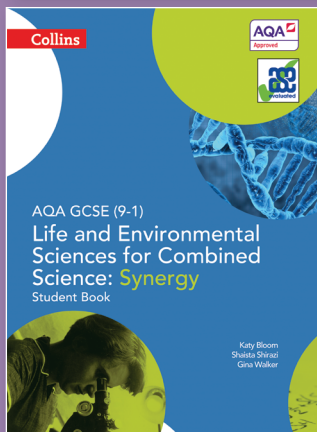
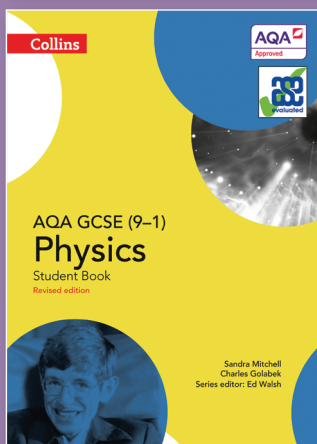
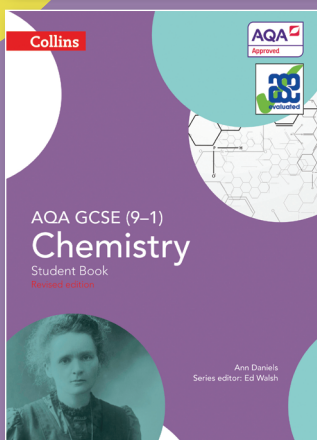
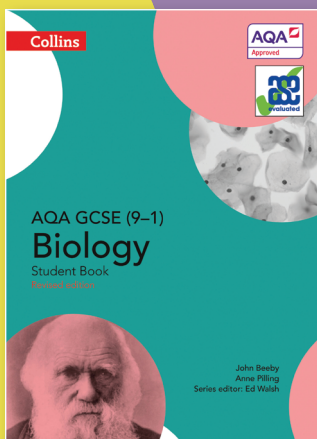


# Collins



All Student  
Books have  
been approved  
by AQA.

# GCSE Science

Engaging resources for the  
**AQA** GCSE Science (9-1)  
specification

Every student will need support in making  
good progress and to succeed in the new linear  
Science GCSEs.

With regular reviews and assessment that address  
performance as well as skills and understanding, our  
resources provide exactly that, for students at every level.

**Series Editor:** Ed Walsh

**Authors:** John Beeby  
Ann Daniels  
Sandra Mitchell  
Anne Pilling

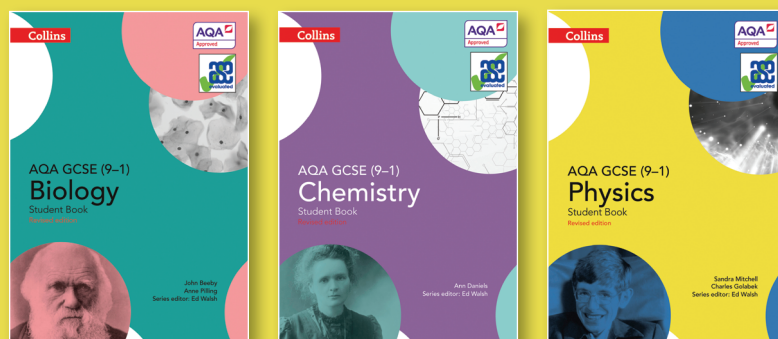
[www.collins.co.uk/AQAGCSEscience](http://www.collins.co.uk/AQAGCSEscience)

# GCSE Science

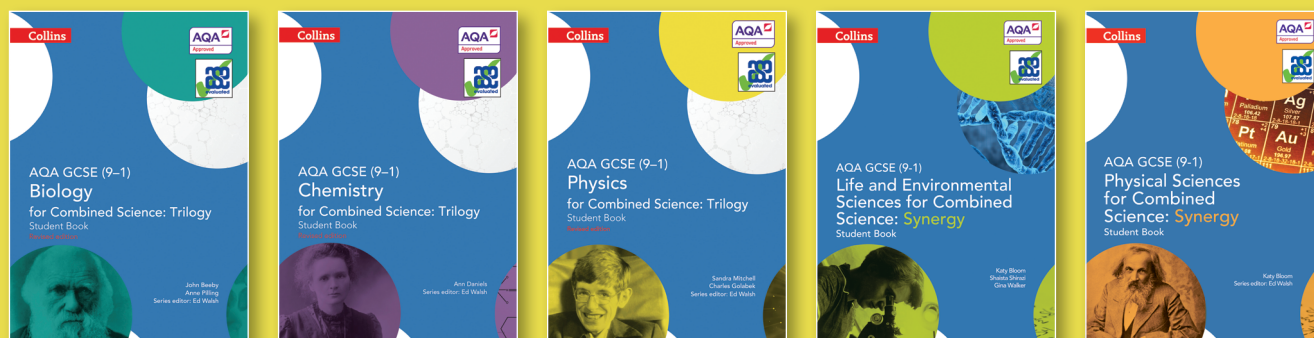
Our resources for the new AQA specification will develop and embed the skills your students need to succeed in all three assessment objectives, while providing a clear and supportive route through the new, more challenging GCSE content.

