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 from September 2015. 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**, 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.)*

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

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.)*

Turn to page 18 for more information on AS and A level Biology B.

Did you know?

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

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 | ⚖ 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

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 (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.

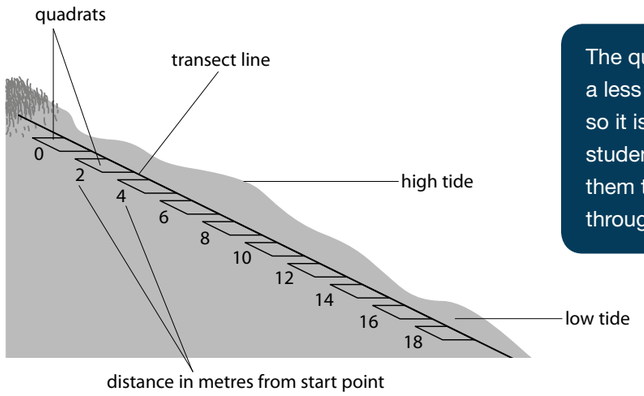
Sample Assessment Materials

This question comes from **A level Biology A (Salters-Nuffield) Paper 1 – The Natural Environment and Species Survival**.

Our questions increase in **demand** throughout the paper; this one is placed near the end of the paper, highlighting its more challenging nature.

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.



Not to scale

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

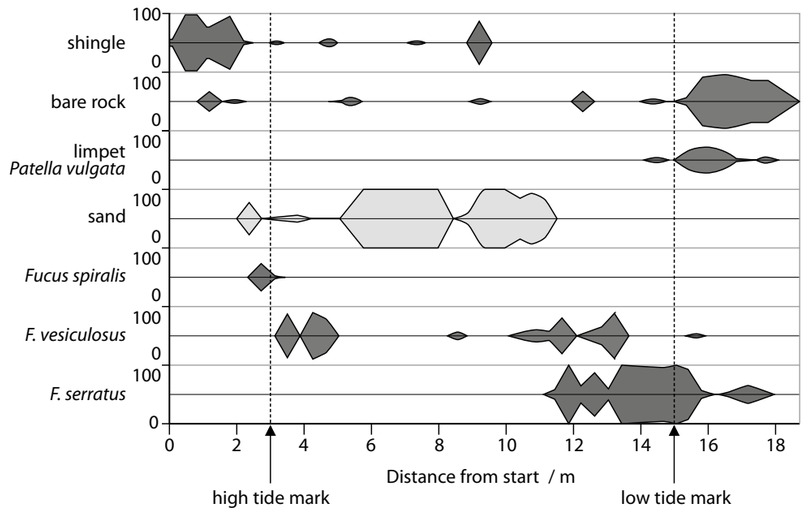
(i) Give a reason why systematic sampling, rather than random sampling, was used in this investigation.

(1)

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.

*(ii) The diagram shows the distribution of some of the abiotic and biotic components of a sea shore. There are three species of seaweed (*Fucus*) and one species of limpet (*Patella vulgata*). Limpets feed on seaweed.



Analyse the data to explain how the distribution patterns of *Fucus spiralis*, *Fucus vesiculosus* and *Fucus serratus* are affected by abiotic and biotic factors.

(6)

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**.

(b) (i) Another study compared the diversity of species at different places on the shore. On the upper shore the following data were obtained.

Species	Number of individuals found
Pelvetia canaliculata	10
Enteromorpha sp.	3
Patella vulgata	3
Littorina littorea	15
Gibbula sp.	14
Lichens	15

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

(3)

$$D = \frac{N(N-1)}{\Sigma n(n-1)}$$

n = total number of organisms of a particular species

N = total number of organisms of all species

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.

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.

(2)

.....

.....

.....

.....

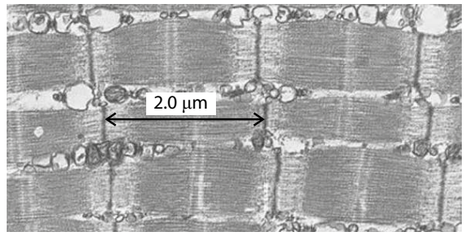
(Total for Question 11 = 12 marks)

This question requires students to **interpret** the information they have calculated in the earlier question to compare with another area of the shore (errors carried forward will be allowed for).

Sample Assessment Materials

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

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



© P154/0217 Skeletal muscle, Biology Media/Science Photo Library

(i) Calculate the magnification of this electron micrograph.

(2)

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

Answer .....

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

(1)

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

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.

(iii) The electron micrograph shows the myofibrils in a relaxed muscle.

Explain how the appearance of this myofibril changes when a muscle contracts.

(2)

.....

.....

.....

.....

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

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

Person	Percentage of muscle fibre	
	Fast twitch	Slow twitch
A	80	20
B	50	50

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

(4)

This **4-mark** question requires students to analyse the data and form a conclusion using their biological knowledge – this tests **AO3**.

.....

.....

.....

.....

.....

.....

.....

(Total for Question 6 = 10 marks)

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 – 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 (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.

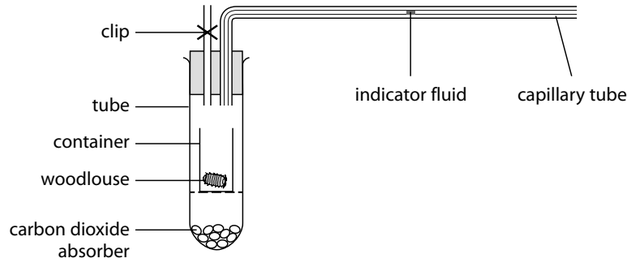
Sample Assessment Materials

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

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

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.

(1)

(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.

(4)

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.

(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.

(5)

Students need to be able to **develop** and **refine** practical design and procedures, so some questions will assess these skills.

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

(2)

(Total for Question 3 = 12 marks)

Sample Assessment Materials

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

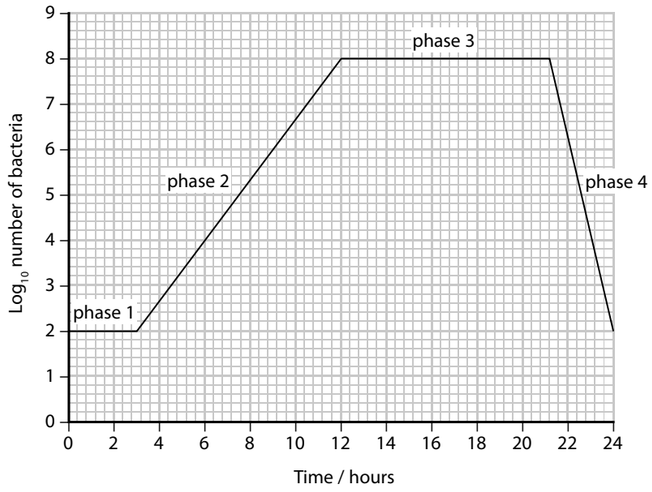
Our questions increase in **demand** throughout the paper; this one is placed near the end of the paper, highlighting its more challenging nature.

However, we also **ramp** the level of demand within questions too. It begins with an **accessible** introduction and multiple-choice question to ensure that all students have the opportunity to engage with this part of the paper.

8 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?

(1)

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

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

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

(6)

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**.

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

$$k = \frac{\log_{10}N_t - \log_{10}N_0}{0.301 \times t}$$

(4)

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.

Answer .....

(Total for Question 8 = 11 marks)