, equipment, and techniques are used in experimental work.

Mathematical skills — *Supported as indicated but also throughout Edexcel Biology 1 & 2* — Activity number

A0: Arithmetic and numerical computation

1 Recognise and use appropriate units in calculations. — 6 7
2 Recognise and use expressions in both decimal and standard form. — 7 11
3 Carry out calculations involving fractions, percentages, and ratios. — 8 11
4 Estimate results to assess if calculated values are appropriate. — 7
5 Use a calculator to find and use power, exponential, and logarithmic functions (AL). — 9

A1: Handling data

1 Use an appropriate number of significant figures in reporting calculations. — 6
2 Find arithmetic means for a range of data. — 24 28
3 Represent and interpret frequency data in the form of bar graphs and histograms. — 16 17 26
4 Demonstrate an understanding of simple probability. — 150
5 Show understanding of the principles of sampling as applied to scientific data and analyse random data collected by an appropriate sampling method. — 150-153
6 Calculate or compare mean, mode, and median for sample data. — 24 26 28
7 Plot and interpret scatter graphs to identify correlation between two variables. — 19 20
8 Make order of magnitude calculations, e.g. in calculating magnification. — 91
9 Select and apply appropriate statistical tests to analyse and interpret data, e.g. the chi-squared test, the Student's *t* test, and Spearman's rank correlation. — 22 23 & Edx2
10 Understand and use measures of dispersion, e.g. standard deviation and range. — 25 26
11 Identify and determine uncertainties in measurements. — 12

A2: Algebra

1 Change the subject of an equation. — 7
2 Use the symbols $=$, $<$, $>$, $\propto$, $\sim$. — 84
3 Substitute numerical values into algebraic equations using appropriate units. — 21 152
4 Solve algebraic equations. — 8 196
5 Use logs in relation to quantities ranging over several orders of magnitude (AL). — 9

A3: Graphs

1 Translate information between graphical, numerical, and algebraic forms. — 21
2 Select an appropriate format to plot two variables from experimental or other data. — 15
3 Predict or sketch the shape of a graph with a linear relationship ($y = mx + c$). — 21
4 Determine the intercept of a graph (AL). — 21
5 Calculate rate of change from a graph showing a linear relationship. — 21 64
6 Draw and use the slope of a tangent to a curve as a measure of rate of change. — 64

A4: Geometry and trigonometry

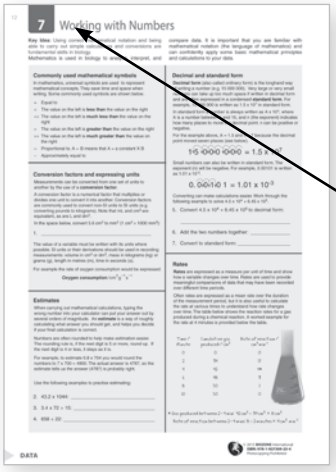
1 Calculate the circumferences, surface areas, and volumes of regular shapes. — 10

Mathematical skills A0-A4, as outlined in the Edexcel specification, are fully identified and aligned to activities that support that skill development.

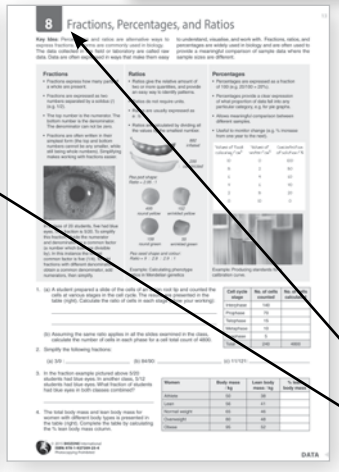
Most skills have an introductory 'how-to' activity and are then supported by application of the skill in different ways in different biological contexts.

☐ 9 Select and apply appropriate statistical tests to analyse and interpret data, e.g. the chi-squared test, the Student's *t* test, and Spearman's rank correlation. — 22 23 & Edx2

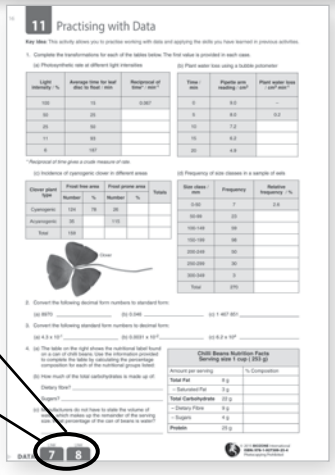
In the example highlighted above, activity #22 introduces how to choose a test, while activity #23 covers Spearman Rank Correlation activities. Other statistical activities are covered in Edexcel Biology 2.



7 Working with Numbers



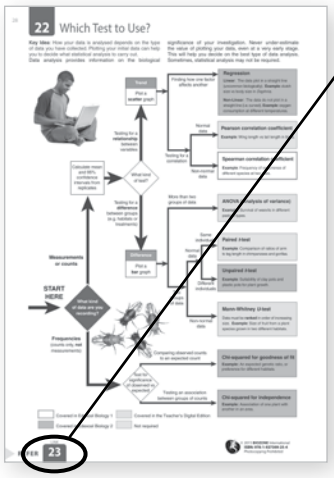
8 Fractions, Percentages, and Ratios



11 Practising with Data

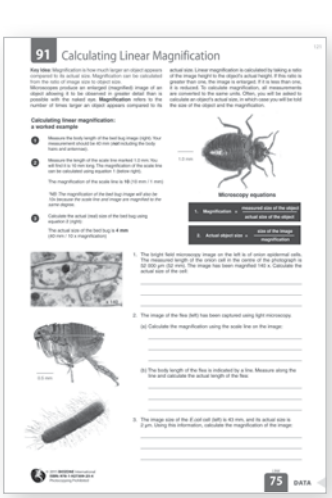
A0: Arithmetic and numerical computation

Working with Numbers covers many of the basic skills in A0.1-A0.4, and students then apply their understanding and application of these skills in subsequent activities, e.g. *Fractions, Percentages, and Ratios*, and *Practising with Data*. They can check back on procedure if they need help.



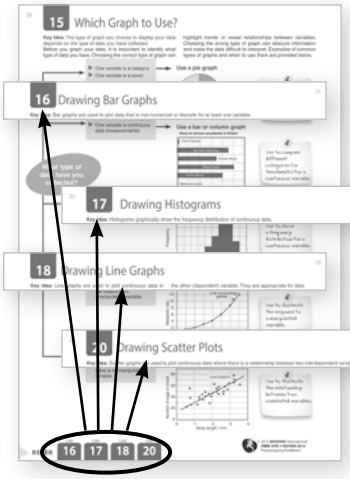
A1: Handling data

What Test to Use? provides students with a tool for selecting a test based on the data (A1.9). *Quantitative Investigation of Variation* is one example of a statistical test applied in an appropriate context. *Apparatus and Measurement* looks at simple techniques for evaluating uncertainties in measurement (A1.11).



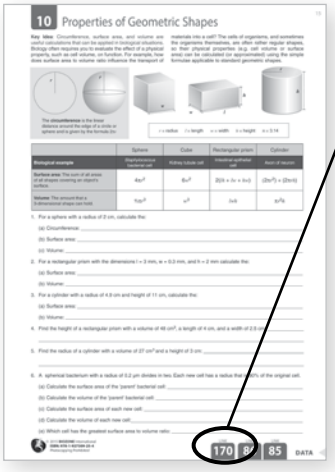
A2: Algebra

Calculating Linear Magnification develops skills in using and manipulating an equation (A2.2). *Assessing Species Diversity* introduces students to Simpson's index of Diversity and is followed by *Investigating Biodiversity* in which students apply their skills to calculate diversity indices for real populations (A2.3).



A3: Graphs

Which Graph to Use? provides students with a tool to select a graph based on the data (A3.2). It is followed by activities in which students apply their skills to plotting second hand data. *Interpreting Line Graphs* covers A3.3 (linear relationships) and A3.4 (determining intercepts). These skills are applied in activities associated with enzyme kinetics (A3.3 and A3.6).

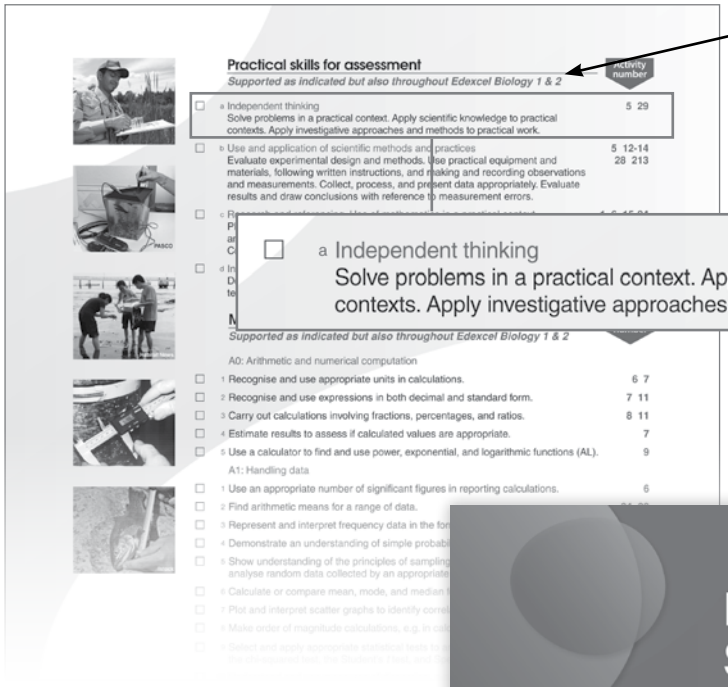


A4: Geometry and trigonometry

Properties of Geometric Shapes introduces students to the calculation of circumference, surface area, and volumes of regular shapes (MS4.1). They then apply this understanding to the calculation of surface area and volume ratios in cells (exemplification).

Addressing the Required Core Practicals

Activities addressing the practical activity requirements of Edexcel AS and A Level Biology are divided between Edexcel Biology 1 and Edexcel Biology 2. Required core practicals 1-8 are supported in Edexcel Biology 1. The basic techniques and skills required for the required practical work are addressed in the introductory chapter (*Practical and Mathematical Skills in Biology*) and in context throughout the workbook. Activities to directly support each of practicals 1-8 are identified (CP-#) in the relevant chapters.