- **Teach with confidence** – our Student Books have been approved by AQA
- **Fully flexible support in print and digital formats** – our course structure allows you to teach your way. With 2, 3 and 5 year schemes of work allowing easy progression from KS3 and a strong basis for A level sciences, plus options for teaching foundation and higher, single sciences and combined
- **Cover the requirements of the (9-1) specification** – teaching and learning resources combined with regular assessment that enables progression for every student
- **Coverage of the new required practicals** – develop and test skills in analysing, interpreting and evaluating information and ideas so students are fully prepared for the indirect assessment
- **Build maths skills** – a dedicated maths spread in every chapter and skills at the appropriate level embedded throughout, provide a wealth of support and practice

## For AQA Single Science



## AQA Combined Science: Trilogy and Combined Science: Synergy

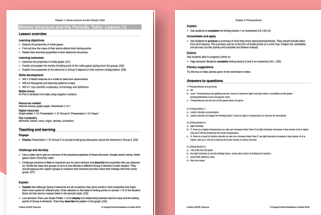


# How is Collins GCSE Science (9-1) structured?

## Teach

### Teacher Packs

Comprehensive support for delivering the new science GCSEs with detailed introductions to the new specification, 2, 3 and 5 year schemes of work, and an editable bank of differentiated lesson plans and worksheets.



## Assess

Ensure all students make good progress with our innovative assessment framework that uses regular checkpoints to help you analyse and track students' progress across the linear course. See page 5 for full details.



## Collins Connect

Content is available online at home and at school, meaning it's ideal for use as a front-of-class teaching tool and as a way to set homework and tests. See page 9 for full details.

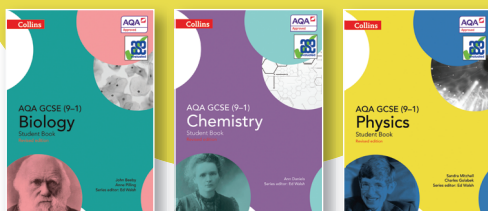


## GCSE (9-1) Science

## Learn

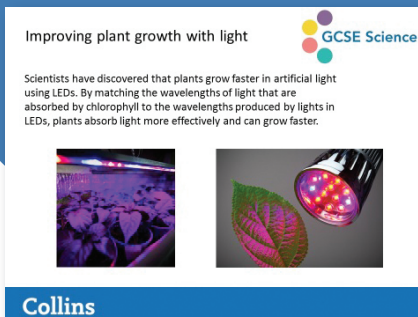
### Student Books

Written by a team of expert authors for the new GCSE (9-1) specification for AQA, the student books support students of all abilities with ramped content and questions on every page. Go to [collins.co.uk/AQAGCSEscience](https://collins.co.uk/AQAGCSEscience) for full details of how the resources support progress for all of your students.

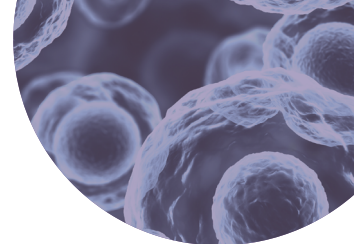


## Build Skills

Worked examples and practice questions incorporated throughout the Student Books and Workbooks support the new maths and practical requirements. Go to [collins.co.uk/AQAGCSEscience](https://collins.co.uk/AQAGCSEscience) for full details of support for maths and practicals.



# Teaching the new Science GCSEs



## Key changes to GCSE Science

### Practical assessment

- Controlled assessment has been discontinued and at least 15% of the total marks available for each GCSE is now dedicated to practical skills

### An increased maths element

- Maths accounts for 10-30% of assessment marks for single science (minimum of 10% in Biology, 20% Chemistry, 30% Physics) and 20% for combined (1:2:3 Biology, Chemistry, Physics).
- Foundation tier students must demonstrate maths skills at a minimum of KS3 Level and Higher tier students at a minimum of Foundation level GCSE Maths

### A linear course

- There are no modules, all assessment takes place at the end of Year 11

### New assessment objectives

- Assessment objective split:
  - AO1 (knowledge recall) – 40%
  - AO2 (application) – 40%
  - AO3 (analysis of information and ideas) – 20%

### New exams and grading system

- 9–1 grading system for Single Science
- Combined Science will have a 17 point grading scale, from 9-9, 9-8 through to 2-1, 1-1

