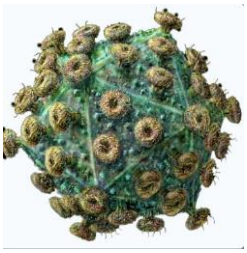
AQA A LEVEL BIOLOGY



A Level Biology is made up of 8 topics, topics 1-4 are taught in yr 12, topics 5-8 in yr 13. You will be assessed throughout with formal exams in the early spring of yr 12, summer yr 12 and winter of yr 13. Final exams will be summer yr 13.

The qualification is based on your achievements in terminal exams, this means exams that take place at the end of the course and **only** these count towards your final grade.

Core content

1. Biological molecules

All life on Earth shares a common chemistry. This provides indirect evidence for evolution. Despite their great variety, the cells of all living organisms contain only a few groups of carbon-based compounds that interact in similar ways. Carbohydrates are commonly used by cells as respiratory substrates. They also form structural components in plasma membranes and cell walls. Lipids have many uses, including the bilayer of plasma membranes, certain hormones and as respiratory substrates. Proteins form many cell structures. They are also important as enzymes, chemical messengers and components of the blood. Nucleic acids carry the genetic code for the production of proteins. The genetic code is common to viruses and to all living organisms, providing evidence for evolution. The most common component of cells is water; hence our search for life elsewhere in the universe involves a search for liquid water.

Summary of content:

Monomers & polymers **carbohydrates** **lipids** **proteins** **enzymes** **DNA & RNA**

DNA replication **ATP** **water** **inorganic ions**

2. Cells

All life on Earth exists as cells. These have basic features in common. Differences between cells are due to the addition of extra features. This provides indirect evidence for evolution. All cells arise from other cells, by binary fission in prokaryotic cells and by mitosis and meiosis in eukaryotic cells. All cells have a cell-surface membrane and, in addition, eukaryotic cells have internal membranes. The basic structure of these plasma membranes is the same and enables control of the passage of substances across exchange surfaces by passive or active transport. Cell-surface membranes contain embedded proteins. Some of these are involved in cell signalling – communication between cells. Others act as antigens, allowing recognition of 'self' and 'foreign' cells by the immune system. Interactions between different types of cell are involved in disease, recovery from disease and prevention of symptoms occurring at a later date if exposed to the same antigen, or antigen-bearing pathogen.

Summary of content:

Eukaryotic, prokaryotic and virus cell structure **transport across membranes** **mitosis**

cell recognition and the immune system **microscopy**

3. Organisms exchange substances with their environment

The internal environment of a cell or organism is different from its external environment. The exchange of substances between the internal and external environments takes place at exchange surfaces. To truly enter or leave an organism, most substances must cross cell plasma membranes. In large multicellular organisms, the immediate environment of cells is some form of tissue fluid. Most cells are too far away from exchange surfaces, and from each other, for simple diffusion alone to maintain the composition of tissue fluid within a suitable metabolic range. In large organisms, exchange surfaces are associated with mass transport systems that carry substances between the exchange surfaces and the rest of the body and between parts of the body. Mass transport maintains the final diffusion gradients that bring substances to and from the cell membranes of individual cells. It also helps to maintain the relatively stable environment that is tissue fluid.

Summary of content:

Surface Area to volume ratio **gas exchange** **digestion and absorption**

mass transport in plants and animals

4. Genetic information, variation and relationships between organisms

Biological diversity – biodiversity – is reflected in the vast number of species of organisms, in the variation of individual characteristics within a single species and in the variation of cell types within a single multicellular organism. Differences between species reflect genetic differences. Differences between individuals within a species could be the result of genetic factors, of environmental factors, or a combination of both. A gene is a section of DNA located at a particular site on a DNA molecule, called its locus. The base sequence of each gene carries the genetic code that determines the sequence of amino acids during protein synthesis. The genetic code is the same in all organisms, providing indirect evidence for evolution. Genetic diversity within a species can be caused by gene mutation, chromosome mutation or random factors associated with meiosis and fertilisation. This genetic diversity is acted upon by natural selection, resulting in species becoming better adapted to their environment. Variation within a species can be measured using differences in the base sequence of DNA or in the amino acid sequence of proteins. Biodiversity within a community can be measured using species richness and an index of diversity.

Summary of content:

DNA, genes and chromosomes **protein synthesis** **genetic diversity** **adaptation**

Species and taxonomy **diversity within a community** **investigating diversity**

5. Energy transfers in and between organisms (A-level only)

Life depends on continuous transfers of energy.
In photosynthesis, light is absorbed by chlorophyll and this is linked to the production of ATP.
In respiration, various substances are used as respiratory substrates. The hydrolysis of these respiratory substrates is linked to the production of ATP.
In both respiration and photosynthesis, ATP production occurs when protons diffuse down an electrochemical gradient through molecules of the enzyme ATP synthase, embedded in the membranes of cellular organelles.
The process of photosynthesis is common in all photoautotrophic organisms and the process of respiration is common in all organisms, providing indirect evidence for evolution.
In communities, the biological molecules produced by photosynthesis are consumed by other organisms, including animals, bacteria and fungi. Some of these are used as respiratory substrates by these consumers.
Photosynthesis and respiration are not 100% efficient. The transfer of biomass and its stored chemical energy in a community from one organism to a consumer is also not 100% efficient.

