AS and A level Biology

❄ Biology A (Salters-Nuffield)
✅ Biology B

Your guide to our qualifications
Hello and welcome

Our AS and A level Biology qualifications will engage and inspire the scientists of the future. We’ve worked with all parts of the science education community and used the opportunity of curriculum change to design courses that will encourage students to develop as scientists, and give them the skills to succeed in their chosen pathway.

To ensure you can cover a range of topics with teaching approaches that will suit you and your students, we’ve created two sets of courses:

- **AS and A level Biology A (Salters-Nuffield)**
- **AS and A level Biology B.**

This guide gives you an overview of our AS and A level Biology courses. You can also learn more about the comprehensive help and support we are planning for you.

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We’re here to help you understand the changes to AS and A level Biology, so you’re ready to teach the specifications. Whether it is on the phone, by email, or in person at a training event, we’ll support you as you plan and teach the new qualifications.

We look forward to meeting you at our New to Edexcel events and answering any questions you might have about our new specifications.

You can learn more at:
http://quals.pearson.com/edexcelasandalevel/biologya and
Our Edexcel AS and A level Biology qualifications

**Straightforward and balanced specifications**

- The AS and A level specifications are **fully co-teachable**, to give you flexibility with your teaching arrangements.
- You can teach all our biology specifications using a **concept-led approach** or a **context-led approach**, as best suits your students (see pages 8 and 9 for more details).
- Specification content is arranged into **distinct topics** and linked to clear descriptive statements, so you and your students know the depth of understanding that’s expected.
- Topics cover **fundamental areas of biology**, such as cells, biological molecules, transport and classification. Later topics build on what has come before to give students a broad knowledge base for assessment and progression to further study and the workplace.
- **Support** is available for each key aspect of the specifications, from transition units helping students make the move from GCSE to AS and A level study, to guidance on integrating mathematical and investigative skills into lessons.

**Assessment you and your students can have confidence in**

- Our exam questions include **clear command words** to ensure students understand the knowledge and skills they’re being asked to demonstrate.
- There are a **range of question styles** to test students’ breadth of knowledge and depth of understanding, and reward the different strengths students have.
- Our question papers are **ramped**, with the level of challenge increasing throughout the exam. Every question, where possible, will begin with a more **accessible** question part that all students can engage with.
- The assessment of students’ **scientific investigative skills** in question papers is based on approaches we know work well already in our international exams and current specifications.

**Supporting students to develop as scientists**

**Practical work is at the heart of the qualifications**

- Core practicals have been designed to meet **assessment requirements** and link directly to the specifications, so your students can develop their practical skills in a context they’re familiar with.
- Our **choices** of core practicals are based on what you’ve told us **works well** in classroom and fieldwork situations and are the experiments you and your students **enjoy**.
- The **range** of core practicals enables students to build their confidence by giving them more than one opportunity to master techniques. It also means if your students miss a lesson, they’ll have a chance to try the technique again.
- You know your students best, so we’ve added extra **flexibility** around practical work, so you can substitute a core practical with one of your own, or do more, if you think they develop the same skills and techniques.
- We’ve created **tools** and **resources** to help you and your students with each aspect of practical work – from planning the experiments and selecting apparatus to honing investigative skills.

**Enabling students to work as scientists**

- It’s **specialist**: your Subject Advisor, Irine Muhiuddin, will be on-hand to answer any queries you may have; our Science Team also regularly send email updates so you know the latest news.
- It’s **local**: training events and network events will be taking place near you.
- It’s **driven by you**: we’ll develop our support based on what you tell us you need.

**Guiding you and your students through the AS and A level courses**

**The AS and A level 2015 Biology qualifications**

Both our courses cover the key concepts in biology but differ in topic matter and teaching styles, so you can choose what will work best for you and your students.

- **AS and A level Biology A (Salters-Nuffield)** – the most widely-used context-led courses.  
  (See page 8 for more details.)
- **AS and A level Biology B** – courses combining traditional and modern topics.  
  (See page 9 for more details.)
How assessment will work at AS and A level

With AS being a stand-alone qualification, it will no longer form part of students’ A level grades. As such, students could choose to take AS and A level exams to receive grades for both qualifications, or just A level papers at the end of Year 13 to gain an A level grade. The qualification structure is the same for all AS and A level Sciences, regardless of exam board.

