THE GREEN SCHOOL FOR GIRLS

Biology KS5 Curriculum Map

Core knowledge and sequencing

Vision Statement

Our vision for the KS5 Biology curriculum is to provide students with a rigorous and engaging learning experience that fosters their curiosity and passion for the subject. Our curriculum will equip students with the knowledge and skills necessary to succeed in their future careers, whether in industry or academia.

Biology is an essential subject for understanding the world around us, and we aim to inspire students to explore the fascinating and diverse aspects of biology. We want our students to be able to think critically, solve problems, and communicate effectively, so they can become leaders in their fields and positively impact society. We envision a curriculum that instils a strong passion for biology, fosters critical thinking, and prepares students to be informed, ethical, and innovative leaders in the ever-changing field of life sciences.

Our curriculum map is designed to be a transformative journey, where students embark on a path of discovery, exploration, and intellectual growth. It focuses on providing students with a comprehensive understanding of the fundamental principles of biology, including the detailed structure of cells and their organelles, as well as the impact of biological molecules as basic building structures. Through practical experiments and engaging theoretical discussions, students will also explore advanced topics, such as immunity, bioenergetics, and gene technology.

Ultimately, our vision for the KS5 Biology AQA curriculum is to empower students to become lifelong learners who are passionate about chemistry and who have the knowledge and skills to make a meaningful impact on the world around them.

Mapping Key:

Core knowledge
Syllabus/NC requirements & coverage
Spiralled concepts / sequences
Hinterland knowledge, experiences, reading
Hyperlink - Units of learning / sequences of lessons / Hyperlink Knowledge Organisers

Year 12

	Autumn Term Y12	Spring Term Y12	Summer Term Y12
What comes before and after (GCSE/Y13)?	**At GCSE, students will already be familiar with the fundamentals of cell structure, DNA, enzymes and sugars as in carbohydrates. Students will also have studies cell division, chemistry of food, microbial growth linking to diseases and monoclonal antibodies.,** **The concepts taught in this term are frequently revisited through Y12 and Y13 and are fundamental to accessing the rest of the A-level course**	**At GCSE, they learn some of the key concepts in the topics genetics and evolution, variation, reproduction and organisation of the digestive system. They have also learnt about transpiration and cells of vascular bundles which will be spiralled in yr 12** **In year 13, they will revisit ideas around inheritance, epigenetics, application of mutation on the synthesis of proteins etc. Students will develop their skill to create more synoptic links.**	**In GCSE, they have learnt about biodiversity and ecosystem and interdependence and competition. Students use this previous knowledge and enhance on their yr 12 knowledge.** **In year 13, they will learn about how the population may lead to the birth of a new species**
What do we teach? Core knowledge **Spiralled concepts**	<u>Knowledge / Concepts</u> 3.1 Biological molecules- 1. Monomers and polymers 2. Carbohydrates 3. Lipids 4. Proteins 5. Enzymes	<u>Knowledge / Concepts</u> 3.3.1 Surface area to volume ratio 3.3.2 Gas exchange 3.3.3 Digestion and absorption 3.3.4 Mass transport 3.4.1 DNA, genes and chromosomes 3.4.2 DNA and protein synthesis	<u>Knowledge / Concepts</u> 3.4.4 Genetic diversity and adaptation 3.4.5 Species and taxonomy 3.4.6 Biodiversity within a community 3.4.7 Investigating diversity

	Autumn Term Y12	Spring Term Y12	Summer Term Y12
	6. Nucleic acids 7. ATP and water 8. Inorganic ions 3.2.1 Cell structure and function 1. Structure and function of Eukaryotic cell 2. Adaptation of cells 3. Compare Eukaryotic and prokaryotic cell 4. Methods of studying cells 5. Fractionation and centrifugation 3.2.2 Cells arise from other cells 1. Cell cycle and mitosis 2. Uncontrolled cell division 3. Binary fission 3.2.3 Transport across cell membranes 3.2.4 Cell recognition and the immune system **'Big Questions'** ● **What are different structures and functions of biological molecules** ● **How can we study cells using centrifugal techniques and microscopes?** ● **How does our immune system works?** ● **How does substance transport across the cell membrane?** **Spiralled Concepts**	3.4.3 Genetic diversity can arise as a result of mutation or during meiosis **'Big Questions'** ● **What is the importance of different structures needed for gas exchange in various organisms?** ● **How is DNA, genes related to protein synthesis?** ● **What is the link between protein synthesis and control of cell division?** ● **What is the link between digestion, absorption and transport across the membrane?** ● **What are different types of proteins and how are they linked with digestion?** ● **What is the role of Hb in gas exchange in different organisms?** **Spiralled Concepts** ● Transport across cell membrane ● Specialised cells, function and adaptation ● Structure of nucleus ● Structure and function of proteins ● Cells in vascular bundle ● Gas exchange	**'Big Questions'** ● **How does courtship behaviours help us to understand the species recognition** ● **How is phylogenetic classification system applied in the real world?** ● **What is a taxon?** ● **What is index of diversity and what is it used for?** ● **What are the different method by which index of diversity investigated?** **Spiralled Concepts** ● Trends in the periodic table ● Spectroscopy ● Enthalpy changes ● Drawing and naming organic molecules ● Writing balanced equations and ionic equations