### More challenging content:

- The level of content has increased, as has the level of challenge

## How our resources support you

- Build and test the skills students need for the new practical assessment
- Full support for practical work, including lesson plans, worksheets and technician notes, in the Teacher Packs
- Resources for each required practical are available on Collins Connect to help students consolidate and practise their learning

- A Maths Skills spread in every chapter provides support for applying maths to science
- Maths skills are embedded throughout and tested at the appropriate level
- Maths activities on Collins Connect help students practise the skills they need for assessment

- Monitor progress using regular assessment and common review checkpoints
- A bank of summative assessment materials and tracking tools in Collins Connect help you track performance across the course and target areas for improvement

- Questions highlight which assessment objectives they are targeting
- Online digital testing on Collins Connect provides targeted feedback on student performance against each assessment objective

- Differentiated content throughout
- Colour coded indicator on each page shows the ramping of demand

- Written for the 2016 specification
- Written by a team of expert authors, the Student Books have been approved by AQA.



## Track students' progress in the new linear GCSE course, with regular formative and summative assessment

### Formative Assessment

When	Where
<b>Ongoing informal and self assessment</b>	<ul style="list-style-type: none"> <li>Integrated questions on every page and at the end of every chapter</li> <li>Digital, auto-marked homeworks for every lesson</li> <li>Detailed lesson plans with embedded opportunities to review students' performance</li> </ul>

### Impact

- Students can review how well they've understood a topic
  - Helps check whether students have mastered the lesson content
- Next steps can be planned effectively

**Ramped questions and outcomes embedded throughout**

### Summative Assessment

When	Where
<b>End of topic</b>	<p>Print and digital tests:</p> <ul style="list-style-type: none"> <li>● Print and digital tests track students' progress on a topic-by-topic basis</li> <li>● Print and digital tests provide common review checkpoints throughout the linear course</li> <li>● Print tests help students prepare and practice for final assessment</li> </ul>
<b>End of teaching block</b>	
<b>End of year and end of course</b>	

### Impact

- Generate group and individual reports to analyse performance by:
  - Assessment objective (AO1, AO2, AO3) to see where strengths and weaknesses are
  - By skill to track performance in maths, required practicals and synoptic questions
  - By individual question type to scrutinise where errors were made
- Get targeted feedback for every student for every test so they know which areas to focus on.

**Regular assessment points to help you track and analyse student performance**

Builds effectively on the Collins Science Key Stage 3 assessment framework to provide consistency in student data from age 11 to 16.

# Student Books

- The Student Books are approved by AQA
- Written by a team of expert authors for the 2016 specification
- Combine clear and comprehensive explanations with a wealth of practice opportunities, to help build the skills that students will need to succeed
- Dedicated pages for practical and maths skills ensure students are fully prepared for the new requirements
- Co-teach both Foundation and Higher tier with a single book
- Key concept spreads highlight concepts that students must grasp before they can move on

Each spread starts with language and ideas at a lower level and increases in complexity, engaging students of all ability levels

Prepare students for the demands of the new specification with differentiated questions, worked examples and lots of opportunities to practice

## Biology

### REQUIRED PRACTICAL

#### Investigating disinfectants

##### Learning objectives:

- carry out experiments with due regard to health and safety
- present and process data, identifying anomalous results
- evaluate methods and suggest further investigations.

##### KEY WORDS

antiseptic  
diffusion  
incubation

For use in a hospital, choosing the right disinfectant or antiseptic to achieve the appropriate hygiene levels is essential. The correct dilution is also important: a concentration high enough to work, but not so high as to be wasteful.

##### Setting up a disc-diffusion investigation

Scientists need a number of different skills to carry out this investigation. This section looks at some of those skills.

The method used to test the effectiveness of a disinfectant (or an antiseptic or antibiotic) is the disc-diffusion technique.

In this experiment, different concentrations of the disinfectant sodium hypochlorite are investigated.

- In the investigation, which is the independent variable and which is the dependent variable?
- Suggest the other possible variables that need to be controlled.

##### Health and safety

Before scientists can begin a disc-diffusion investigation, they must carry out a Risk Assessment.

Hazard	Type of hazard	Risk	Safety precautions
Ethanol			
Sodium hypochlorite			
Bacteria			
Agar plate			

Add more rows to include the activities involved, e.g. flaming an inoculating loop.

- Complete the Risk Assessment table.
- Suggest why:
  - scientists would use Mueller–Hinton blood agar; in the school lab, you would use nutrient agar
  - you would incubate the plate at 25°C; the scientists at 37°C.

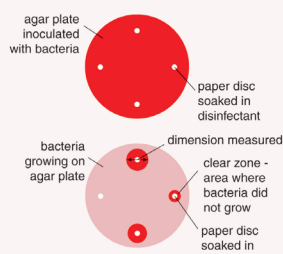


Figure 1.47 Disc-diffusion technique

## Biology

### Cells at work

##### Learning objectives:

- explain the need for energy
- describe aerobic respiration as an exothermic reaction.