**To achieve an AS qualification, students need to take:**

\[
\begin{align*}
\text{AS Paper 1} & \quad + \quad \text{AS Paper 2} & = & \quad \text{AS grade}
\end{align*}
\]

Note: AS exam papers will include questions on some of the core practicals in the AS specification.

**To achieve an A level qualification, students need to take:**

\[
\begin{align*}
\text{A level Paper 1} & \quad + \quad \text{A level Paper 2} & + & \quad \text{A level Paper 3} & = & \quad \text{A level grade}
\end{align*}
\]

Note: A level exam papers will include questions on some of the core practicals in the specification. All content in the AS specification is included in the A level specification.

**The Practical Endorsement (at A level only)**

\[
\begin{align*}
\text{Teacher assessment of students’ practical competency} & \quad = \quad \text{Practical Endorsement (reported on A level certificate)}
\end{align*}
\]

**Practical Endorsement**

AS and A level Biology is 100% externally assessed; this means there are no coursework elements in the new courses. Instead, students are required to complete a number of core practicals throughout the courses that cover specific skills and techniques. Students’ investigative skills and knowledge and understanding of core practicals will be tested in exam papers and will contribute to their final grades.

In addition, students’ skills and technical competency when completing practical work will be assessed by teachers. This will form the basis for the award of a Practical Endorsement at A level. This is separate to the A level grade and, if awarded, will be reported as a ‘Pass’ on A level certificates for students who achieve it.

Turn to pages 10 and 11 for details on the assessment model for AS and A level Biology A (Salters-Nuffield).

Turn to pages 12 and 13 for details on the assessment model for AS and A level Biology B.
Edexcel AS and A level Biology — offering you choice

There are many ways to teach a subject as diverse as biology. That’s why we’re offering two sets of AS and A level Biology qualifications. Both Biology A (Salters-Nuffield) and Biology B cover the core subject criteria and are an excellent basis for progression to further study, but they differ in topic matter and teaching styles. This way, you can choose the course that will work best for you and your students.

Biology A (Salters-Nuffield)

- The established and most widely-used context-led courses. They have been created in partnership with the University of York Science Education Group.
- The course uses storylines and real-life contexts to introduce biological principles.
- AS exams: two equally-weighted papers covering specification topics and investigative skills.
- A level assessment: all three papers assess investigative skills and theoretical knowledge and understanding of specification topics. Paper 3 also includes questions based on a pre-release article, enabling students to apply their knowledge to a new context.
- Topics covered alongside the core subject criteria include developmental biology, the musculoskeletal system, and learning and habituation.

- A range of specific core practicals link directly to AS and A level Biology A (Salters-Nuffield) specification topics, giving students opportunities to develop their investigative skills and consolidate their learning. (See Appendix 5 of the specifications for more details.)

Turn to pages 10–17 for more information on AS and A level Biology A (Salters-Nuffield).

Biology B

- Courses are built around a combination of traditional and modern topics.
- AS exams: two equally-weighted papers covering specification topics and investigative skills.
- A level exams: all three papers assess theoretical knowledge and understanding of specification topics; Paper 3 also focuses on investigative skills.
- Topics covered alongside the core subject criteria include microbiology; there’s also a focus on physiology, such as osmoregulation and the kidney.
- A range of specific core practicals link directly to AS and A level Biology B specification topics, giving students opportunities to develop their investigative skills and consolidate their learning. (See Appendix 5 of the specifications for more details.)

Turn to pages 18–23 for more information on AS and A level Biology B.

Did you know?

The thematic presentation of topics means you can also teach the courses using a concept-based route, if you wish.
## AS and A level assessment at a glance

### AS

- Exam questions will test students’ knowledge and understanding of the relevant specification topics.
- Each paper assesses students’ knowledge and understanding of experimental methods, based on the core practicals in the specification.
- Question types: multiple choice, short and long answer questions (up to 9 marks), and calculations.
- Questions assessing students’ use of mathematical skills will make up 10% of the exam papers.