6. Organisms respond to changes in their internal and external environments (A-level only)

A stimulus is a change in the internal or external environment. A receptor detects a stimulus. A coordinator formulates a suitable response to a stimulus. An effector produces a response. Receptors are specific to one type of stimulus.

Nerve cells pass electrical impulses along their length. A nerve impulse is specific to a target cell only because it releases a chemical messenger directly onto it, producing a response that is usually rapid, short-lived and localised.

In contrast, mammalian hormones stimulate their target cells via the blood system. They are specific to the tertiary structure of receptors on their target cells and produce responses that are usually slow, long-lasting and widespread.

Plants control their response using hormone-like growth substances.

7. Genetics, populations, evolution and ecosystems (A level only)

The theory of evolution underpins modern Biology. All new species arise from an existing species. This results in different species sharing a common ancestry, as represented in phylogenetic classification. Common ancestry can explain the similarities between all living organisms, such as common chemistry (eg all proteins made from the same 20 or so amino acids), physiological pathways (eg anaerobic respiration), cell structure, DNA as the genetic material and a 'universal' genetic code.

The individuals of a species share the same genes but (usually) different combinations of alleles of these genes. An individual inherits alleles from their parent or parents.

A species exists as one or more populations. There is variation in the phenotypes of organisms in a population, due to genetic and environmental factors. Two forces affect genetic variation in populations: genetic drift and natural selection. Genetic drift can cause changes in allele frequency in small populations. Natural selection occurs when alleles that enhance the fitness of the individuals that carry them rise in frequency. A change in the allele frequency of a population is evolution.

If a population becomes isolated from other populations of the same species, there will be no gene flow between the isolated population and the others. This may lead to the accumulation of genetic differences in the isolated population, compared with the other populations. These differences may ultimately lead to organisms in the isolated population becoming unable to breed and produce fertile offspring with organisms from the other populations. This reproductive isolation means that a new species has evolved.

Populations of different species live in communities. Competition occurs within and between these populations for the means of survival. Within a single community, one population is affected by other populations, the biotic factors, in its environment. Populations within communities are also affected by, and in turn affect, the abiotic (physicochemical) factors in an ecosystem.

8. The control of gene expression (A-level only)

Cells are able to control their metabolic activities by regulating the transcription and translation of their genome. Although the cells within an organism carry the same coded genetic information, they translate only part of it. In multicellular organisms, this control of translation enables cells to have specialised functions, forming tissues and organs.

There are many factors that control the expression of genes and, thus, the phenotype of organisms. Some are external, environmental factors, others are internal factors. The expression of genes is not as simple as once thought, with epigenetic regulation of transcription being increasingly recognised as important.

Humans are learning how to control the expression of genes by altering the epigenome, and how to alter genomes and proteomes of organisms. This has many medical and technological applications.

Consideration of cellular control mechanisms underpins the content of this section. Students who have studied it should develop an understanding of the ways in which organisms and cells control their activities. This should lead to an appreciation of common ailments resulting from a breakdown of these control mechanisms and the use of DNA technology in the diagnosis and treatment of human diseases.

Exams & Assessments

Students will be assessed throughout the year. There are 4 topics in each year and an assessment in the middle and at the end of each one.

At the end of year 12, during the summer term all students will sit formal **Internal Progression Exams (IPE's)** in the hall.

At the end of the course students will sit 3 papers, each 2 hours long. Paper 1 assesses topics 1-4, paper 2 assesses topics 5-8 and paper 3 all topics and includes an extended essay question.

Weighting of assessment objectives for A-level Biology

Assessment objectives (AOs)	Component weightings (approx %)			Overall weighting (approx %)
	Paper 1	Paper 2	Paper 3	
AO1	44–48	23–27	28–32	30–35
AO2	30–34	52–56	35–39	40–45
AO3	20–24	19–23	31–35	25–30
Overall weighting of components	35	35	30	100

10% of the overall assessment of A-level Biology will contain mathematical skills equivalent to Level 2 or above.

At least 15% of the overall assessment of A-level Biology will assess knowledge, skills and understanding in relation to practical work.

Expectations

All students will be expected to maintain a **high attendance** level and it will be your responsibility to catch up with any work missed due to absence.

You will need to buy;

- a text book
- a hard backed note book for use as a laboratory book.
- a folder, with dividers and plastic wallets to store your lesson notes in.