Practical skills for assessment

Supported as indicated but also throughout Edexcel Biology 1 & 2

Activity number

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Evaluate experimental design and methods. Use practical equipment and materials, following written instructions, and making and recording observations and measurements. Collect, process, and present data appropriately. Evaluate results and draw conclusions with reference to measurement errors.

Supported as indicated but also throughout Edexcel Biology 1 & 2

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3 Carry out calculations involving fractions, percentages, and ratios. 8 11
4 Estimate results to assess if calculated values are appropriate. 7
5 Use a calculator to find and use power, exponential, and logarithmic functions (AL). 9

A1: Handling data

1 Use an appropriate number of significant figures in reporting calculations. 6
2 Find arithmetic means for a range of data.

Practical skills to be assessed are clearly outlined in the introduction to the first chapter. Each is aligned to activities that support that skill development.

In the example highlighted above, activity #5 introduces the protocols for quantitative investigations, while activity #29 allows the student to apply their skills and understanding to the analysis of an investigation involving second hand data.

Practical & Mathematical Skills in Biology

Also supported in Edexcel Biology 2

Key terms
accuracy
assumption
bar graph
chi-squared test
control
controlled variable
correlation
dependent variable
fair test
histogram
hypothesis
independent variable
line graph
mean
median
mode
observation
percentage error
precision
prediction
quantitative data
qualitative data
sample
scatter graph
standard deviation
statistical test
Student's *t* test
variable

CP AS core practical activities

Core practicals supported as indicated

Activity number

1 Investigate the effect of a named variable (e.g. temperature or substrate concentration) on the rate of an enzyme controlled reaction. 63
2 Set up and use a light microscope, including simple stage micrometer and eyepiece graticule, to examine and measure specimen material. Draw cells from a specialised plant or animal tissue. 89 90 94
3 Prepare stained squashes of cells from a plant root tip to show stages of mitosis in the meristem under a light microscope.. 93 101
4 Investigate the effect of sucrose concentrations on the growth of pollen tubes. 119
5 Investigate the effect of temperature on the permeability of plasma membranes, e.g. in beetroot. 164
6 Determine the water potential of plant tissue, e.g. by using a calibration curve based on a dilution series of a solute. 168 169
7 Dissect an insect to show the structure of the gas exchange system. 182
8 Use a potometer to investigate factors affecting water uptake (and loss) by shoots. 213

AT Use of apparatus and techniques

Supported as indicated but also throughout Edexcel Biology 1 & 2

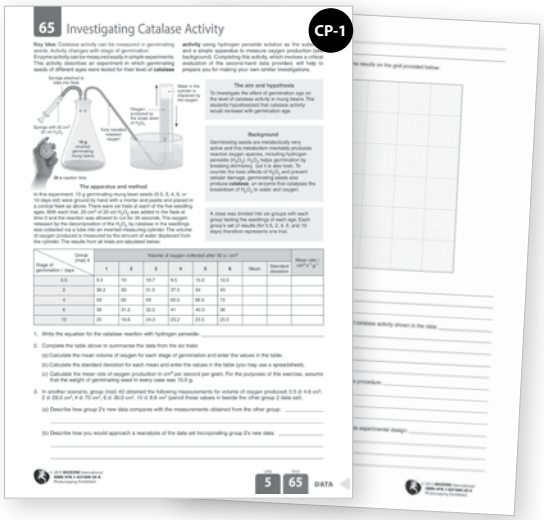
Activity number

1 Use appropriate apparatus to record a range of quantitative data, including mass, time, volume, temperature, length, and pH. 12 90
2 Use appropriate instrumentation, such as a colorimeter or potometer, to record quantitative data. 34 213
3 Use laboratory glassware for a range of techniques, including serial dilution. 12 168
4 Use a light microscope (including graticule) at high and low power. 89 90
5 Make annotated scientific drawings from observations. 27 94
6 Use qualitative reagents to identify biological molecules. 4 44
7 Separate biological compounds, e.g. mixtures of monosaccharides, amino acids, or pigments, using thin layer or paper chromatography or gel electrophoresis. 40 126
8 Record physiological functions and plant or animal responses safely and ethically. 180 197
9 Use aseptic techniques in microbiological investigations. 78 Edx 2
10 Use dissection equipment safely. 182 194
11 Use sampling techniques e.g. quadrats, transects, in fieldwork. 151 Edx2
12 Use ICT, e.g in computer modelling or to collect or process data. 13 23

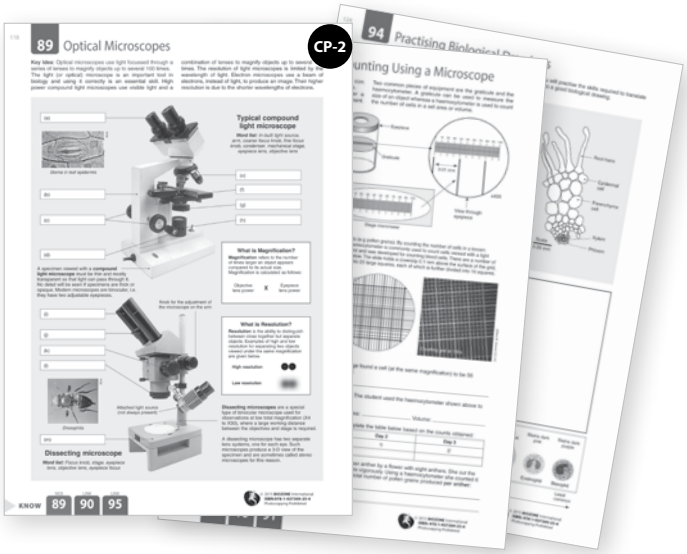
The required **core practical activities** for Edexcel AS Biology are identified in the introduction to the first chapter. In some cases, the required practical is supported by several activities.

Many required core practicals will rely on an understanding of basic skills and techniques that have been covered elsewhere in the workbook.

Skills in the use of apparatus and techniques are fully addressed, often in an appropriate biological context and supporting the required core practicals.

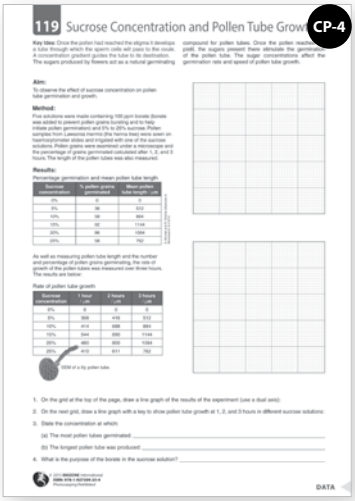


Core practical 1: Investigate a factor (stage of germination) affecting the rate of an enzyme controlled reaction (decomposition of H_2O_2 by catalase).

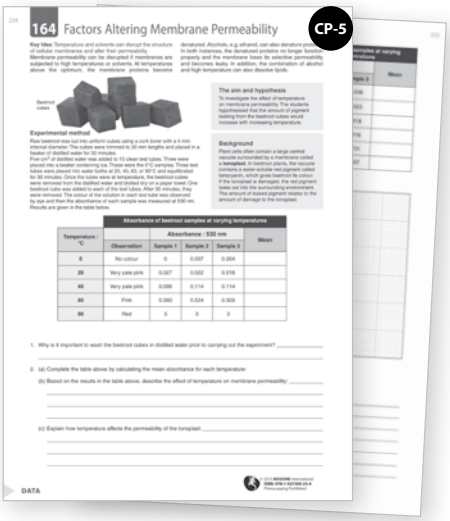


Practical 2: Use a light microscope, including using simple stage and eyepiece micrometers and drawing a small number of cells from a specialised tissue (blood).

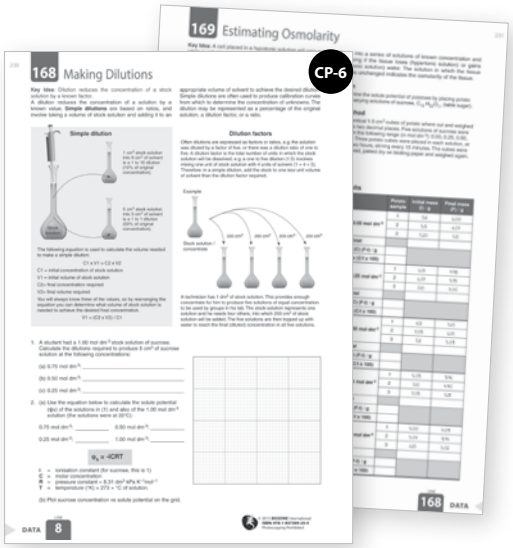
Core practical 3: Make a temporary squash preparation of a root tip to show stages of mitosis (under light microscope (see also activity #89).



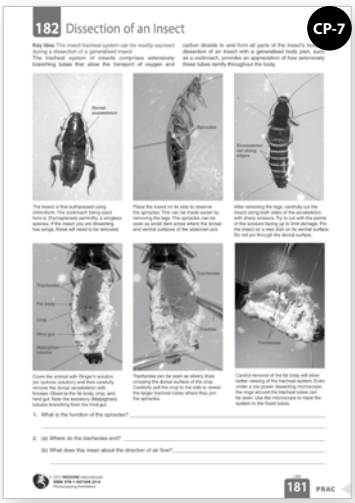
Core practical 4: Investigate the effect of sucrose concentrations on pollen tube growth.



Core practical 5: Investigate the effect of temperature on beetroot membrane permeability (extension provided: effect of solvent).



Core practical 6: Determine the water potential of a plant tissue (potato). Includes serial dilution to produce a calibration curve (practical techniques #3).

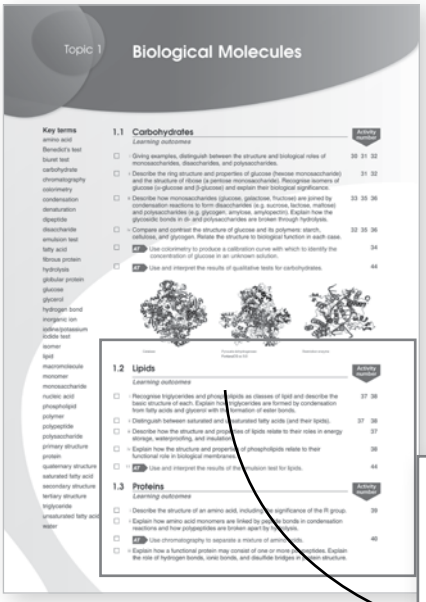


Core practical 7: Dissect an insect (cockroach) to show the structure of the gas exchange system.