### A level

- Exam questions will test students’ knowledge and understanding of the relevant specification topics and experimental methods based on the core practicals in the specification.
- Paper 3 also includes questions based on a pre-release article.
- Question types: multiple choice, short and long answer questions (up to 9 marks), and calculations.
- Questions assessing students’ use of mathematical skills will make up 10% of the exam papers.

#### Paper 1 – Lifestyle, Transport, Genes and Health

- 80 marks
- 50% weighting
- 1 hour 30 minutes
- Topic 1: Lifestyle, Health and Risk
- Topic 2: Genes and Health

#### Paper 2 – Development, Plants and the Environment

- 80 marks
- 50% weighting
- 1 hour 30 minutes
- Topic 3: Voice of the Genome
- Topic 4: Biodiversity and Natural Resources

#### Paper 3 – The Natural Environment and Species Survival

- 100 marks
- 33.3% weighting
- 2 hours
- Topic 1: Lifestyle, Health and Risk
- Topic 2: Genes and Health
- Topic 3: Voice of the Genome
- Topic 4: Biodiversity and Natural Resources
- Topic 5: On the Wild Side
- Topic 6: Immunity, Infection and Forensics

#### Paper 2 – Energy, Exercise and Co-ordination

- 100 marks
- 33.3% weighting
- 2 hours
- Topic 1: Lifestyle, Health and Risk
- Topic 2: Genes and Health
- Topic 3: Voice of the Genome
- Topic 4: Biodiversity and Natural Resources
- Topic 7: Run for your Life
- Topic 8: Grey Matter

#### Paper 3 – General and Practical Applications in Biology

- 100 marks
- 33.3% weighting
- 2 hours
- All topics across the full A level specification.
- A section of the paper will include questions based on a pre-release article.

### Assessing practical work at AS and A level

AS and A level Biology is 100% externally assessed; this means there are no coursework elements in the new courses. Instead, students are required to complete a number of core practicals throughout the courses that cover specific skills and techniques.

Practical skills will now be assessed in two ways:

- **Investigative skills, and knowledge and understanding of core practicals will be tested in AS and A level exams and contribute to students’ overall grades.**

- **Teacher assessment** of students’ skills, techniques and competency when completing practical work will count towards the Practical Endorsement at A level. This is separate to the A level grade and, if awarded, will be reported as a ‘Pass’ on A level certificates.

Looking for more information about AS and A level exams?
The distribution and abundance of species on a rocky shore were investigated using a systematic sampling technique.

(a) The diagram shows the placing of the transect and quadrats on a rocky shore.

(b) Give a reason why systematic sampling, rather than random sampling, was used in this investigation.

This question tests **AO3** by requiring students to analyse data and form a conclusion.

Asterisked questions will also usually be worth 6 or 9 marks. They will test students’ abilities to construct a sustained line of reasoning.

Knowledge of sampling techniques, related to one of the core practicals, is tested in this question part.

The asterisk shows that this is a question testing the logical presentation of information and ideas in students’ answers.

A key point is to construct a sustained line of reasoning by using the ideas in students’ answers.
(b) (i) Another study compared the diversity of species at different places on the shore. On the upper shore the following data were obtained.

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of individuals found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvetia canaliculata</td>
<td>10</td>
</tr>
<tr>
<td>Enteromorpha sp.</td>
<td>3</td>
</tr>
<tr>
<td>Patella vulgata</td>
<td>3</td>
</tr>
<tr>
<td>Littorina littorea</td>
<td>15</td>
</tr>
<tr>
<td>Gibbula sp.</td>
<td>14</td>
</tr>
<tr>
<td>Lichens</td>
<td>15</td>
</tr>
</tbody>
</table>

Calculate an index of diversity (D) for this site using the formula below.

\[
D = \frac{N(N - 1)}{\sum_{i=1}^{n} n_i} - \left( \frac{N}{2} \right)
\]

Where:
- \( n_i \) = total number of organisms of a particular species
- \( N \) = total number of organisms of all species

Answer: .................................................................