	Autumn Term Y12	Spring Term Y12	Summer Term Y12
	• Cell structure • Fundamental molecules of life- biochemical • Stimulants to immune system • Role of specific genes in controlling cell division • Importance of ions and proteins in transporting substances across the membrane		
How does this meet the syllabus/NC requirements?	The curriculum follows AQA's syllabus and includes all knowledge and skills from the specification The scheme uses the recommended split in topics between two teachers.		
Why do we teach in this sequence?	The order in which topics are taught in biology is based on a logical progression of concepts, building from simpler to ideas that are more complex. Biological molecules provides a foundation for understanding the structure of cell wall, DNA, proteins etc. Students learn about the basic constituents of these molecules, which they can apply synoptically throughout the course. This knowledge is essential for understanding many Biology topics. Cells are constructed from biological molecules. Students gain an understanding of how these molecules, such as proteins, lipids, carbohydrates, and nucleic acids, play critical roles in cell structure and function by studying them together. This contextual understanding	Once students have learnt key concepts from last term, students can now apply these in the topic taught in this term. Combining mass transport, genes, and protein synthesis highlights the interdisciplinary nature of biology. It encourages students to make connections between genetics, biochemistry, and physiology, resulting in a more thorough understanding of living organisms. They can investigate how genetic differences affect protein structure and function in the context of mass transport. Students can use this approach to investigate the real-world implications of genetic information and its role in the synthesis of proteins involved in mass transport mechanisms.	This integrated approach fosters a deeper appreciation for the complexity of life on Earth and how genetic, ecological, and taxonomic factors contribute to the diversity of species within ecosystems. By studying these topics together, students can analyze how genetic diversity at the molecular level influences species diversity, how species are classified and organized into taxonomic groups, and how biodiversity within communities is shaped by ecological interactions and adaptations. This holistic perspective enhances students' critical thinking skills, encourages them to explore the intricate web of life, and equips them to address ecological and conservation

	Autumn Term Y12	Spring Term Y12	Summer Term Y12
	increases the material's relevance and meaning. This lays the foundational knowledge for understanding the topic energy transfer in and between organisms in year 2. Many cellular processes and functions rely on specific biological molecules. Protein structure, for example, determines their functions as enzymes or structural components of cells. When these concepts are taught together, students can see the direct connections between molecular biology and cell biology, which reinforces their understanding.	They can link genetic mutations to diseases that affect ion transport, such as cystic fibrosis. Students delve deeper into the structure of haemoglobin in RBC and investigate how oxygen and carbon dioxide are carried around by these unique cells that contain a unique protein.	challenges with a more profound understanding of the natural world.
Inter-curricular links (to build schema)	• Rearranging and substitution of mathematical formula (Maths, Physics + Chemistry) • Organic chemistry (Chemistry) • Converting units (Maths, Physics + Chemistry) • Using Ratios to convert numbers(Maths) • Rounding (Maths, Physics + Chemistry) • Percentages (Maths, Physics + Chemistry) • Graph drawing (Maths, Physics + Chemistry) • Practical Skills (Physics + Chemistry)	• Rearranging and substitution of mathematical formula (Maths, Physics + Chemistry) • Converting units (Maths, Physics + Chemistry) • Rounding (Maths, Physics + Chemistry) • Graph drawing (Maths, Physics + Chemistry) • Pollution and Global Warming (Geography + Environmental Science) • Organic molecules (Chemistry) • Fermentation (Chemistry) • Energy transfers (Physics) • Economic evaluation (Business)	• Rearranging and substitution of mathematical formula (Maths, Physics + Chemistry) • Converting units (Maths, Physics + Biology) • Rounding (Maths, Physics + Chemistry) • Organic molecules (Chemistry)