Core practical 8: Investigate factors (temperature, light, humidity) affecting water uptake by plant shoots using a potometer.

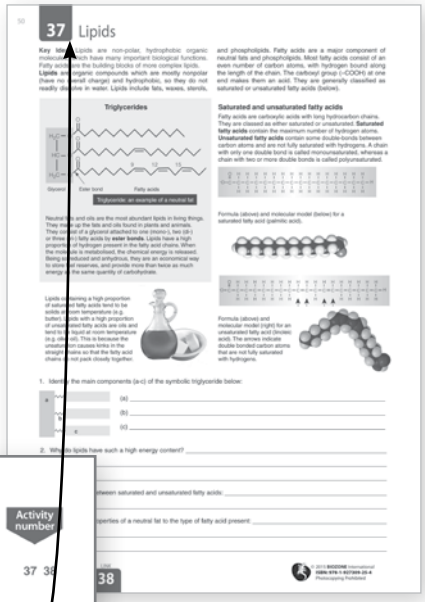
Engage, Explore, Explain, Elaborate, and Evaluate

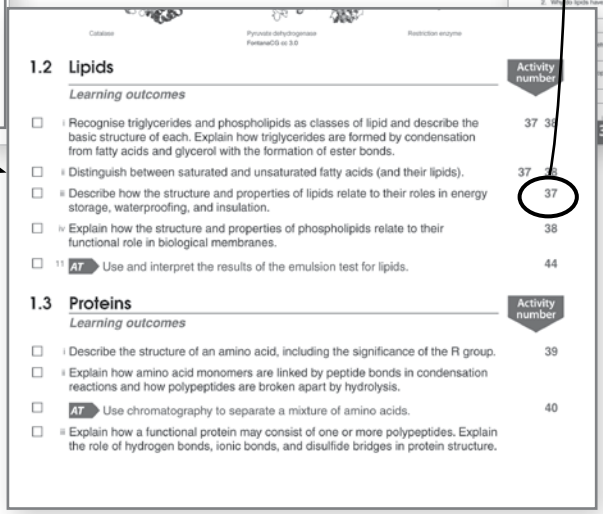
In developing Edexcel BIOLOGY 1, we have focussed on the learning outcomes and skills identified in the Edexcel Biology specification. The activities in Edexcel BIOLOGY 1 have been specifically written to address this content**.** Our focus is student engagement though the use of a concept-based, highly visual design and opportunity to demonstrate skills and understanding.

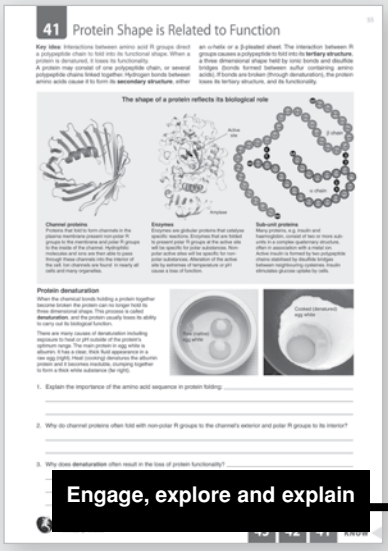


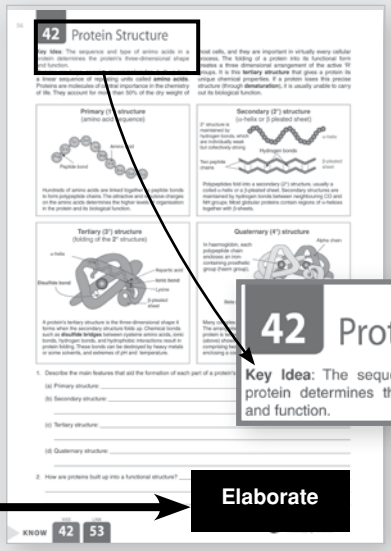
The introduction to each chapter provides a summary of the learning outcomes and, where appropriate, core practicals, presented as a series of short student learning aims. The students achieve understanding of each statement by completing its corresponding activity.

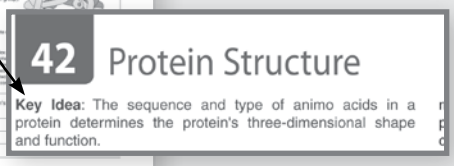
Activities are written and presented so that students progressively extend and deepen their understanding, using what they have learned in earlier activities to complete later related activities and to solve new problems.











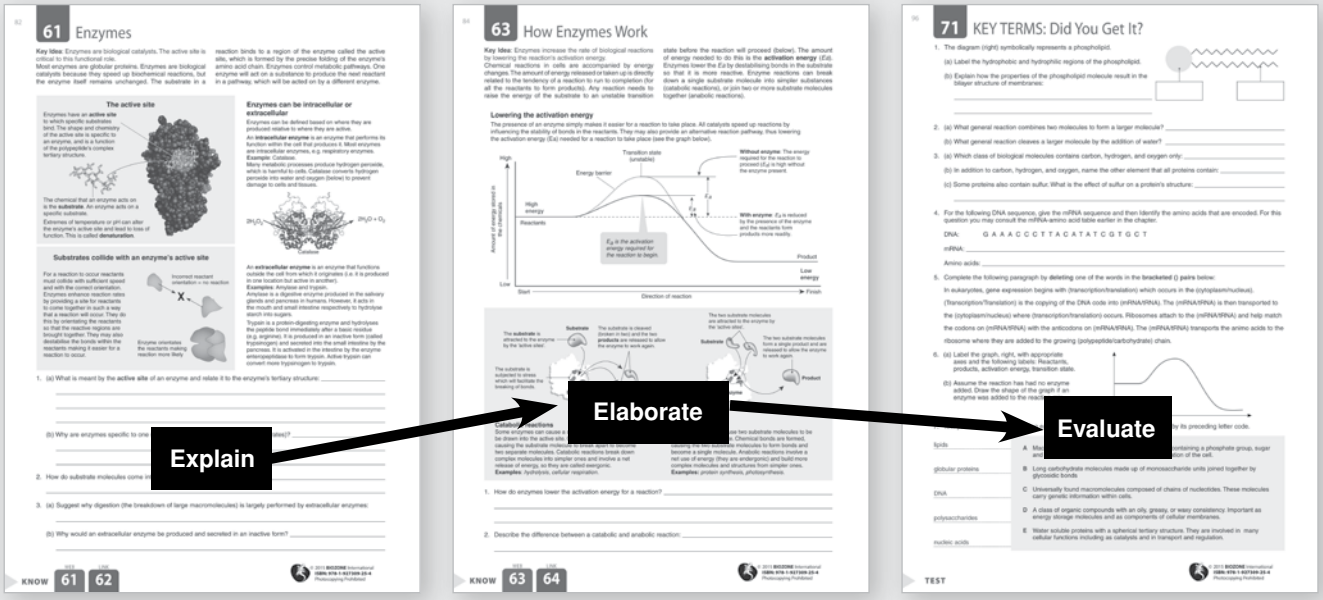
Engage, explore and explain

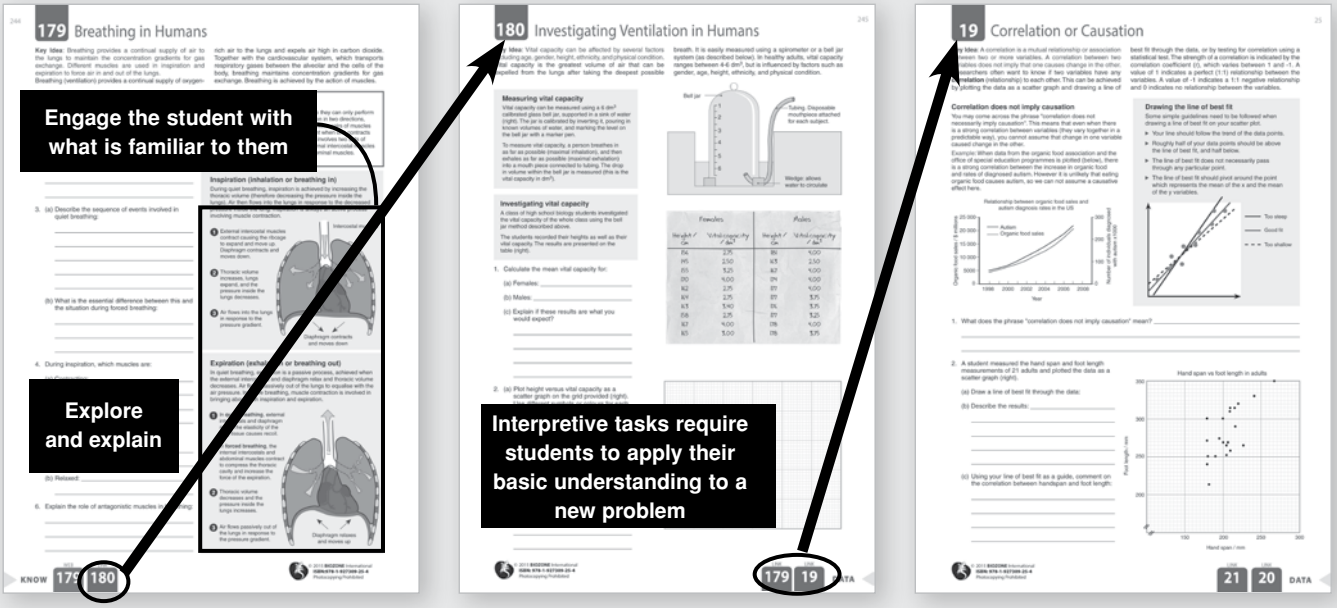
Elaborate

The KEY IDEA provides a focus for each activity. The key ideas through a chapter provide a concise summary of the chapter content.

Students become actively involved in the learning activity by interacting with the material, answering the question and completing the set tasks. Many activities are suitable as assessment tasks.

Engage, explain, elaborate, and evaluate: Activities are nested. An introductory activity introduces and builds understanding of a specific core idea, and a subsequent activity involves applying that understanding to a new situation, e.g. analysing data, finding a solution, or interpreting new information.