This question requires use of mathematical manipulation, in this instance Simpson’s diversity index. This is part of the requirement for 10% of marks in exam papers to assess mathematics.

Any formulae are provided for students.

(ii) On the middle shore the index was found to be 7.74 with a total individual count of 37.

Comment on the relationship between diversity and the total number of individuals on these two parts of the shore.

..........................................................................................................................
..........................................................................................................................
..........................................................................................................................
..........................................................................................................................

(Total for Question 11 = 12 marks)
The question is ramped towards a more demanding final part. Ramping of the whole paper, as well as within each question, encourages students to complete papers whilst still stretching the most able.

**Sample Assessment Materials**

This question comes from **A level Biology A (Salters-Nuffield) Paper 2 – Energy, Exercise and Co-ordination.**

(ii) The number of myofibrils in this electron micrograph is

(i) Calculate the magnification of this electron micrograph.

(b) The electron micrograph shows the arrangement of protein filaments in the contractile units of muscle myofibrils.

![Electron micrograph of muscle myofibrils](image)

2.0 µm

(i) Calculate the magnification of this electron micrograph.

Answer: ..............................................................

(ii) The number of myofibrils in this electron micrograph is

- A one
- B three
- C six
- D nine

10% of marks within the paper will be used to assess mathematical skills, such as this magnification calculation.

(c) Muscle tissue contains fast twitch and slow twitch fibres.

The table below shows the percentage of these fibres in two different people.

<table>
<thead>
<tr>
<th>Person</th>
<th>Percentage of muscle fibre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fast twitch</td>
</tr>
<tr>
<td>A</td>
<td>80</td>
</tr>
<tr>
<td>B</td>
<td>50</td>
</tr>
</tbody>
</table>

Explain which person has muscles that are more resistant to fatigue.

Answer: ..............................................................

(Total for Question 6 = 10 marks)

AS and A level assessment at a glance

AS

- Exam questions will test students’ knowledge and understanding of the relevant specification topics.
- Each paper assesses students’ knowledge and understanding of experimental methods, based on the core practicals in the specification.
- Paper 1 – Core Cellular Biology and Microbiology
  - 80 marks
  - 50% weighting
  - 1 hour 30 minutes
  - Topic 1: Biological Molecules
  - Topic 2: Cells, Viruses and Reproduction of Living Things

- Paper 2 – Core Physiology and Ecology
  - 80 marks
  - 50% weighting
  - 1 hour 30 minutes
  - Topic 3: Classification and Biodiversity
  - Topic 4: Exchange and Transport

Note: All AS exams must be taken in the same examination series. Results from AS examinations will count towards the AS grade but will not form part of the A level grade.

A level

- Exam questions will test students’ knowledge and understanding of the relevant specification topics.
- Paper 1 – Advanced Biochemistry, Microbiology and Genetics
  - 90 marks
  - 30% weighting
  - 1 hour 45 minutes
  - Topic 1: Biological Molecules
  - Topic 2: Cells, Viruses and Reproduction of Living Things
  - Topic 3: Classification and Biodiversity
  - Topic 4: Exchange and Transport
  - Topic 5: Energy for Biological Processes
  - Topic 6: Microbiology and Pathogens
  - Topic 7: Modern Genetics

- Paper 2 – Advanced Physiology, Evolution and Ecology
  - 90 marks
  - 30% weighting
  - 1 hour 45 minutes
  - Topic 1: Biological Molecules
  - Topic 2: Cells, Viruses and Reproduction of Living Things
  - Topic 3: Classification and Biodiversity
  - Topic 4: Exchange and Transport
  - Topic 8: Origins of Genetic Variation
  - Topic 9: Control Systems
  - Topic 10: Ecosystems

- Paper 3 – General and Practical Principles in Biology
  - 120 marks
  - 40% weighting
  - 2 hours 30 minutes
  - All topics across the full A level specification.
  - Half of the paper will focus on testing students’ knowledge and understanding of practical skills and techniques.