	Autumn Term Y12	Spring Term Y12	Summer Term Y12
Hinterland Knowledge; **Cultural capital**; Challenging, vocabulary-building, **reading material**	• Understanding of structures and functions of biological molecules and why they have certain properties. • Maths Skills • Knowledge of everyday use test kits including covid tests. Vocabulary: Monomers, polymer, monosaccharide, polysaccharide, homogenate, supernatant, phospholipid bilayer, replication, ligase, helicase, triglyceride, lysosome, field of view, centrifuge, pellet, cytotoxic, co-transport, degenerate, univbersal code, semi-conservative,	• Genetic basis and synthesis of transport proteins has practical applications in biotechnology and medicine. • Mass transport, genes, and protein synthesis are closely tied to biochemistry. This integrated approach helps students appreciate the biochemical underpinnings of transport processes and how genes encode the information needed for protein synthesis. • Mass transport within organisms is crucial for their survival in specific ecological niches. Students can explore how genetic diversity and adaptations influence the transport of essential molecules in various ecosystems, connecting genes and proteins to ecological dynamics.Maths Skills Vocabulary: tracheoles and spiracles,gill lamellae and filaments, counter-current principle, ventilation, co-tranport mechanism, dicotyledonous plants, endopeptidases, exopeptidases and	• The study of biodiversity and investigating diversity is directly relevant to conservation biology • how genetic variations influence species interactions and ecosystem stability • how genetic variations within and among species drive evolutionary processes and lead to the development of biodiversity within ecosystems. • genetic data are used to select traits, improve crop yields, and develop genetically modified organisms Vocabulary: Species richness, index of diversity,taxonomic system, biodiversirty, gene technologies, quantitative investigation, standard deviation, taxon, hierarchy, immunology and genome sequencing, Directional selection, stabilising selection, meiosis, crossing over, independent assortment og gametes, random fertilisation ,

	Autumn Term Y12	Spring Term Y12	Summer Term Y12
		membranebound dipeptidases	

Year 13

	Autumn Term Y13	Spring Term Y13	Summer Term Y13
What comes before and after (GCSE/Y12)?	At GCSE, they learn about bioenergetics and inheritance. They also learnt about carbon cycle, in this term they will learn about the application of new nutrient cycles and link it with many topics synoptically such as photosynthesis, population and energy in the ecosystem. In year 12 students have learnt about biological molecules which will be extensively referred to in this term. The structure if organelles and the topics such as mass transport will also be used to explicitly explain the synoptic link.	From GCSE, students will be familiar with concepts around nerve impulse, sense organs, structure of heart, cardiac cycle. They also have learnt about the ecosystem and populations and the impact of prey predator relationships on the ecosystem. They will spiral on most of the topics from yr 12 learning such as biological molecules, transport across membrane, and importance of cell cycle. The students will develop deeper understanding of how the nervous impulse is generated, how is the heart beat generated and conducted, they will link it to the role of specialised cells.	At GCSE, students are taught about -paper chromatography. During year 12, students covered periodicity and will have an understanding of trends across the periodic table. At this stage studnets should be able to create synoptic links across the two year A level course.

	Autumn Term Y13	Spring Term Y13	Summer Term Y13
What do we teach? Core knowledge Spiralled concepts	Knowledge / Concepts 3.5.1 Photosynthesis 3.5.2 Respiration 3.5.3 Energy and ecosystems 3.5.4 Nutrient cycles 3.7.1 Inheritance 3.7.2 Populations 3.7.3 Evolution may lead to speciation 'Big Questions' • What are the mechanisms involved during respiration and photosynthesis? • Spiralled Concepts • Structure of mitochondria and chloroplast • Mass transport in plants • Biodiversity within a community • Species and taxonomy • Half equations	Knowledge / Concepts 3.6 Organisms respond to changes in their internal and external environments 3.6.1 Stimuli, both internal and external, are detected and lead to a response 3.6.1.1 Survival and response 3.6.1.2 Receptors 3.6.1.3 Control of heart rate 3.6.2 Nervous coordination 3.7.4 Populations in ecosystems 3.8.1 Alteration of the sequence of bases in DNA can alter the structure of proteins 'Big Questions' • Demonstrate an understanding of the need to manage the conflict between human needs and conservation in order to ensure natural resource sustainability • How can the alterations in DNA effect the activity of a gene? • What is the difference between **sensitivity to light, sensitivity to colour and visual acuity are explained by differences in the optical pigments of rods and cones** Spiralled Concepts • Deformation of stretch-mediated sodium ion channels • Organic reactions • Epigenetics and inheritance • Structure and function of eye	Knowledge / Concepts 3.6.3 Skeletal muscles are stimulated to contract by nerves and act as effectors 3.6.4 Homeostasis is the maintenance of a stable internal environment 3.8 The control of gene expression 'Big Questions' • How does cellular control and transport of certain genetic markers affect the gene expression • What are the steps involved in DNA technology? • What are the applictions of DNA technology in diagnosing and treating huiman diseases? Spiralled Concepts • Calcium ion concentration • Transmission acroos the membrane using the proteins in the membrane • Structure of proteins in muscles • Role of enzymes in gene technology • Role of proteins as a second messanger model