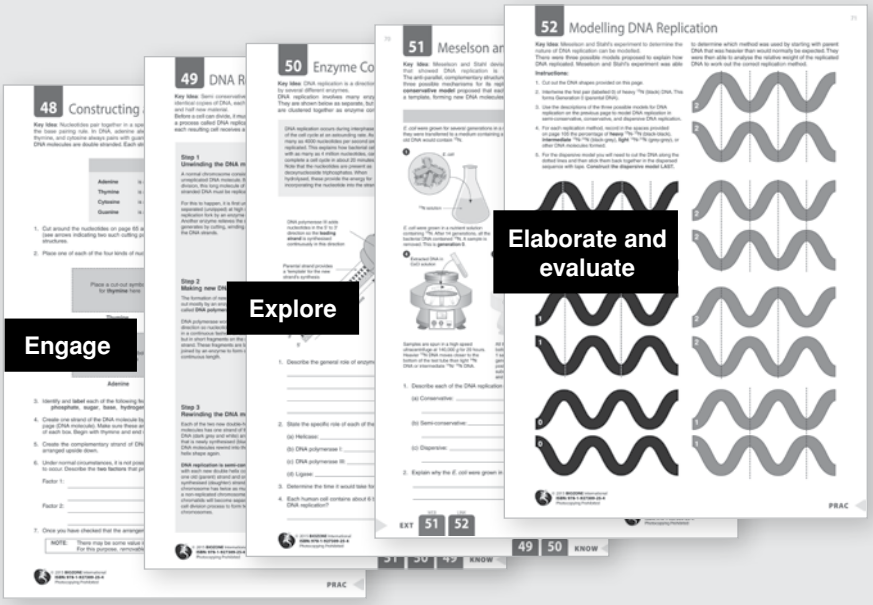
This activity begins by engaging the student with something familiar (breathing) and, through explanation, students deepen their understanding of the basic process.

Students then make an investigation of lung ventilation using a simple spirometer, developing a deeper understanding of breathing and lung volumes.

A link to *Correlation or Causation* provides students with help to plot or interpret the results of their investigation.

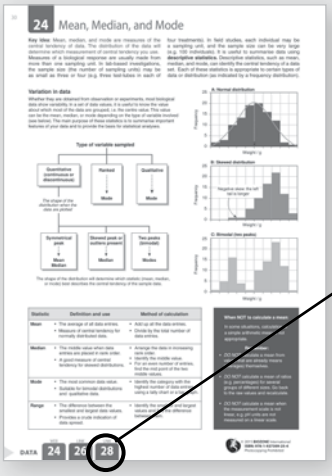
Groups of activities build knowledge and understanding by giving students the chance to learn and apply their knowledge in a series of linked activities.

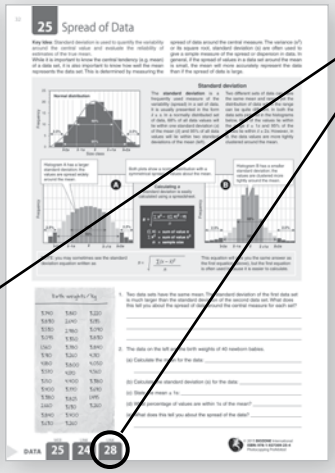
Engage: make a model
Explore: relate structure to function
Elaborate: examine supporting evidence
Evaluate: build a model as proof

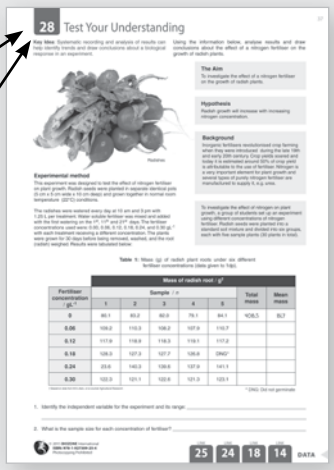


LINKS - Making Connections

The Link tabs help students to connect ideas between different topics in the Edexcel Biology programme. Connections may be made to activities that build on or develop an idea, utilise the same core principles in another biological context, or examine the evidence for a biological process such as DNA replication or ATP synthesis. The connections help students to appreciate that the same core principles underlie many biological phenomena and there is evidence to support them. Understanding these core principles brings understanding to a wide range of contexts and situations, even if they are unfamiliar.



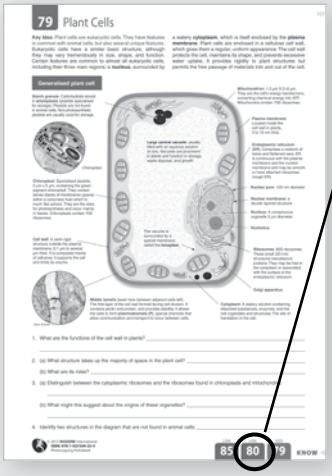


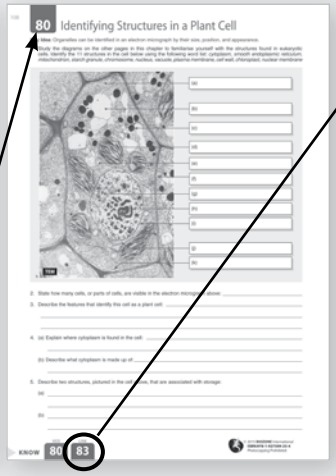


EXAMPLE 1

Descriptive statistics

Calculate measures of central tendency and variability in data. Then apply these principles to real, second-hand data. Students can then progress to applying these skills to the analysis of primary data collected through their own practical work.

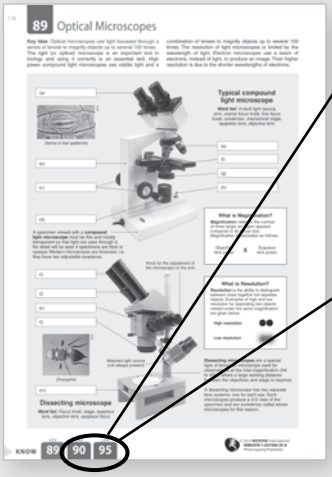


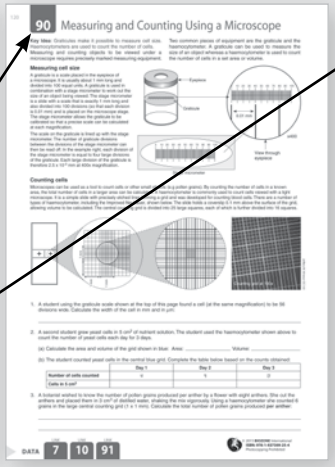


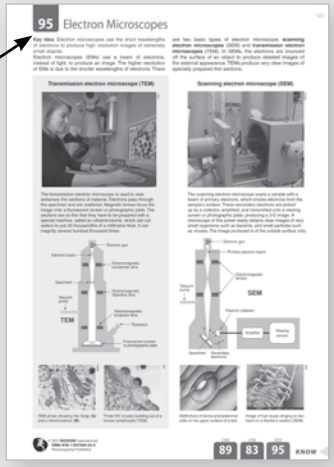
EXAMPLE 2

The plant cell and organelles

Apply the understanding of plant cell structure to label organelles in an electron micrograph.



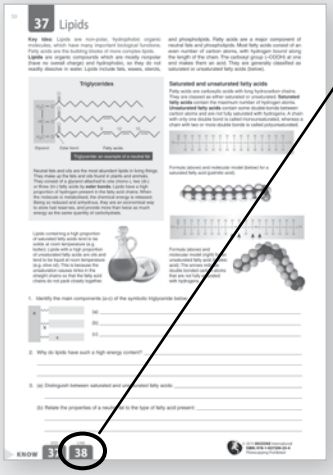




EXAMPLE 3

Microscopy

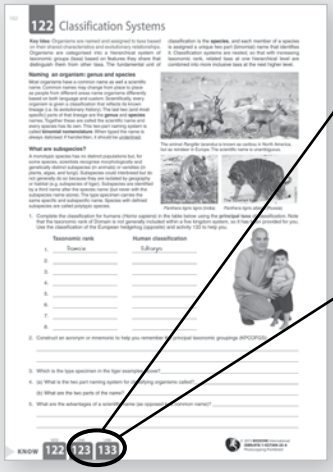
Learn the basics of light microscope function and use this understanding to correctly use an eyepiece micrometer and graticule. Compare light microscopes to electron microscopes.



EXAMPLE 4

Lipids

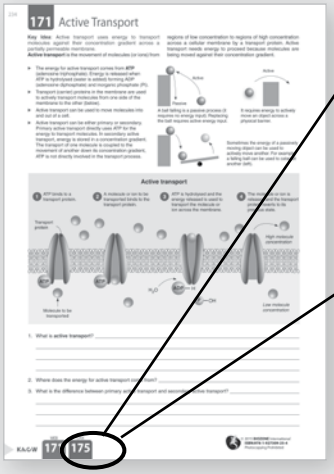
Make connections between the structure of lipids and their modification for use in the plasma membrane.



EXAMPLE 5

Classification

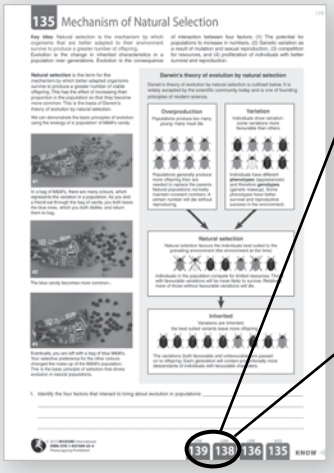
Understand how (and why) living organisms are grouped together and how this helps us understand their evolutionary relationships.



EXAMPLE 6

Active transport

Explain how ATP is produced and used in transporting substances across cellular membranes.