##### KEY WORDS

active transport  
respiration  
aerobic  
respiration  
exothermic

This runner is using energy to run a marathon. But we all need a continuous supply of energy – 24 hours a day – just to stay alive.

##### We need energy to live

Organisms need energy:

- to drive the chemical reactions needed to keep them alive, including building large molecules
- for movement.

Energy is needed to make our muscles contract and to keep our bodies warm. It's also needed to transport substances around the bodies of animals and plants.

In other sections of the book, you will also find out that energy is needed:

- for cell division
- to maintain a constant environment within our bodies
- for **active transport**. Plants use active transport to take up mineral ions from the soil, and to open and close their stomata
- to transmit nerve impulses.

- List four uses of energy in animals.
- List four uses of energy in plants.

##### Aerobic respiration

Respiration



Figure 1.35 An average runner uses around 13 000 kJ of energy for a marathon

This chemical reaction is exothermic as it releases energy. The energy transferred is released as heat.



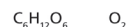
Figure 1.36 Birds and mammals use energy to maintain body temperature

- What is the purpose of respiration?
- How do birds and mammals maintain body temperature?

##### Bioenergetics

This is the equation for aerobic respiration:

glucose + oxygen →



This equation describes the process of aerobic respiration. The energy released through each of a series of steps is actually released as heat.

The first group of steps occurs in the mitochondria.

- When and where does respiration occur?
- Give one characteristic feature of mitochondria.
- Why do we often get hot after exercise?

Presenting and processing data

The agar plates are incubated, and the clear zones measured. Scientists need to analyse the data they have collected:

Concentration of sodium hypochlorite (g/dm <sup>3</sup> )	Area of clear zone around disc (mm <sup>2</sup> )			Mean area of clear zone around disc (mm <sup>2</sup> )
	Test 1	Test 2	Test 3	
0.0	0	0	0	0
0.5	0	0	0	0
1.0	32	31	34	32
1.5	91	89	91	90
2.0	470	381	379	380
2.5	499	505	497	
3.0	546	552	551	
3.5	575	568	567	
4.0	578	582	580	
4.5	580	580	580	
5.0	579	578	583	

- 5 How is the area of a clear zone calculated? Hint: you need to recall a formula.
- 6 Complete the table by calculating the mean area of the clear zone.

REMEMBER!  
The area of a circle can

Required practicals spreads in each chapter build and test students' development of the appropriate skills

Maths skills are embedded throughout the book and revisited in dedicated maths pages

Biology  
MATHS SKILLS

Size and number

Learning objectives:

- make estimates for simple calculations, without using a calculator
- be able to use ratio and proportion to calibrate a microscope
- recognise and use numbers in decimal and standard form.

KEY WORDS  
calibrate  
graticule  
haemocytometer  
standard form

The size of structures is important in biology, from whole organisms to molecules.

Estimating cell size

Accurate measurements are often essential. But estimating cell size or number is sometimes sufficient and may be quicker.

To estimate cell size, we can count the number of cells that fit across a microscope's field of view.

Size of one cell =  $\frac{\text{diameter of field of view}}{\text{number of cells that cross this diameter}}$

If the field of view of this microscope, at this magnification, is 0.3 mm, or 300  $\mu\text{m}$ , we can do a quick calculation without

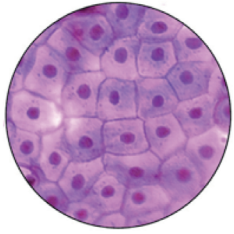
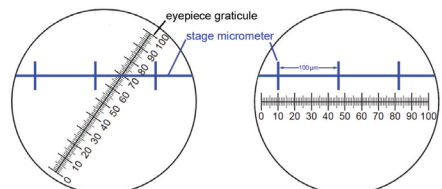


Figure 1.48: In this image, approximately five cells fit across the field of view. We round numbers up or down to make calculations straightforward.

- 3 What would be the diameter of a cell that was 65 divisions on this graticule?
- 4 How many graticule divisions would a cell that was 35  $\mu\text{m}$  across take up?



The graticule is enclosed within the eyepiece. A stage micrometer is placed on the stage of the microscope.

The divisions on the eyepiece graticule and stage micrometer are lined up.

Figure 1.49: Calibrating, then using an eyepiece graticule.

Numbers written in standard form

When writing and working with very large or very small numbers, it is convenient to use standard form. Standard form shows the magnitude of numbers as powers of ten.

Standard form numbers are written as:  $A \times 10^n$

where:  $A$  is a number greater than 1 but less than 10. This could be decimal number such as  $A=3.75$ , as well as an integer number such as  $A=7$ .  $n$  is the index or power.