	Autumn Term Y13	Spring Term Y13	Summer Term Y13
How does this meet the national curriculum?	The curriculum follows AQA's syllabus and includes all knowledge and skills from the specification The scheme uses the recommended split in topics between two teachers.		
Why do we teach in this sequence?	With the key concepts having been taught in year 1, students begin to start applying their knowledge at a higher level in year 2. Biological molecules, cell organelle, structure and function which has been taught in year 1 is used to spiral the concepts taught in this term. This provides opportunities for long term recall, develops particular skills further and broadens their schema's. Several maths skills are used which studnets develop throughout the two year programme. Students can gain a better understanding of the interactions between organisms and their environments, as well as the evolutionary processes that drive adaptation. This knowledge enables them to make accurate predictions about how ecosystems will behave under changing conditions. Students are encouraged to make connections between biology, chemistry, and environmental science using this approach. They see how biological and chemical processes interact in the carbon, nitrogen, and phosphorus cycles, for	Students can see how organisms' responses to their environment are inseparably linked to population dynamics in ecosystems when these topics are taught together. Changes in external environmental factors, for example, can cause population size shifts, and organism responses play a critical role in these changes. Students are encouraged to think critically about how organisms adapt and respond to environmental changes, as well as how these adaptations affect population dynamics within ecosystems. They are capable of analysing cause-and-effect relationships, forecasting ecological outcomes, and proposing solutions to ecological problems. Incorporating these topics may inspire students to pursue research or projects that investigate organisms' responses to environmental changes and their implications for population dynamics. This hands-on experience can help them learn even more.	Finally, the last topic of biology is taught – it links with many topics synoptically. Studnets make a link as how the proximal convoluted tubule reabsorbs glucose and water; the loop of Henle maintains a gradient of sodium ions in the medulla; and the distal convoluted tubule and collecting ducts reabsorb water. They also focus on factors influencing blood glucose concentration. The liver's role in glycogenesis, glycogenolysis, and gluconeogenesis. Studnets also focus on how the presence of non-coding DNA and regulatory genes means that knowledge of the genome cannot be easily translated into the proteome. How the sequencing methods are constantly evolving and have become automated. Some of the topics are picked from spring term, this is to facilitate studnets the best synoptic skills and focus on recall and retention of the content.

	Autumn Term Y13	Spring Term Y13	Summer Term Y13
	example, providing a multidisciplinary perspective.		
Inter-curricular links (to build schema)	• Rearranging and substitution of mathematical formula (Maths, Physics + Chemistry) • Converting units (Maths, Physics + Chemistry) • Rounding (Maths, Physics + Chemistry) • Graph drawing (Maths, Physics + Chemistry) • Practical Skills (Physics + Chemistry) • Organic molecules (Chemistry) • Orders and power (Maths)	• Rearranging and substitution of mathematical formula (Maths, Physics + Chemistry) • Converting units (Maths, Physics + Chemistry) • Rounding (Maths, Physics + Chemistry) • Graph drawing (Maths, Physics + Chemistry) • Practical Skills (Physics + Chemistry) • Organic molecules (Chemistry) • Logarithms (Maths) •	•
Hinterland Knowledge; **Cultural capital**; Challenging, vocabulary-building, **reading material**	• **The role of organic molecules in our body and medicine** • **The impact of these organic molecules on the environment** • **Maths Skills** • **How the limiting factors of bioenergetics actually slow down the rate of the respective recations?** **Vocabulary:** **saprobionts in decomposition, Nitrification, denitrification, ammonification, nitrogen fixation,**	• **The role of organic molecules in our body and medicine.** • **why genetic drift is important only in small populations** • **The ethics of the use of plastics** • **Industrial applications of transition metals as pigments** • **How different types of gene mutations effect on the encoded polypeptide** • **What are the impacts of different types of gene mutation** **Vocabulary:**	• **The role of increased oestrogen concentrations in the development of some breast cancers** • **What is the epigenetic control of gene expression in eukaryotes** • **Balance the humanitarian aspects of recombinant DNA technology with opposition from environmentalists and anti-globalization activists; and** • **Connect recombinant DNA technology to gene therapy.**