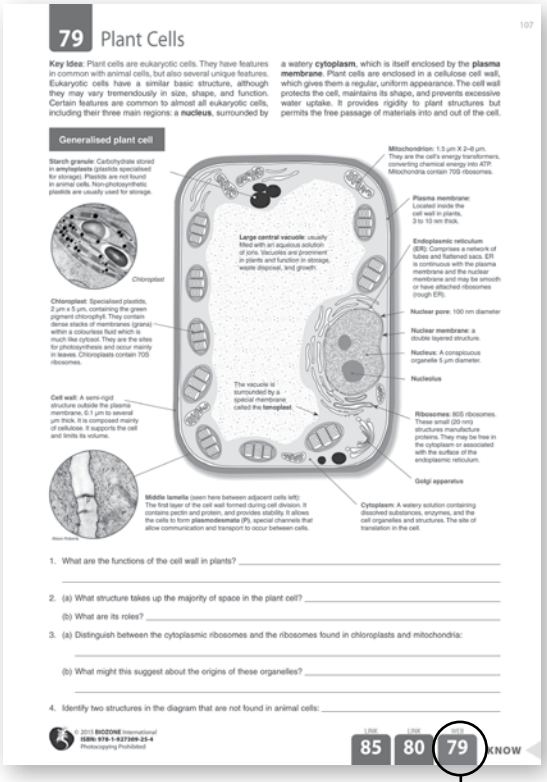


EXAMPLE 7

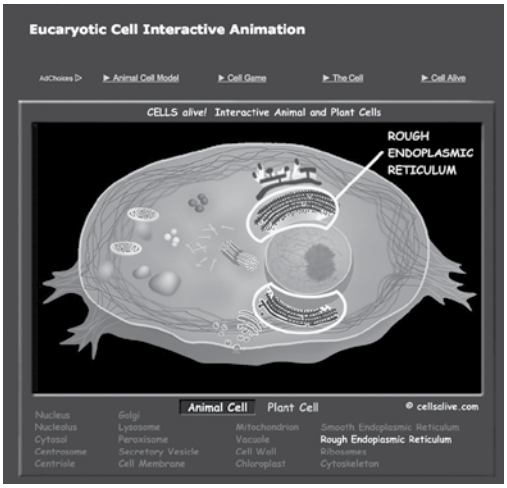
Natural selection

Learn the mechanisms by which natural selection operates, then use real data to see its effect on real populations.

Making Use of Weblinks



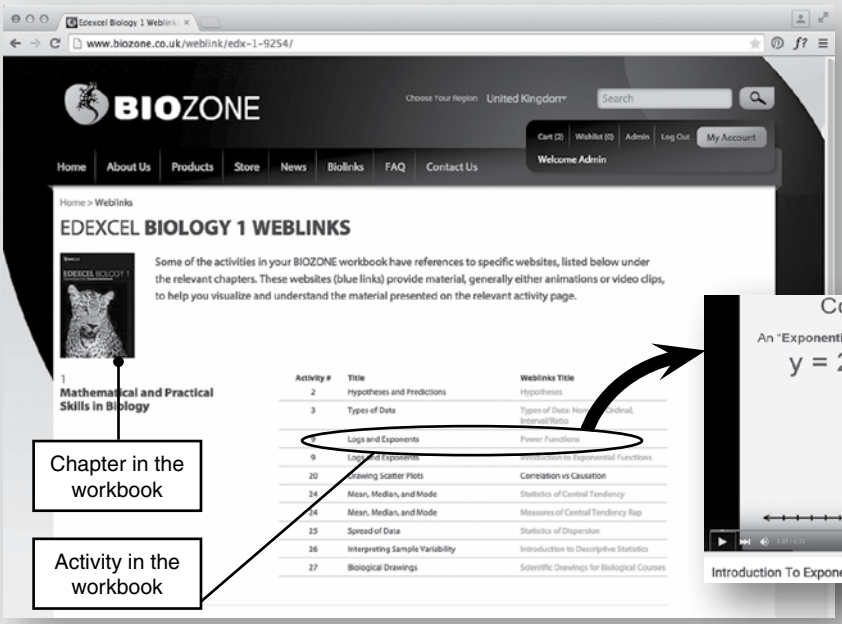
The tab system at the base of each activity identifies if there is a weblink available to support the activity's content. The weblinks are distinct from the general Biolinks site on BIOZONE's website. They are coded with the activity number and are only accessible through a specific url (below), so bookmark the address at the beginning of your teaching year and always have them on hand. The weblinks comprise short video clips or animations aimed specifically at the activity content. These are external sites from a wide range of reputable sources and are invaluable as support to explain content or view an animation of a complex process such as DNA packing or translation. It's easy and we've done the hard work for you. Just click and view.



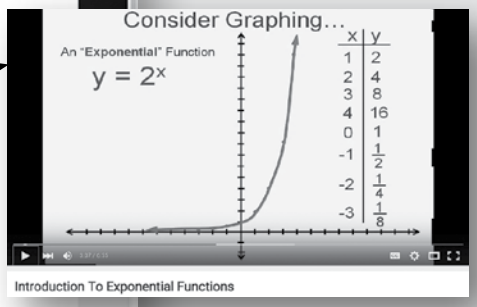
Weblinks exist for most of the activities in the workbook, from cells to evolution.

www.biozone.co.uk/weblink/EdxI-1-9254

This WEBLINKS page provides links to **external web sites** with supporting information for the activities. Almost exclusively, they are narrowly focussed animations and video clips relevant to the activity on which they are cited. They offer great support to aid student understanding of basic concepts, especially for visual learners.



Weblink Animation



Bookmark weblinks by typing in the address: it is not accessible directly from BIOZONE's website

Corrections and clarifications to current editions are always posted on the weblinks page

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 workbooks and supporting products can make teaching a mixed ability class easier. Here, we offer three approaches for differential instruction.

MAKING A START

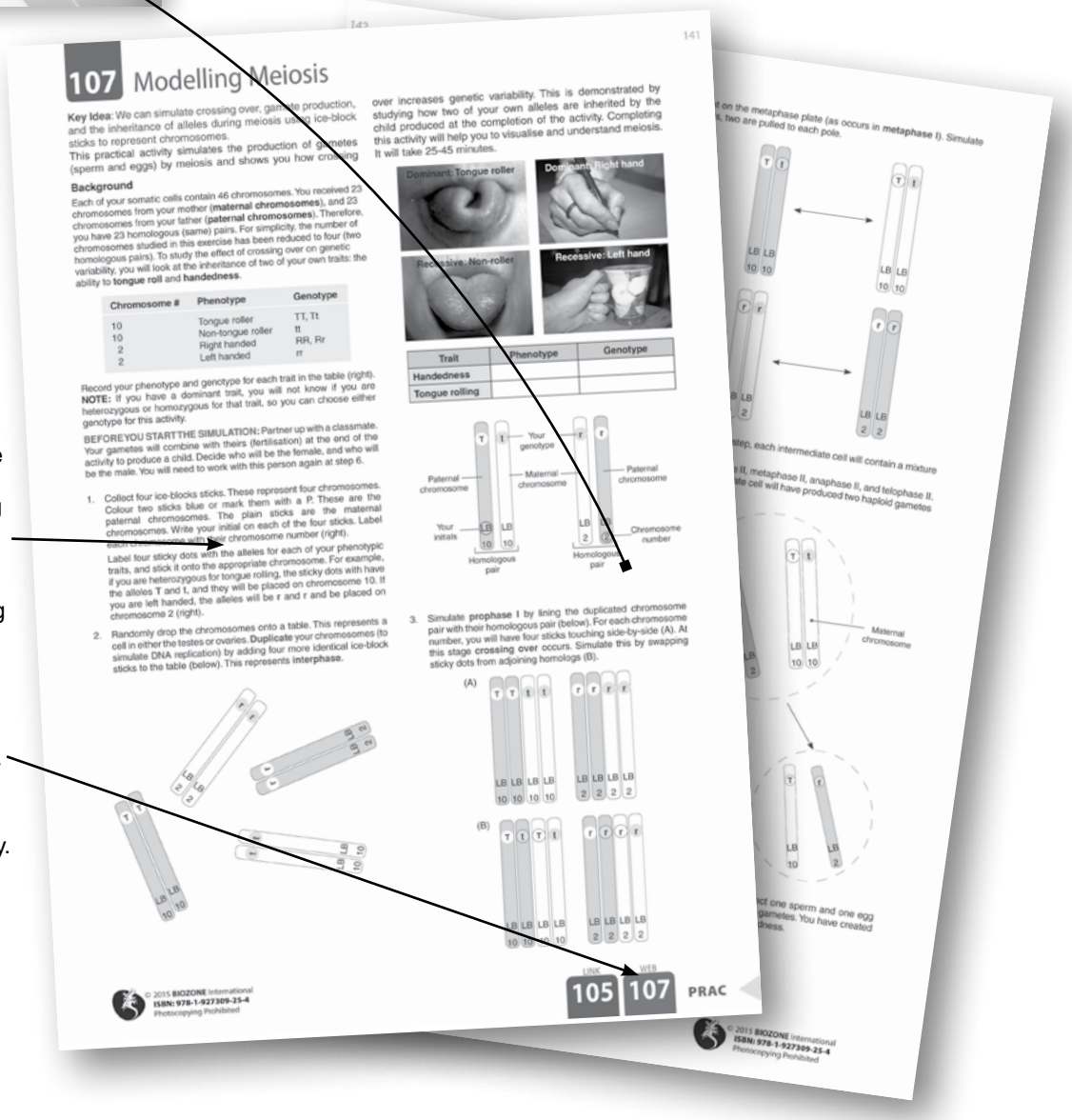
Regardless of which activity you might be attempting in class, a 5-10 minute introduction to the task by the teacher is useful orientation for all students. For collaborative work, the teacher can then divide the class into appropriate groups, each with a balance of able and less able students. Depending on the activity, the class may regroup at the end of the lesson for collaborative discussion.

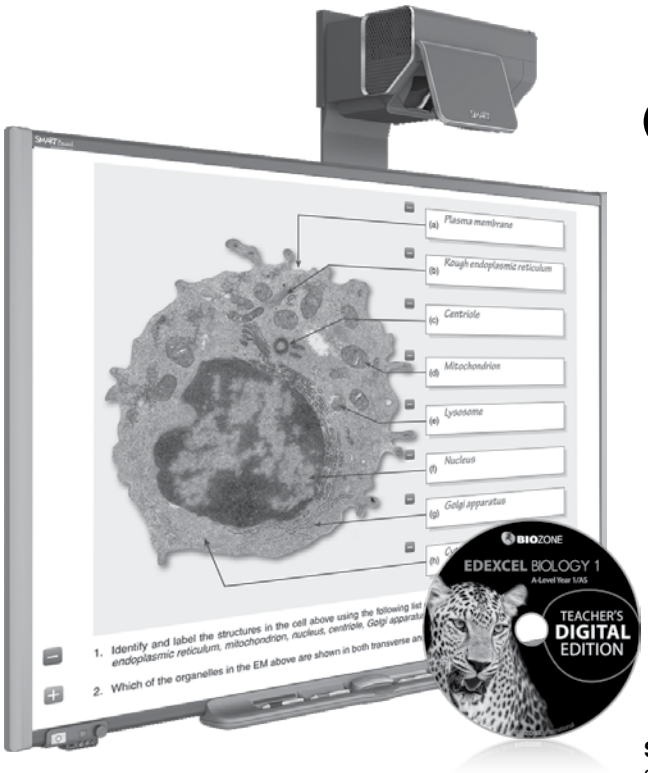
1 Peer to peer support

- Use **peer-to-peer learning** for more challenging activities where the content may be more complex and the questions require students to draw on several areas of their knowledge to synthesise an answer. Examples of such activities include those with a graphing component followed by an evaluation task.
- Stronger peers can assist weaker students and both groups benefit from verbalising their thoughts and presenting them to a group. ESL students can ask their peers to explain unfamiliar terms (both scientific and English) and this benefits both parties. **Paper practicals** (e.g. *Modelling Meiosis, Modelling DNA Replication*) are another ideal vehicle for this kind of peer-to-peer learning.