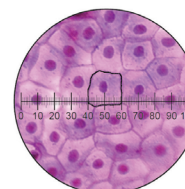
We use standard form with large numbers, small numbers and calculations. In standard form:

- when multiplying: multiply numbers and add powers (see example in Figure 1.50).
- when dividing: divide numbers and subtract powers.

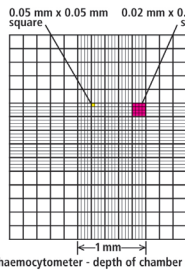
Blood cell type	Width of an average cell (m)
Lymphocyte (small)	$7.5 \times 10^{-6}$
Macrophage	$5.0 \times 10^{-5}$
Megakaryocyte	$1.5 \times 10^{-4}$
Neutrophil	$1.2 \times 10^{-5}$

The sizes of different types of blood cell, written in standard form.

- 5 Look at the table of cell sizes. Arrange the cell types in descending order of size.
- 6 How many times larger is a megakaryocyte than a lymphocyte?



The calibrated eyepiece graticule can be used to make measurements of cells or other structures viewed with that microscope.



For a 0.2 x 0.2 mm counting chamber:  
Dimensions:  
top length: 0.2 mm =  $2.0 \times 10^{-1}$  m  
side length: 0.2 mm =  $2.0 \times 10^{-1}$  m  
depth: 0.1 mm =  $1.0 \times 10^{-1}$  m  
 $\therefore$  volume of counting chamber =

$(2.0 \times 10^{-1}) \times (2.0 \times 10^{-1}) \times (1.0 \times 10^{-1})$   
multiply  
=  $4.0 \times 10^{-2} \text{ m}^3$

Figure 1.50: Calculating the volume of a counting chamber. The counting chamber is a hollow on a microscope slide which holds a set volume of fluid. It has a grid ruled onto it, with a depth of 0.1 mm. The number of cells in a given volume can be calculated.

exothermic. A reaction is described releases energy. Some of the energy is lost as heat.



use heat energy to maintain a constant

respiration?

Animals make use of the waste heat

erobic respiration:

→ carbon dioxide + water (energy released)



the overall change brought about by chemical reactions. A small amount is used at each stage in the series.

occurs in the cytoplasm of cells, but is transferred by chemical reactions in

respiration occur?

feature of actively respiring cells.

not when we exercise?



Figure 1.37 Insect flight muscles have huge numbers of well-developed mitochondria

DID YOU KNOW?  
The muscle an insect uses to fly is the most active tissue found in nature.

COMMON MISCONCEPTIONS  
Don't forget that all organisms respire. The equation is the reverse

Real-life contexts and applications are included to show students the relevance of the concepts they are studying

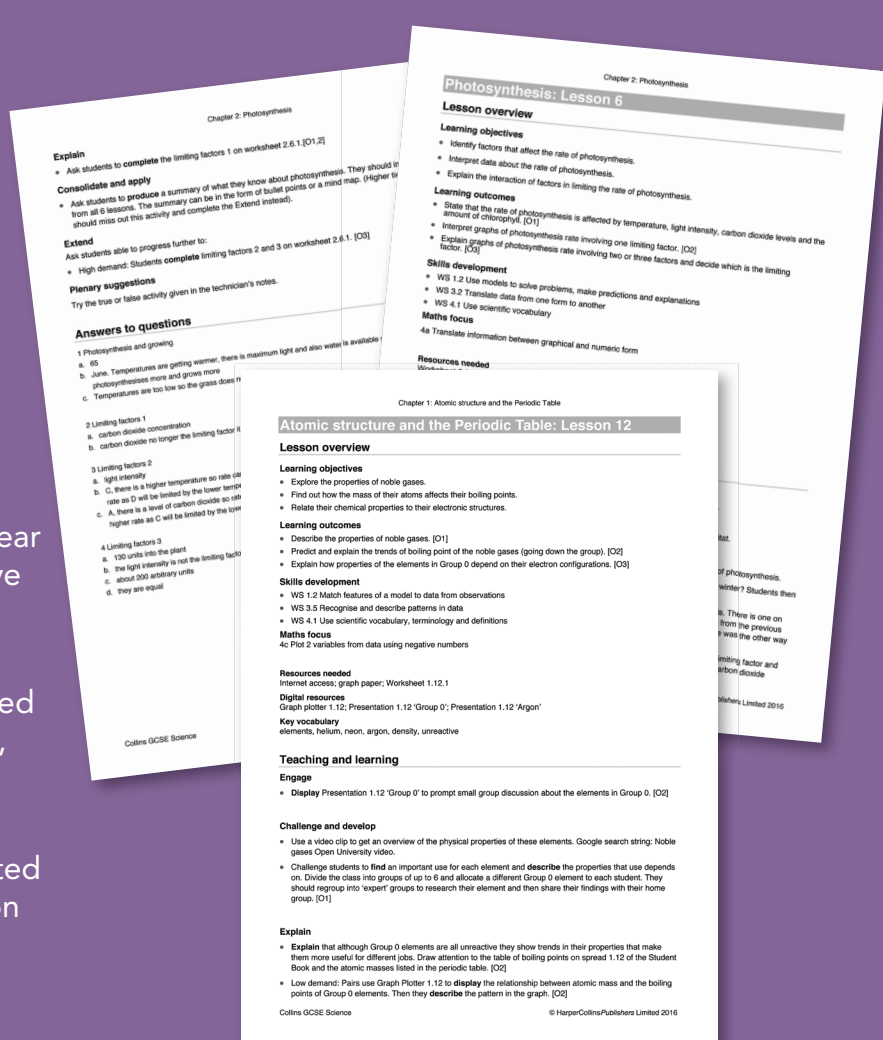
Higher-only content is clearly flagged for easy co-teaching