Assessing practical work at AS and A level

AS and A level Biology is 100% externally assessed, this means there are no coursework elements in the new courses. Instead, students will be required to complete a number of core practicals throughout the course that cover specific skills and techniques.

Practical skills will be assessed in two ways:

- Teacher assessment of students’ skills, techniques and competency when completing practical work will count towards the Practical Endorsement at A level. This is separate to the A level grade and, if awarded, will be reported as a “Pass” on A level certificates.
Sample Assessment Materials

This question comes from A level Biology B Paper 3 – General and Practical Principles in Biology.

3 The diagram below shows a simple respirometer used by a student to measure the rate of respiration of a small invertebrate called a woodlouse. The rate was measured by observing the distance the indicator fluid moved in a known time.

(a) Give one way in which the student could modify the procedure to obtain a better measurement of the rate of respiration.

(b) Explain what would happen to the indicator fluid after five hours if a culture of known time.

3

(1)

capillary tube

indicator fluid

clip

container

woodlouse

carbon dioxide absorber

(b) Explain what would happen to the indicator fluid after five hours if a culture of a small invertebrate called a woodlouse.

Your answer should explain the reasons for the modifications and include reference to the ethical treatment of the animal, and show how you could produce valid results.

(5)

(Total for Question 3 = 12 marks)

(c) (i) The student wanted to compare the rate of respiration of a mouse with that of a woodlouse.

Explain how you could modify the procedure used to measure the rate of respiration of the woodlouse so that it could be used to compare with the rate of respiration of a mouse.

Your answer should explain the reasons for the modifications and include reference to the ethical treatment of the animal, and show how you could produce valid results.

(2)

(ii) Comment on how the results you would expect to obtain for a mouse would differ from the results for a woodlouse.

(Total for Question 3 = 12 marks)

Learn more at http://quals.pearson.com/edexcelasandalevel/biologyb/SAMs
Sample Assessment Materials

This question comes from A level Biology B Paper 1 – Advanced Biochemistry, Microbiology and Genetics.

(a) Which is the correct order of the phases 1 to 4 shown on the graph?

- A lag, log, death, stationary
- B lag, log, stationary, death
- C log, lag, death, stationary
- D log, lag, stationary, death

(1)

(b) Evaluate the use of dilution plating and optical methods for determining the number of bacterial cells in a culture.

Answer: ..............................................................

(Total for Question 8 = 11 marks)

(c) Calculate the growth rate constant (k) for phase 2 of this culture, using the formula:

\[ k = \frac{\log_{10} N_f - \log_{10} N_i}{0.301 \times t} \]

(4)

* Asterisked questions will usually be worth 6 or 9 marks. They will test students’ abilities to present information and ideas logically and construct a sustained line of reasoning.

Typically, about 10% of questions on question papers (except A level Paper 3) will be multiple-choice questions in this format.

(6)

Learn more at http://quals.pearson.com/edexcelasandalevel/biologyb/SAMs
**How we’re supporting you**

Based on what you’ve told us, we’ve looked in depth at how we can give you the support you need to plan and implement the Edexcel AS and A level Biology A (Salters-Nuffield) and Biology B specifications successfully. We’ve also explored how we can help you and your students overcome those critical barriers to progress in science.

Whether it’s getting started with the qualifications, helping students to master fundamental mathematical and practical skills, or getting an answer to a query, we’ll be there to help with a wide range of free support.

**Understanding the new standard**

- **A bank of exemplar student work** and **examiner commentaries**, available before first teaching to help you and your students understand the standard that’s expected.

- **Additional sample assessment materials** to help you familiarise yourself with the assessment styles and to use with your students to help assess their progress throughout the course.

- **Enhanced examiner reports** and **feedback training events*** after each exam series.

**Designing your curriculum**

- **Getting Started Guides** – summarising the AS and A level Biology, our assessment models and specification content.

- **Mapping documents** showing changes to the AS and A level specifications, so you know the content that’s been removed, added, or changed in emphasis – all at a glance.