	Autumn Term Y13	Spring Term Y13	Summer Term Y13
	reduction, phosphorylation, photolysis, link reaction, leaching, NPP, GPP, respiratory loss, mycorrhizae, chemiosomotic theory, triose phosphate, acetate, electron transport chain, hydrolysis of ATP, photoionisation, carbon fixation,	**Gene mutation, substitution, inversion, duplication and translocation of bases, epigenetic control, frame shift mutation, mark-release-recapture,** succession, carrying capacity, belt transect, reproductive isolation , species diversity, speciation, gene pool and allele frequency, Hardy–Weinberg equation, crosses involving sex-linkage, autosomal linkage, multiple alleles and epistasis	**Vocabulary: Stationary phase, Mobile phase, DNa fingerprinting, VNTR, PCR, Osmoregulation, role of ADHelectrophoresis, recombinant DNA technology, DNA can be amplified by in vitro and in vivo techniques, gene markers, promoter and terminator genes, restriction endonucleases, tumour suppressor genes and oncogenes, abnormal methylation of tumour suppressor genes and oncogenes ,**

How Do We Study Biology ?
To begin, a well-structured biology course begins with fundamental concepts and principles of biology and progresses to more complex concepts. Each topic is revisited throughout the course, and students build on their knowledge of the topic. For example, when teaching

bioenergetics, students are reminded of cell structure concepts.

We use a variety of strategies in lessons to develop knowledge and skills. Practical work is an essential component of biology education. Students are given opportunities to conduct experiments and plan their own investigations. Practical work helps students understand concepts taught in class and develop critical thinking and problem-solving skills.

We also give students a lot of problem-solving exercises to help them understand the concepts. Students should learn how to apply what they've learned to solve real-world problems and apply what they've learned to unfamiliar situations.

Why Do We Study Biology ?

Biology is a fundamental science that plays a crucial role in our daily lives. Here are some reasons why we study biology:

1. Biology provides a solid educational foundation for students interested in furthering their education in biology or related fields. It offers a thorough understanding of fundamental biological concepts.
2. A-Level Biology is an important qualification for students interested in careers in healthcare, research, environmental science, biotechnology, pharmaceuticals, and a variety of other fields. It provides access to a diverse range of career opportunities.
3. Knowledge of Living Systems: Biology teaches students about living organisms, including their structure, function, and interactions with their surroundings. This knowledge is necessary for making informed decisions in many aspects of life.
4. Literacy in Science: Biology provides students with scientific literacy, allowing them to critically evaluate scientific claims, participate in discussions about ethical and environmental issues, and make informed decisions in a world that is becoming increasingly science-centred.

Co-curricular Provision

Medical society, journal club, biology Olympiad

Employability Skills									
Communication & Interpersonal Skills	✔	Problem Solving Skills	✔	Using initiative & being self-motivated	✔	Working under pressure & meeting deadlines	✔	Organisational skills	✔
Team working	✔	Ability to learn and adapt	✔	Numeracy	✔	Valuing diversity & difference	✔	Negotiation skills	✔

SMSC	
Spiritual	Biology can lead to a profound appreciation for the Earth's intricate and interconnected web of life. Some people find spiritual meaning in contemplating species diversity, ecosystem beauty, and the remarkable adaptations that have evolved over millions of years. Connection to Nature: A thorough understanding of biology can help you feel more connected to the natural world. When studying organisms, their behaviours, and their environments, students may experience a spiritual connection to nature as well as a sense of wonder.
Moral	Biology at this level helps students understand the impact of human activities on ecosystems and the environment. It promotes environmental awareness and encourages responsible stewardship of our planet.
Social	A deep understanding of biology can inspire individuals to engage in community initiatives related to health, environmental conservation, or science education. They can contribute positively to their communities by sharing their knowledge and skills.
Cultural	Biology highlights the incredible diversity of life on Earth. This diversity can inspire cultural appreciation for the richness of different ecosystems and the need for biodiversity conservation. A deep understanding of biology can inspire individuals to engage in community initiatives related to health, environmental conservation, or science education. They can contribute positively to their communities by sharing their knowledge and skills.