AS and A level Biology

* Biology A (Salters-Nuffield)
* Biology B

from 2015

Your guide to our new qualifications
Hello and welcome

With our new AS and A level Biology qualifications, we’ve created courses that 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 for first teaching in September 2015:

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

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

The new AS and A level Biology

Whilst much will seem familiar to you, there are some changes and new additions to our AS and A level Biology from September 2015.

- AS and A level Biology will be linear qualifications; assessments for each qualification will now take place at the end of each course.
- AS will be a stand-alone qualification, meaning it will not form part of students’ A level grades. However, the content of the AS is included in the A level content, to allow the two qualifications to be co-taught.
- Questions assessing students’ use of mathematical skills will make up 10% of the exam papers. This is about the same proportion allocated in our current exam papers, but you may notice that questions now test a wider range of maths skills, and to a slightly greater depth.
- There will be no coursework elements in our AS and A level Biology courses. Instead, students will be required to complete a number of core practicals which cover specific skills and techniques.
- Practical skills will now be assessed in two ways: investigative skills, and knowledge and understanding of some core practicals will be assessed in AS and A level exams and contribute to students’ overall grades.
- Teacher assessment of students’ competency when completing practical work will count towards the separate Practical Endorsement at A level (see page 7 for more details).
- We’ve taken the opportunity to update our specifications and have replaced some elements with new content to strengthen their focus on the key principles of biology.
- Some of your students will be hoping to study biology or a related subject at university. Wishing to encourage this, we’ve worked with Higher Education institutions to ensure that our qualifications provide the right preparation for further study.

We’re here to help you understand the changes to AS and A level Biology, so you’re ready to teach the new specifications from September 2015. 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 Getting Ready to Teach events and answering any questions you might have about our new specifications.

The Science Team

AS and A level Biology are changing. You can learn more at: www.edexcel.com/BiologyChanges.
Our Edexcel AS and A level Biology qualifications

Straightforward and balanced specifications

- The new 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.

Inspiring students to think 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

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 has been based on approaches we know work well already in our international exams and current specifications.
- There are plenty of tools and support available to help you and your students with exam preparation. In addition to student exemplars with examiner commentaries and extra assessment materials, there’s a range of free online services to help you and your students test, track and understand their progress and performance.

Support that’s timely and tailored to your needs

- It’s specialist: your Subject Advisor, Stephen Nugus, 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 in the run-up to September 2015 and beyond.
- 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 new AS and A level 2015 Biology qualifications

Both our new 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, updated for September 2015. (See page 8 for more details.)
- AS and A level Biology B – brand-new courses for September 2015 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 from September 2015, 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:

- **AS Paper 1**
- **AS Paper 2**

**=** **AS grade**

*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:

- **A level Paper 1**
- **A level Paper 2**
- **A level Paper 3**

**=** **A level grade**

*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)

- Teacher assessment of students’ practical competency
- **=** Practical Endorsement (reported on A level certificate)

**Practical Endorsement**

From September 2015, AS and A level Biology will be 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 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.

AS and A level Biology are changing. You can learn more at: [www.edexcel.com/BiologyChanges](http://www.edexcel.com/BiologyChanges).

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

There are many ways to teach a subject as diverse as biology. That’s why we’re offering (Salters-Nuffield) and Biology B cover the core subject criteria and are an excellent basis 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, updated for September 2015. 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.)

Did you know?

The thematic presentation of topics means you can also teach the courses using a concept-based route, if you wish.

Biology B

- Brand-new courses designed for first teaching from September 2015.
- 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.)

Did you know?

The nature of the topics means you can also teach the courses using a context-based route, if you wish.

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

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

**AS** (first assessment: summer 2016)
- Exam questions will test students’ knowledge and understanding of the relevant specification topics.
- Each paper will also assess 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.

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

- 80 marks
- 60% 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
- 60% weighting
- 1 hour 30 minutes
- Topic 3: Voice of the Genome
- Topic 4: Biodiversity and Natural Resources

**A level** (first assessment: summer 2017)
- 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 will also include 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 – 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

From September 2015, AS and A level Biology will be 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 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.
11 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.

(1) 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.

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

Asterisked questions are also demanding, but they provide an introduction to more challenging nature.

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

The question begins with a less demanding part, so it is accessible to students and encourages them to progress throughout the paper.

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

Learn more at **www.edexcel.com/BioASAMs**.
(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.

\[ D = \frac{N(N - 1)}{\sum n(n - 1)} \]

\( n \) = total number of organisms of a particular species
\( N \) = total number of organisms of all species

Answer

(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)
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.

Answer ..............................................................

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.

(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 ..............................................................

The question requires students to analyse the data and form a conclusion using their biological knowledge – this tests AO3.

Learn more at www.edexcel.com/BioASAMs.
Exam questions will test students’ knowledge and understanding of the relevant specification topics.

Each paper will also assess 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.

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

Notes on AS exams: 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 (first assessment: summer 2017)

Exam questions will test students’ knowledge and understanding of the relevant specification topics.

Paper 3 will also test students’ investigative skills, based on 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.

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

From September 2015, AS and A level Biology will be 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 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.

Students will be asked about their understanding of the core practicals they have carried out.

Our specification gives guidance on the command words used in our question papers. For “explain”, the question will always require students to give a justification.

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 green algae was added to the container and the tube was completely covered in light-proof paper.

(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 would produce valid results.

(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)
**Sample Assessment Materials**

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

A broth culture for growing bacteria was set up.

Dilution plating was used to determine the number of live bacteria in the culture over a period of 24 hours.

The graph below shows the number of live bacteria in the culture during this 24-hour period.

(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

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

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

\[
k = \frac{\log_{10} N_f - \log_{10} N_0}{0.301 \times t}
\]

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

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.

10% of marks in the papers will require candidates to use mathematical skills. This question requires students to read from the graph and use their calculator to process the data.

**Learn more at www.edexcel.com/BioBSAMs**
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 new 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 new 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.

**Designing your curriculum**

- **Getting Started Guides** – summarising the changes to AS and A level Biology from 2015, 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.

**Preventing 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.

**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 new 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.

**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 new 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.
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 new 2015 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.

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.

Coming spring 2015! Sign up now at: www.pearsonschools.co.uk/aleveledexcelbiology2015cg.

Note: These resources are not yet endorsed and will be subject to change.
Get in touch!

Supporting you in the run-up to September 2015 and beyond

Email us: TeachingScience@pearson.com

Call us: 0844 576 0037

Visit us online: www.edexcel.com/Biology2015