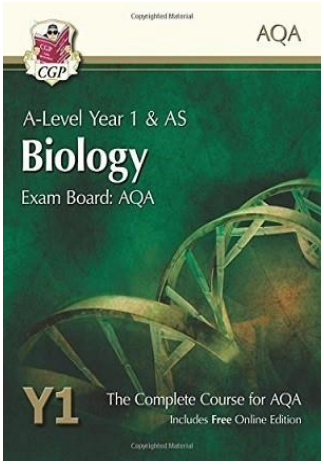
You will be expected to **study outside of school** hours to extend your knowledge and understanding of the topics being taught and produce **all work on the agreed deadlines.** Failure of any of the above will result in yourself and your parents being asked to attend an interview with the Head of Biology and/or the Sixth Form Team to address these issues and if not resolved could result in removal from the course.

TEXT BOOKS

We will be using the following text book for AS AQA Biology:

CGP A-Level Year 1 & AS Biology ISBN 978 1 78294 319 8

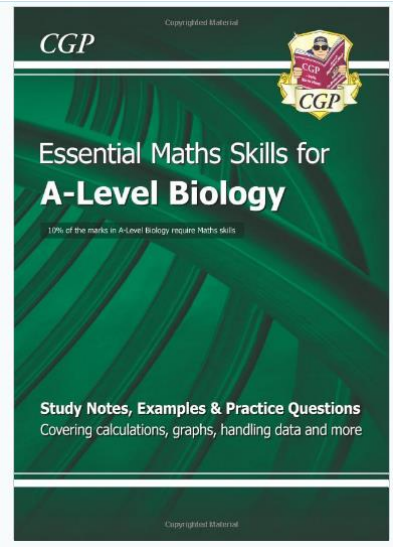
(There are text books available from CGP that cover both years 1 and 2, which are also fine to use).

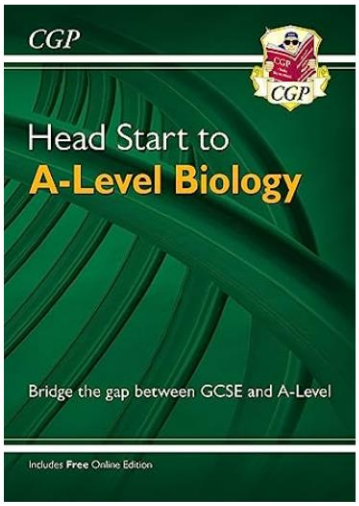


OTHER BOOKS

It is also recommended that students purchase one of the books available that cover the maths skills required in A level Biology. The new specification includes more maths than the previous one and around 10% of the marks require these maths skills. There are various books available but CGP have one entitled 'Essential Maths Skills for A-level Biology'.

In addition, the Head Start to Biology text book supports with the transition from GCSE to A level and is recommended for Yr 12.





AS Biology Residential Field Trip – Investigating Populations & Environments

During the summer term of Year 12 we will be running a residential fieldtrip to Flatford Mill in Suffolk. This trip offers an excellent opportunity for students that will enrich their knowledge and understanding of A level Biology.

At A level, the AQA specification places considerable emphasis on practical work including. The course to Flatford Mill provided by the Field Studies Council gives comprehensive coverage of much of the populations and ecology content from the A level course and will use fieldwork to allow students to gain a strong understanding of "How Science Works"; through the development and practice of investigative skills and through the consideration of how scientific evidence may be used to assess people's impact on the environment. In addition, we will carry out two of the six required core practicals in the field.

In addition, the course includes:

- Expert tuition by fully trained staff
- Rigorous and proven health and safety procedures including 24 hour emergency cover
- Full board
- Specialist equipment and exclusive access to specially developed resources.

Individual letters will be given to all AS Biology students in September giving all the relevant details of the trip. This will include cost and payment details (including deposit details).

COURSE CONTENT

Definitions and Concepts *(revisited AS content in italics)*	**Sampling and Experimental Techniques**	**Data Analysis and Presentation Skills** *(revisited AS content in italics)*	**How Science Works (these areas will either be linked to fieldwork or discussion sessions)**
• *Species concept* • *Taxonomy* • *Species diversity* • Habitat, population • Community, ecosystem • Niche, Abiotic/biotic • Population size effected by: abiotic factors • Inter/intraspecific competition & predation • Energy transfer /trophic levels • Net/gross productivity • Succession (pioneer to climax)	• Random sampling • Transect sampling • Percentage cover and frequency • Mark-Release-Recapture • Quantitative data on energy transfer	• Construction of pyramids of no/biomass/energy • Species Diversity Index • Graphical techniques • Mean, normal distribution and Standard deviation • *Null Hypotheses* • *Standard Error (95% confidence)* • *Spearmans Rank and/or Chi-squared*	• Effect of farming practices on energy efficiency and productivity such as: - Fertilisers (inc leaching/eutrophication) - Pesticides - Biological control - Intensive farming • Global warming and effect on such as: - Crop yield - Insects no.s/life cycles - Distribution of spp • Conservation of spp/habitat and management of succession (use of scientific evidence and conflicts of interest)