Google search: 'calibrating a microscope, haemocytometer, standard form'

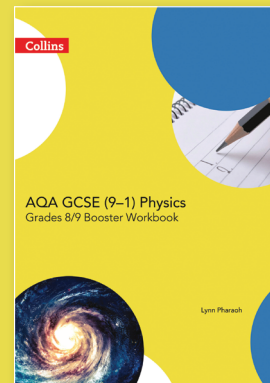
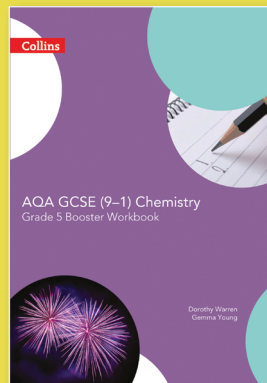
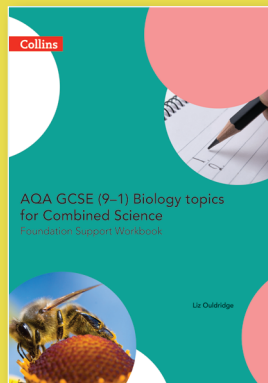


# Teacher Packs

- Deliver the new GCSE Science curriculum with confidence, using the detailed support for introducing and teaching the new specification
- Make planning easy with 2, 3 and 5 year schemes of work and a comprehensive set of editable lesson plans and worksheets
- Equip students with the skills they need for working scientifically, using maths, and carrying out practicals
- Prepare students for the demands of the new specification with differentiated questions and activities in every lesson and targeted supporting worksheets
- All resources are also provided on CD-ROM



# Workbooks



**Build confidence, support the development of key skills and provide plenty of practice with a range of targeted GCSE Science workbooks. Ideal for use with any AQA GCSE Science course.**

With our Foundation Workbooks for AQA GCSE (9-1) Combined Science, support the development of key literacy and numeracy skills of students in the 1-4 grade range.