- **Editable schemes of work** and **course planners** for teaching AS and A level courses separately or together, to account for the different teaching approaches your centre may choose.

**Preparing for practical work**

- **A handy list of core practicals** enabling you to get the information you need from the specifications quickly and easily.

- **Mapping documents** matching the core practicals to the essential skills appendix in our specifications.

- **Teacher, technician and student worksheets** which detail the procedure, apparatus and safety instructions for each core practical.

- **Teacher materials for developing investigative skills**, helping you integrate practical work and the teaching of investigative skills into your lessons.

- **Student materials for developing investigative skills** encouraging a deeper understanding of the underlying science behind practicals, guiding students to think independently as scientists and helping their preparations for AS and A level assessment.

**Teaching and learning**

- **Transition units** – written by experienced teachers, these classroom materials are designed for those initial AS lessons, to help your students develop the essential skills they need to transition from GCSE to A level study successfully.

- **Topic delivery guides** to refresh your knowledge on some of the AS and A level content, and offer teaching suggestions.

- **Teacher and student materials for developing maths skills** to help you and your students understand the mathematical requirements of the AS and A level specifications and give opportunities to practise applying these essential skills.

**Tracking and progression**

- **ResultsPlus**
  A free online service giving detailed, instant feedback on your students’ exam performance.

- **Secure mock papers** that will be released when you need them.

- **Mock Analysis** – a specific component of our ResultsPlus service that allows you to use past papers as mocks and receive the same detailed analysis of students’ exam performance.

- **examWizard**
  A free, easy-to-use exam preparation tool containing a bank of past questions to help you create your own mock exams and tests.

*There may be a charge for these events.
Subject and local support when you need it

- **New to Edexcel events** to support you as you prepare to teach our courses from September 2015.
- **Local network events** for the latest updates and providing opportunities to network and share best practice with fellow teachers.
- **Training events** throughout the academic year to help with delivering the AS and A level courses.
- **Regular email updates** from our Science Team.
- **An expert Subject Advisor, Irine Muhiudden, and specialist Science Team** available to answer your queries.


Published resources

**Endorsed resources for: Edexcel AS and A level Biology A (Salters-Nuffield) and Edexcel AS and A level Biology B**

We’re committed to helping teachers deliver our new AS and A level Biology courses and students to achieve their full potential. To do this, we aim for our qualifications to be supported by a wide range of high-quality resources, produced by a range of publishers, including ourselves.

We’re working with a range of publishers who have their resources endorsed:

- Hodder Education: Edexcel A level Biology Year 1 and Year 2 (Student Book, Student Guides, and Teaching and Learning Resources).
- Edexcel AS/A level Biology B: Books 1 and 2.

It is not necessary to purchase endorsed resources, including those published by Pearson, to deliver our qualifications.

**Published resources from Pearson**

**Salters-Nuffield AS/A level Biology**

The Salters-Nuffield (SNAB) resources have been tried and trusted for over a decade and are the only A level Biology resources that are supported by a dedicated project team run by the University of York Science Education Group (UYSEG).

Developed in collaboration with schools, educational specialists and scientists from universities and industry, the edition of Salters-Nuffield AS/A level Biology continues to offer a context-led approach to A level Biology designed to stimulate scientific interest and enquiry set in real-life contexts. With exciting new features throughout, Salters-Nuffield AS/A level Biology helps to develop successful independent biologists able to progress from GCSE and to further study at Higher Education and beyond.

**Edexcel AS/A level Biology B**

Our paid-for resources are written specifically to help you teach the new Edexcel A level Biology B and to develop successful independent biologists able to progress from GCSE and to further study at Higher Education and beyond.

**Developing a deep subject understanding:** help your students understand the bigger picture and recognise connections across topics.

**Removing the barriers to learning:** understanding core conceptual knowledge and acquiring key scientific skills are essential to removing barriers to learning and developing confident and independent learners.

**Synoptic learning and exam preparation:** our Edexcel A level Biology B course approaches synoptic learning, consolidation and revision.

Get in touch!

Supporting you for any of your science qualification needs

support.pearson.com/uk/s/qualification-contactus