In Modelling Meiosis, students can collaborate in pairs to determine the outcome of a mating between two individuals with different traits. This tests and creates understanding by putting theory into practice.

Encourage able students to extend their knowledge by visiting the **recommended weblinks** for the activity.





2 Interactive revision of tasks in class

- Use the workbook PDFs with HIDE/SHOW answers on the **Teacher's Digital Edition** to review activities in class using a data projector or interactive whiteboard.
- 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.

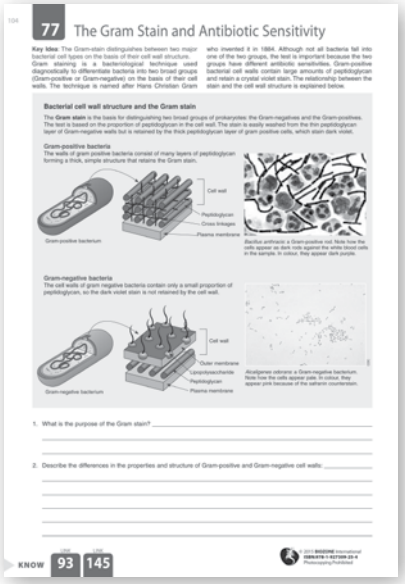
3 Gaining confidence

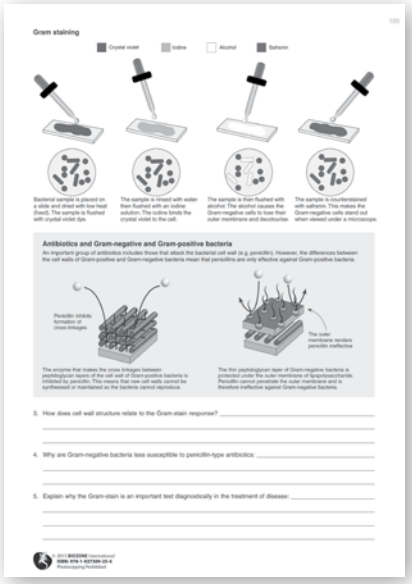
- The questions in BIOZONE's workbook activities have generally been written in a direct questioning style, e.g. "What are the differences between A and B", or "Why are A and B different?". This makes it easier for the students to understand what is required to answer the question.
- Questions are also arranged so that simpler questions (describe, what, identify, name) are generally asked first, followed by questions demanding an explanation (explain, how, why, account for). This allows students to gain confidence from answering the simpler questions first before attempting the questions that require more comprehensive answers.
- This arrangement also allows teachers to direct students appropriately so that some may attempt only the simpler questions themselves and work with peers to attempt the more challenging questions.

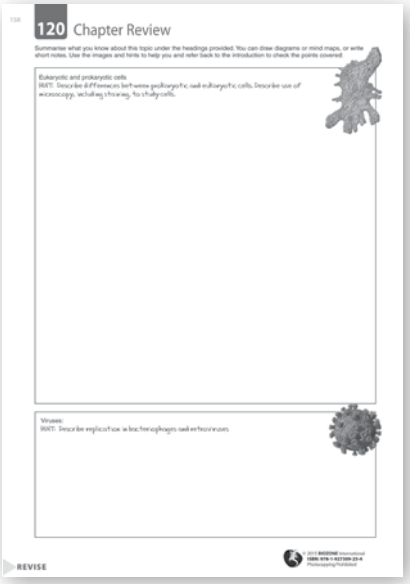
Students A and B will work through simpler questions themselves but may require assistance with the more challenging questions in an activity.

Student C is capable. She completes all of an activity including the more challenging questions.

Student D (above) is capable and completes the set work quickly. She can assist her peers and demonstrate her understanding in the relevant section of the review sheets.

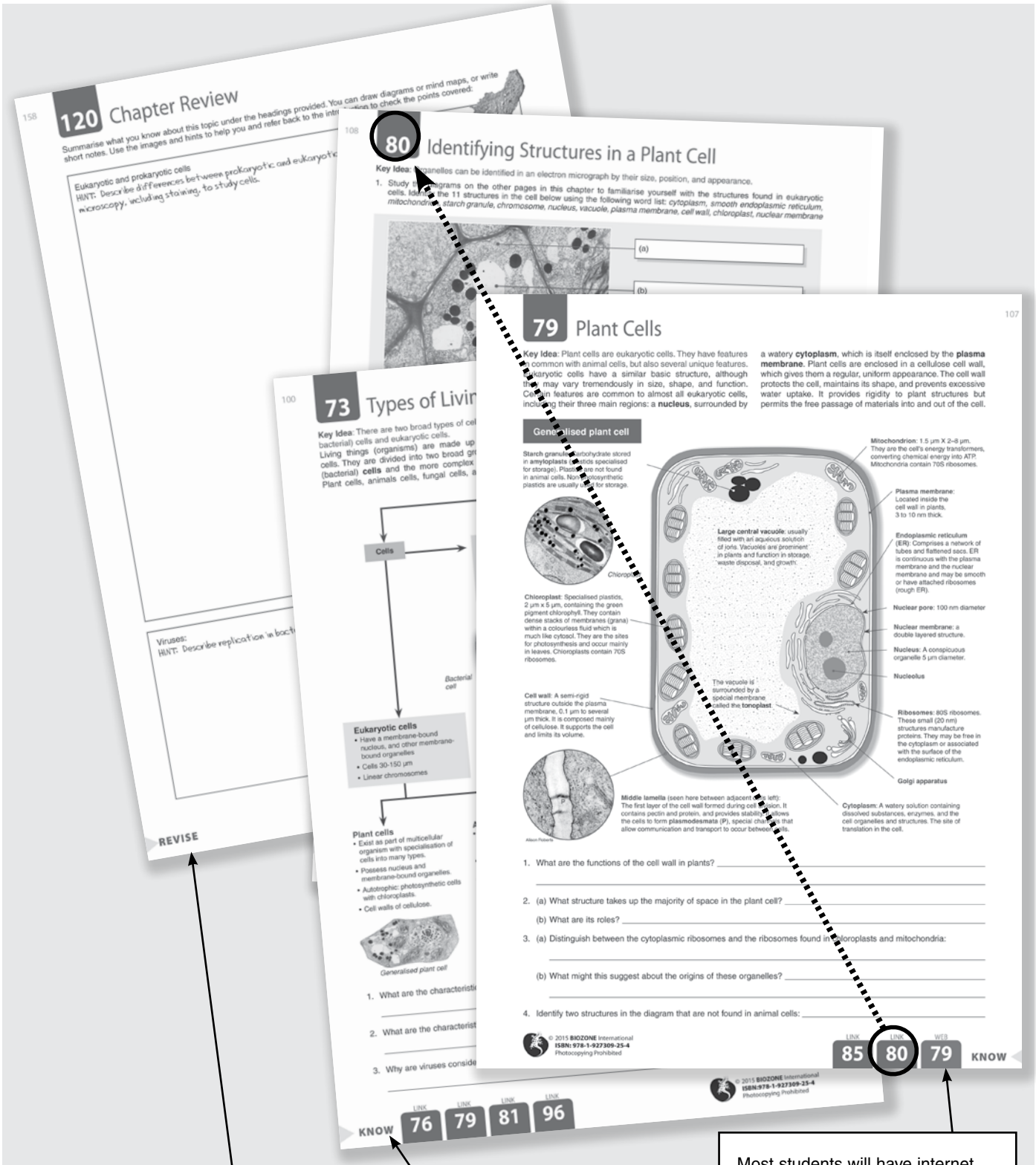






Choosing Activities for Home Study

Many of the workbook activities are ideal for homework or as vehicles for a quick synoptic assessment. Chapter reviews, literacy activities, and follow-on activities are ideal as homework. They provide a way in which to review and consolidate material that has recently been completed, helping learners by presenting the material in a slightly different way. The information for review activities can be found in the content of the chapter, although stronger students may not need to refer back to source material to complete the set work.



Review activities are ideal as homework. Students can produce their own review and then have it checked by the teacher or compare and discuss it with peers if they want to check their thinking.

Set simpler activities or preparatory reading (REFER activities) for homework. This encourages less able students to achieve and to be properly prepared for in-class lessons.

Most students will have internet access. Encourage them to visit the assigned **weblinks** if they are having trouble understanding a subject or visualising a process. They should also check activities indicated as **links**.