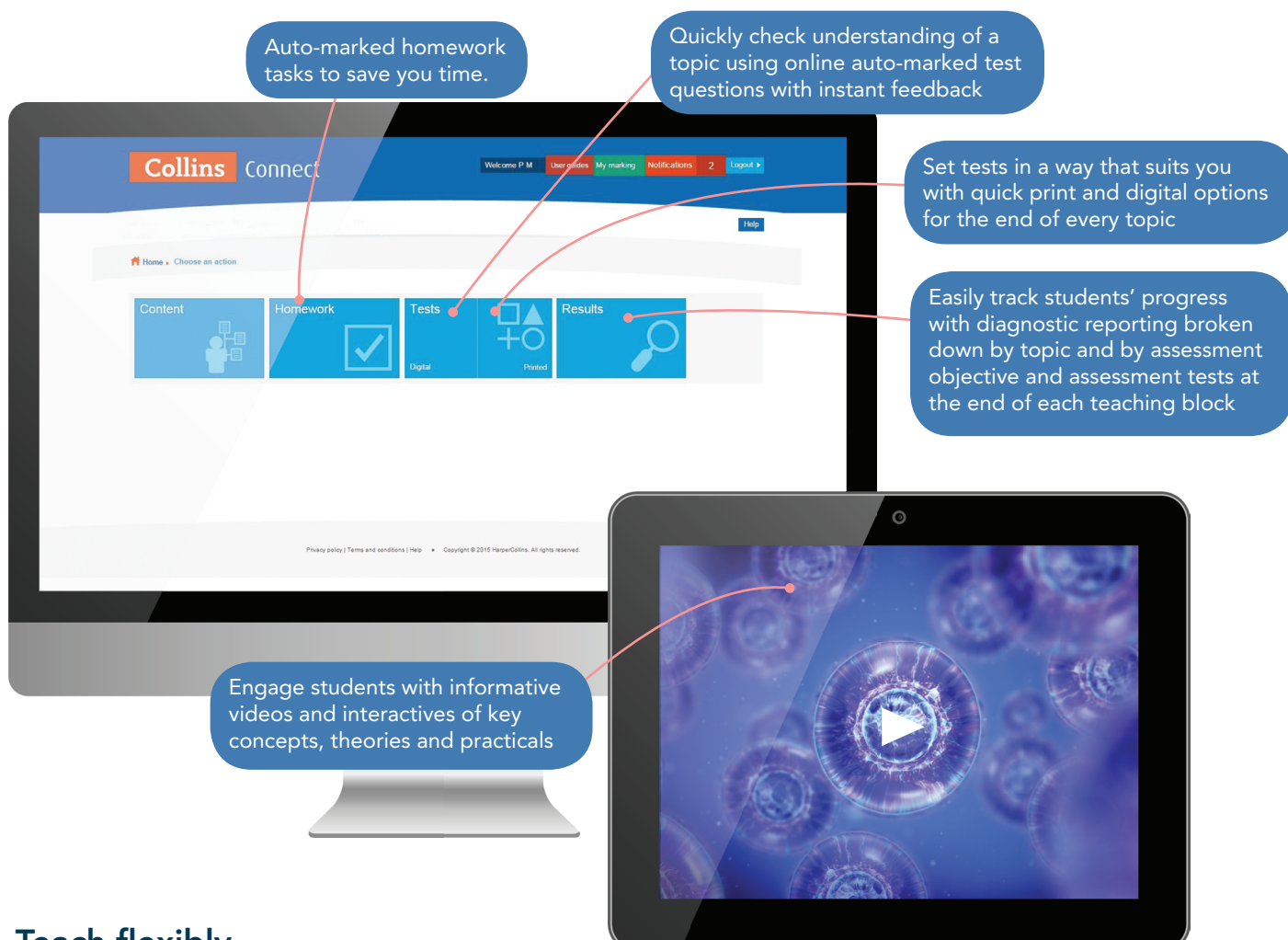
With our Grade 5, and Grade 8/9 Booster Workbooks for AQA GCSE (9-1), help your borderline 4/5 and 8/9 students focus on key topics and reach their full potential with targeted, level specific questions and support.

- Foundation Workbooks for AQA Combined Science (9-1)
- Grade 5 Booster Workbooks for AQA GCSE Science (9-1)
- Grade 8/9 Booster Workbooks for AQA GCSE Science (9-1)



## Teach GCSE Science flexibly and in a way that suits your students with a full suite of digital resources

Powered by an innovative online learning platform, **Collins Connect** makes GCSE Science content available at home and at school, meaning it's ideal for use as a front-of-class teaching tool and as a way to set homework and tests.



### Teach flexibly

- Interactive digital version of the Student Book, ideal for whiteboard use
- Front-of-class view provides total fluidity between digital and print with a page for page match

### Build skills

- Maths activities help students develop the skills they need for GCSE
- Resources for all required practicals help students consolidate and practice their learning
- Build confidence in answering longer questions with downloadable, editable practice questions with full mark scheme

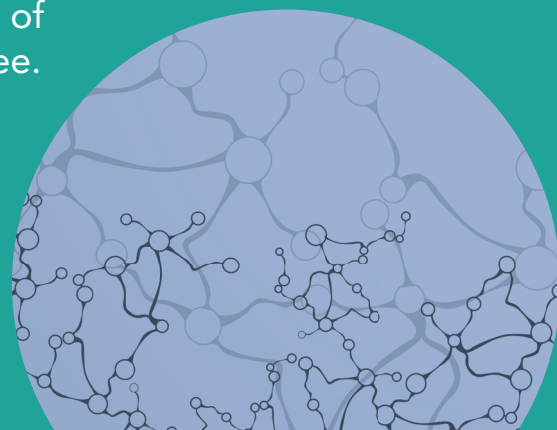
You can trial **Collins Connect** completely free for 14 days. Email [education.support@harpercollins.co.uk](mailto:education.support@harpercollins.co.uk) to find out more. Sample material is also available for you to look at online for free – visit [connect.collins.co.uk/secondary-teaching-resources](http://connect.collins.co.uk/secondary-teaching-resources).

# Support for the new curriculum

Download  
for free from  
[www.collins.co.uk/  
AQAGCSE Science](http://www.collins.co.uk/AQAGCSE%20Science)

## Schemes of Work

Support your planning with 2, 3 and 5 year schemes of work, available to download from our website for free. These editable schemes of work provide a flexible approach for teaching Single and Combined Science GCSEs and are designed to help you get the most from our resources.