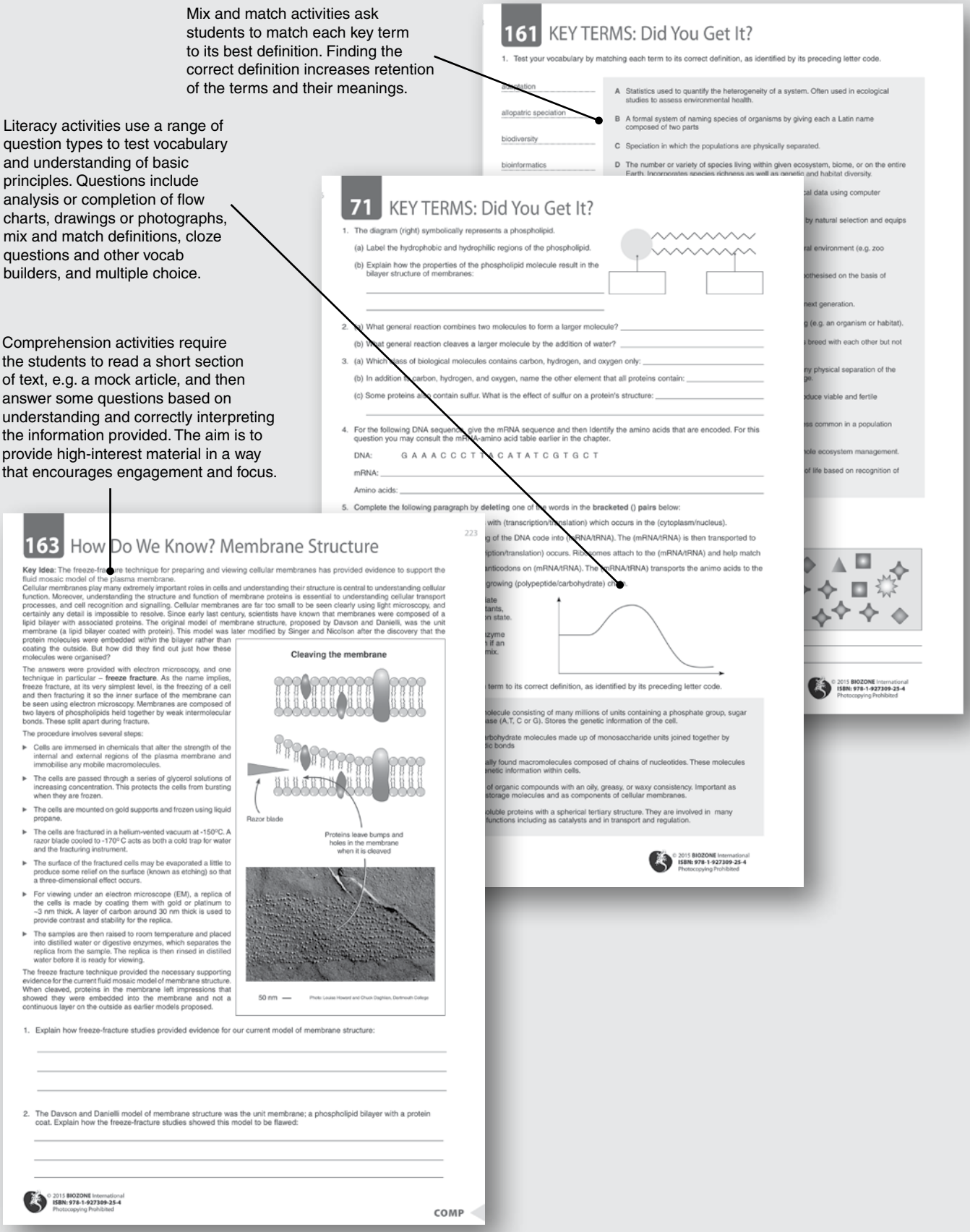
Focus on Scientific Literacy

Within all areas of science, scientific literacy is an important area of focus. With it, communication in the topic is more effective, more concise, and less cumbersome. BIOZONE's aim is to provide a method by which students would encounter and become familiar with scientific terms in various contexts. Beginning with the list of KEY TERMS at the beginning of each chapter, students can create their own glossary of commonly used terms. They can learn to use these key terms appropriately by encountering them in context within the activities, and reinforce their understanding of the term by completing the literacy activities throughout the workbook. These take several forms:

Mix and match activities ask students to match each key term to its best definition. Finding the correct definition increases retention of the terms and their meanings.

Literacy activities use a range of question types to test vocabulary and understanding of basic principles. Questions include analysis or completion of flow charts, drawings or photographs, mix and match definitions, cloze questions and other vocab builders, and multiple choice.

Comprehension activities require the students to read a short section of text, e.g. a mock article, and then answer some questions based on understanding and correctly interpreting the information provided. The aim is to provide high-interest material in a way that encourages engagement and focus.



161 KEY TERMS: Did You Get It?

1. Test your vocabulary by matching each term to its correct definition, as identified by its preceding letter code.

allopatric speciation
biodiversity
bioinformatics

A Statistics used to quantify the heterogeneity of a system. Often used in ecological studies to assess environmental health.
B A formal system of naming species of organisms by giving each a Latin name composed of two parts
C Speciation in which the populations are physically separated.
D The number or variety of species living within given ecosystem, biome, or on the entire Earth. Incorporates species richness as well as genetic and habitat diversity.

71 KEY TERMS: Did You Get It?

1. The diagram (right) symbolically represents a phospholipid.
(a) Label the hydrophobic and hydrophilic regions of the phospholipid.
(b) Explain how the properties of the phospholipid molecule result in the bilayer structure of membranes:

2. (a) What general reaction combines two molecules to form a larger molecule?
(b) What general reaction cleaves a larger molecule by the addition of water?
3. (a) Which class of biological molecules contains carbon, hydrogen, and oxygen only:
(b) In addition to carbon, hydrogen, and oxygen, name the other element that all proteins contain:
(c) Some proteins also contain sulfur. What is the effect of sulfur on a protein's structure:
4. For the following DNA sequence, give the mRNA sequence and then identify the amino acids that are encoded. For this question you may consult the mRNA-amino acid table earlier in the chapter.
DNA: G A A A C C C T T A C A T A T C G T G C T
mRNA:
Amino acids:
5. Complete the following paragraph by **deleting** one of the words in the **bracketed () pairs** below:

163 How Do We Know? Membrane Structure

Key Idea: The freeze-fracture technique for preparing and viewing cellular membranes has provided evidence to support the fluid mosaic model of the plasma membrane.

Cellular membranes play many extremely important roles in cells and understanding their structure is central to understanding cellular function. Moreover, understanding the structure and function of membrane proteins is essential to understanding cellular transport processes, and cell recognition and signalling. Cellular membranes are far too small to be seen clearly using light microscopy, and certainly any detail is impossible to resolve. Since early last century, scientists have known that membranes were composed of a lipid bilayer with associated proteins. The original model of membrane structure, proposed by Davson and Danielli, was the unit membrane (a lipid bilayer coated with protein). This model was later modified by Singer and Nicolson after the discovery that the protein molecules were embedded *within* the bilayer rather than coating the outside. But how did they find out just how these molecules were organised?

The answers were provided with electron microscopy, and one technique in particular – **freeze fracture**. As the name implies, freeze fracture, at its very simplest level, is the freezing of a cell and then fracturing it so the inner surface of the membrane can be seen using electron microscopy. Membranes are composed of two layers of phospholipids held together by weak intermolecular bonds. These split apart during fracture.

The procedure involves several steps:

- Cells are immersed in chemicals that alter the strength of the internal and external regions of the plasma membrane and immobilise any mobile macromolecules.
- The cells are passed through a series of glycerol solutions of increasing concentration. This protects the cells from bursting when they are frozen.
- The cells are mounted on gold supports and frozen using liquid propane.
- The cells are fractured in a helium-vented vacuum at -150°C. A razor blade cooled to -170° C acts as both a cold trap for water and the fracturing instrument.
- The surface of the fractured cells may be evaporated a little to produce some relief on the surface (known as etching) so that a three-dimensional effect occurs.
- For viewing under an electron microscope (EM), a replica of the cells is made by coating them with gold or platinum to ~3 nm thick. A layer of carbon around 30 nm thick is used to provide contrast and stability for the replica.
- The samples are then raised to room temperature and placed into distilled water or digestive enzymes, which separates the replica from the sample. The replica is then rinsed in distilled water before it is ready for viewing.

The freeze fracture technique provided the necessary supporting evidence for the current fluid mosaic model of membrane structure. When cleaved, proteins in the membrane left impressions that showed they were embedded into the membrane and not a continuous layer on the outside as earlier models proposed.

Cleaving the membrane

Razor blade

Proteins leave bumps and holes in the membrane when it is cleaved

50 nm

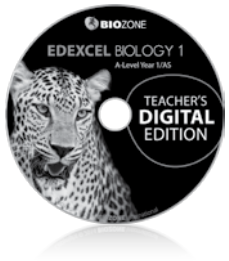
1. Explain how freeze-fracture studies provided evidence for our current model of membrane structure:

2. The Davson and Danielli model of membrane structure was the unit membrane; a phospholipid bilayer with a protein coat. Explain how the freeze-fracture studies showed this model to be flawed:

COMP

The Teacher's Digital Edition

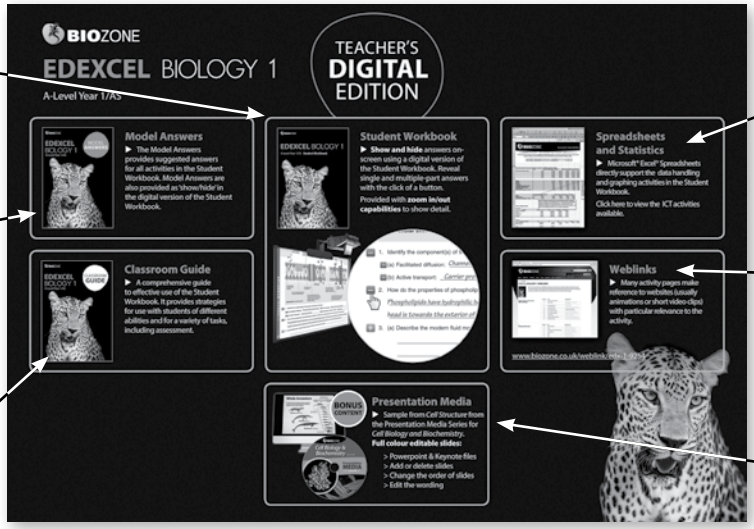
The *Teacher's Digital Edition* is aimed primarily at extending the pedagogical tools at a teacher's disposal. Many of the features of this resource have been developed in response to requests from teachers themselves.



A digital (PDF) version of the workbook (non-printable). Use the interactive buttons to HIDE or SHOW the answers.

Digital copy of the Model Answers (non-printable). Suggested answers are provided to all activities. Some include explanatory detail.

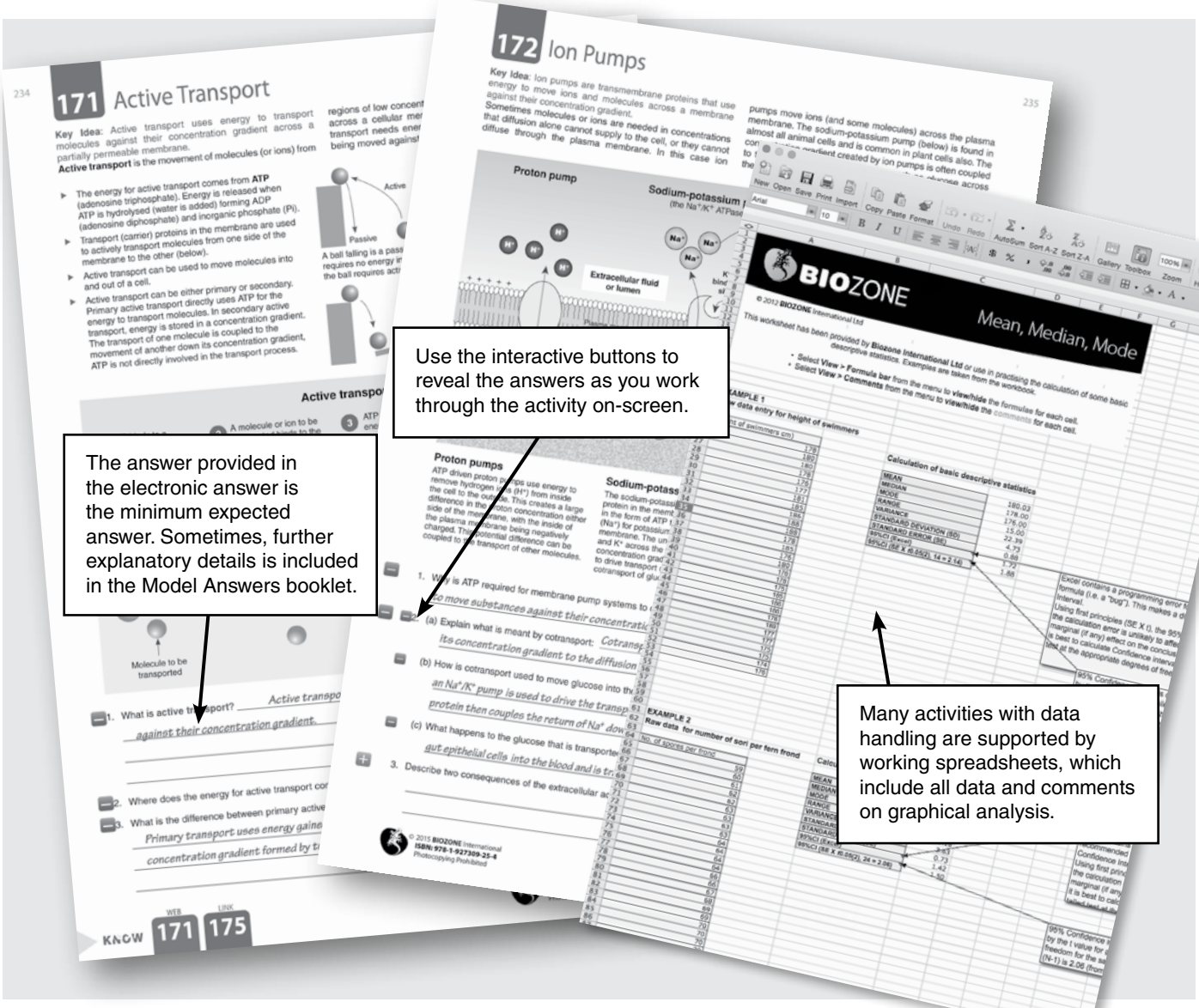
This **Classroom Guide** is provided as a printable PDF (no restrictions).



Link to ***Excel®*** **spreadsheets** for most activities with a data analysis component.

Access the *Weblinks* directly from this link for a range of animations and video clips to support the activities.

A **BONUS** sample of fully editable ppt slides from the Presentation Media series for 'Cell Biology and Biochemistry'.



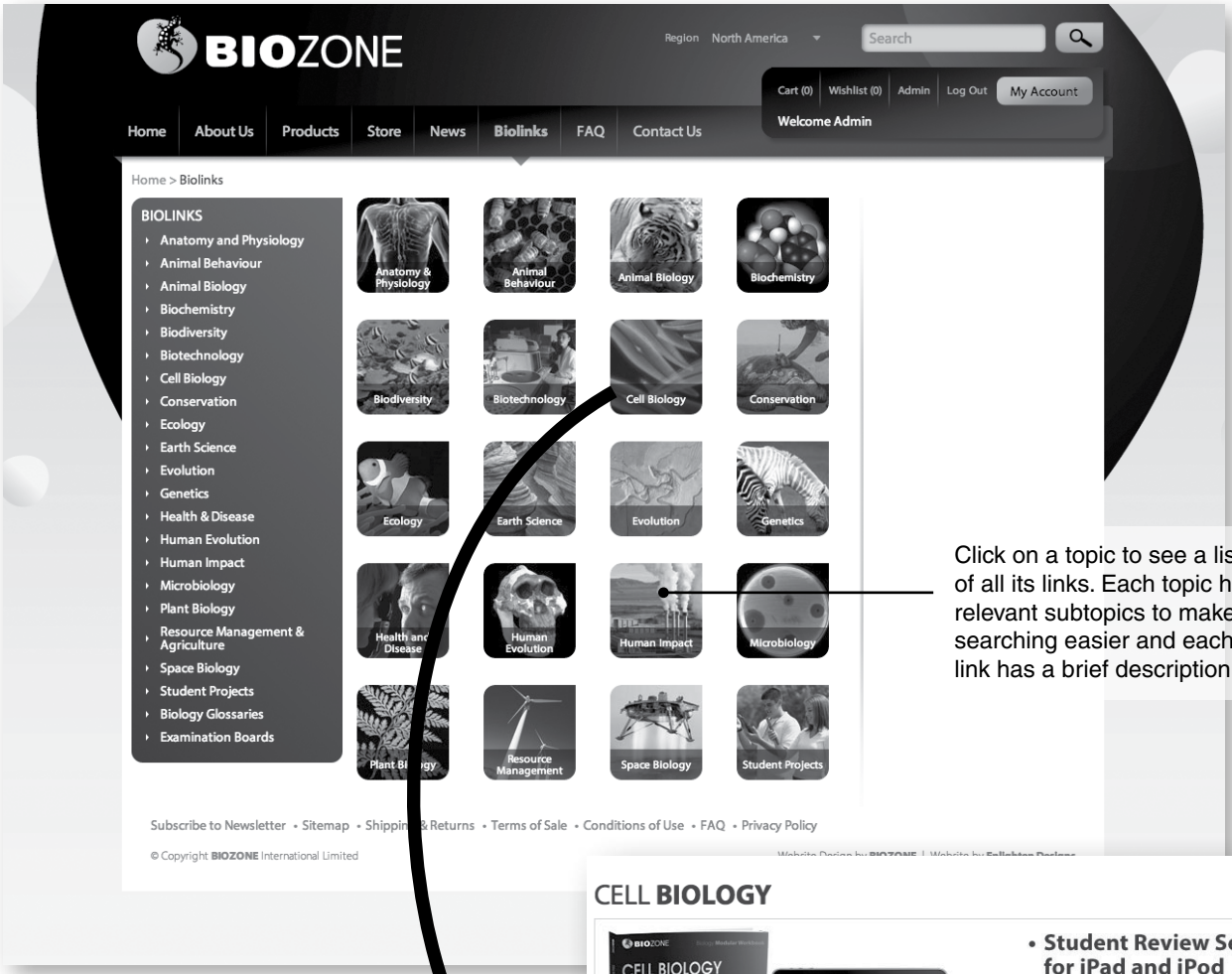
Use the interactive buttons to reveal the answers as you work through the activity on-screen.

The answer provided in the electronic answer is the minimum expected answer. Sometimes, further explanatory details is included in the Model Answers booklet.

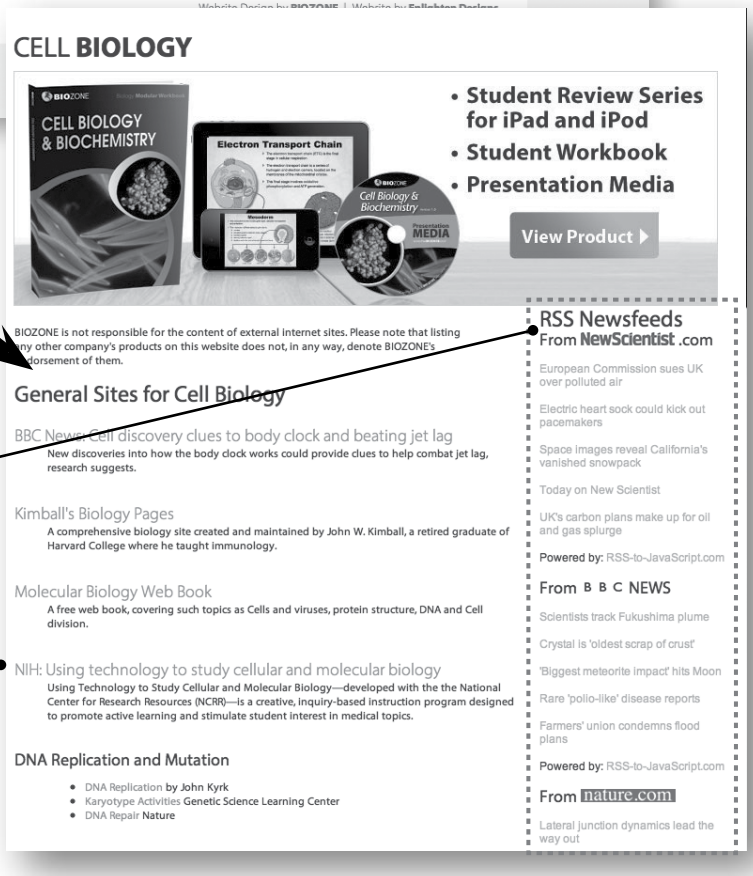
Many activities with data handling are supported by working spreadsheets, which include all data and comments on graphical analysis.

Resources on BIOZONE's Website

BIOZONE's web site should be the first stop for biologists. As well as providing all our product information (including shipping dates) and updates, *www.biozone.co.uk* provides quick access to the latest RSS newsfeeds and podcasts from around the world. The Resource hub also provides quick links to access the websites of publishers of references cited in the workbooks. Perhaps of greatest value to students and teachers is the BIOLINKS area of Biozone's website. The BIOLINKS pages are distinct from *Weblinks* (which are specific to each workbook edition) and provide a database of well organised hyperlinks pertaining to topics of interest in biology. The database is updated regularly, so that outdated, not operational, or no longer relevant sites are removed and new sites are added as they appear.



Click on a topic to see a list of all its links. Each topic has relevant subtopics to make searching easier and each link has a brief description.



RSS Newsfeeds and Podcasts in the right hand column provide the latest news and information from the world of science.

Click on the link to access the named site. The brief description tells you how the site may be of interest, as well as any country specific bias, if this is relevant.