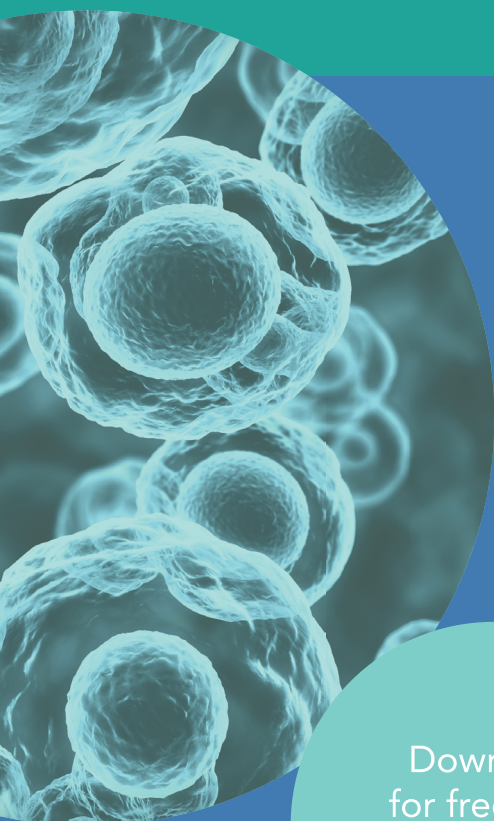


## Transition Units

Help your Year 9 students get to grips with key ideas and prepare them to work at a GCSE level of challenge with our ready-to-go units, specifically written to address the transition from KS3 to the new GCSE science.

- Flexible units that can be used in any order, so you can pick up and teach in a way that suits your timetable
- Cover 5 key ideas from the new curriculum: Seedlings and coloured light, sound reflectors, barometric pressure, rhododendrons and milk glue
- Each unit includes three lesson plans, resource sheets, worksheets, technician notes and front of class PowerPoints

Download  
for free from  
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AQAGCSE Science](http://www.collins.co.uk/AQAGCSE%20Science)



## About the Series Editor



### Ed Walsh

Ed Walsh is a curriculum developer, CPD provider and school improvement officer. A teacher for twenty years and a team leader for twelve of those, he now writes and edits curriculum materials, designs and delivers CPD and works with science departments to improve the quality of their provision. He regularly presents sessions at ASE regional and national conferences and is a Regional Development Leader for the Science Learning Network in the south west. Ed's current projects include developing the Science Mark programme for the National Science Learning Centre, piloting the use of iPads in science teaching and writing STEM teaching materials for Siemens. He lives in Cornwall, where he works with local schools as Science Adviser.

### John Beeby

After completing a PhD in insect biochemistry, John Beeby was a teacher of Biology and Chemistry. He has extensive examining experience. John has a passion for making science interesting and relevant and the latest scientific research and developments accessible to learners.

### Ann Daniels

Ann is a former headteacher, curriculum developer, teacher trainer and teacher in the UK. She now works as an Educational Consultant, international adviser and assessment specialist.

### Sandra Mitchell

Sandra Mitchell spent over twenty years working in schools, as a Head of Physics and a Head of Science. She has extensive examining experience and is a writer, having contributed to several successful textbooks.

### Anne Pilling

Anne began her career undertaking research into slow release nutrient tablets and copper based fungicides before becoming a secondary school Science teacher based in the North West. She went on to work as a Consultant Adviser for a local authority, initially as part of the National Strategies initiative, with responsibility for primary and secondary science before taking up her current role as an independent consultant. Anne also has extensive examining experience.

## About the Authors



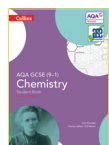
# Collins GCSE Science: Component chart

## Student Books



### Biology

978-0-00-815875-0  
£18.99



### Chemistry

978-0-00-815876-7  
£18.99



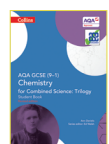
### Physics

978-0-00-815877-4  
£18.99



### Biology for Combined Science: Trilogy

978-0-00-817504-7  
£12.99



### Chemistry for Combined Science: Trilogy

978-0-00-817505-4  
£12.99



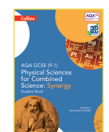
### Physics for Combined Science: Trilogy

978-0-00-817506-1  
£12.99



### Life and environmental Sciences for Combined Science: Synergy

978-0-00-817495-8  
£18.99



### Physical sciences for Combined Science: Synergy

978-0-00-817496-5  
£18.99

## Teacher Packs

### Biology

978-0-00-815879-8 • £125

### Chemistry

978-0-00-815880-4 • £125

### Physics

978-0-00-815881-1 • £125

### Combined Science

978-0-00-815878-1 • £150

## Booster Workbooks

### Biology: Grade 5

978-0-00-819436-9 • £4.99

### Biology: Grade 8/9

978-0-00-819433-8 • £4.99

### Chemistry: Grade 5

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