

Biology Curriculum Outline 2024-2025

This outline provides a long-term overview of the knowledge and skills developed in this subject. More detailed short- and medium-term schemes of work, not published here, are available by contacting the Biology Department.

	Term 1	Term 2	Term 3	Term 4	Term 5	
Year 13	<p>Unit Title: Biology - Module 1, 2, 3, 4, 5 & 6.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> In Module 5, it is important that organisms, both plants and animals can respond to stimuli. This is achieved by communication within the body, which may be chemical and/or electrical. Both systems are covered in detail in this module. Communication is also fundamental to homeostasis with control of temperature, blood sugar and blood water potential being studied as examples. In this module, the biochemical pathways of photosynthesis and respiration are considered, with an emphasis on the formation and use of ATP as the source of energy for biochemical processes and synthesis of biological molecules. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems. Module 6 covers the role of genes in regulating and controlling cell function and development. Heredity and the mechanisms of evolution and speciation are also covered. Some of the practical techniques used to manipulate DNA such as sequencing and amplification are considered and their therapeutic medical use. The use of microorganisms in biotechnology is also covered. Both of these have associated ethical considerations and it is important that learners develop a balanced understanding of such issues. Learners gain an appreciation of the role of microorganisms in recycling materials within the environment and maintaining balance within ecosystems. The need to conserve environmental resources in a sustainable fashion is considered, whilst appreciating the potential conflict arising from the needs of an increasing human population. Learners also consider the impacts of human activities on the natural environment and biodiversity. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems. <p>Skills: PAG, M0, M1, M2, M3, M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>					
	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 12	<p>Unit Title: Biology - Module 1,2,3 &4.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> In Module 1, the development of practical skills is a fundamental and integral aspect of the study of any scientific subject. These skills not only enhance learners' understanding of the subject but also serve as a suitable preparation for the demands of studying biology at a higher level. In Module 2, all living organisms have similarities in cellular structure, biochemistry and function. An understanding of these similarities is fundamental to the study of the subject. This module gives learners the opportunity to use microscopy to study the cell structure of a variety of organisms. Biologically important molecules such as carbohydrates, proteins, water and nucleic acids are studied with respect to their structure and function. The structure and mode of action of enzymes in catalysing biochemical reactions is studied. Membranes form barriers within, and at the surface of, cells. This module also considers the way in which the structure of membranes relates to the different methods by which molecules enter and leave cells and organelles. The division and subsequent specialisation of cells is studied, together with the potential for the therapeutic use of stem cells. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems. 					

- In Module 3, learners study the structure and function of gas exchange and transport systems in a range of animals and in terrestrial plants. The significance of surface area to volume ratio in determining the need for ventilation, gas exchange and transport systems in multicellular organisms is emphasised. The examples of terrestrial green plants and a range of animal phyla are used to illustrate the principle. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems.
- In Module 4 the learners study the biodiversity of organisms; how they are classified and the ways in which biodiversity can be measured. It serves as an introduction to ecology, emphasising practical techniques and an appreciation of the need to maintain biodiversity. The learners also gain an understanding of the variety of organisms that are pathogenic and the way in which plants and animals have evolved defences to deal with disease. The impact of the evolution of pathogens on the treatment of disease is also considered. The relationships between organisms are studied, considering variation, evolution and phylogeny. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems.

Skills:
PAG, M0, M1, M2, M3, M4.
HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.

		Term 1	Term 2	Term 3	Term 4	Term 5	
Year 11		<p>Unit Title: Organisms, Genes and Ecosystems – Homeostasis.</p> <p>Knowledge: Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes. In this section we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility.</p> <p>Skills: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8 (Biology only).</p>	<p>Unit Title: Organisms, Genes and Ecosystems – Inheritance, variation and evolution.</p> <p>Knowledge: In this section we will discover how the number of chromosomes are halved during meiosis and then combined with new genes from the sexual partner to produce unique offspring. Gene mutations occur continuously and on rare occasions can affect the functioning of the animal or plant. These mutations may be damaging and lead to a number of genetic disorders or death. Very rarely a new mutation can be beneficial and consequently, lead to increased fitness in the individual. Variation generated by mutations and sexual reproduction is the basis for natural selection; this is how species evolve. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. Once new varieties of plants or animals have been produced it is possible to clone individuals to produce larger numbers of identical individuals all carrying the favourable characteristic. Scientists have now discovered how to take genes from one species and introduce them in to the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial.</p> <p>Skills: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8 (Biology only).</p>			<p>Unit Title: Revision and Practice of Key Ideas.</p> <p>Knowledge: As outlined in previous sections.</p> <p>Skills: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8 (Biology only).</p>	
		Term 1	Term 2	Term 3	Term 4	Term 5	Term 6

Year 10	<p>Unit Title: Organisms, Genes and Ecosystems – Infection and Response.</p> <p>Knowledge: Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria. Unfortunately many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics.</p> <p>Skills: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8 (Biology only).</p>	<p>Unit Title: Organisms, Genes and Ecosystems – Bioenergetics.</p> <p>Knowledge: In this section we will explore how plants harness the Sun's energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.</p> <p>Skills: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8 (Biology only).</p>	<p>Unit Title: Organisms, Genes and Ecosystems – Homeostasis.</p> <p>Knowledge: Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes. In this section we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility.</p> <p>Skills: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8 (Biology only).</p>		
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Year 9	<p>Unit Title: Organisms, Genes and Ecosystems – Cell Biology.</p> <p>Knowledge: Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells.</p> <p>Skills: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8 (Biology only).</p>	<p>Unit Title: Organisms, Genes and Ecosystems – Organisation.</p> <p>Knowledge: In this section we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis.</p> <p>Skills: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8 (Biology only).</p>	<p>Unit Title: Organisms, Genes and Ecosystems – Ecology.</p> <p>Knowledge: The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.</p> <p>Skills: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8 (Biology only).</p>		

Key/Legend/Notes:

KS5 Skills:

- PAG Skills - Planning, Implementing, Analysis, Evaluating, Practical Skills, Techniques and Apparatus.
- M0 - Arithmetic and numerical computation.
- M1 - Handling data
- M2 - Algebra
- M3 - Graphs

- M4 - Geometry and trigonometry.
- HSW1 Use theories, models and ideas to develop scientific explanations.
- HSW2 Use knowledge and understanding to pose scientific questions, define scientific problems, present scientific arguments and scientific ideas.
- HSW3 Use appropriate methodology, including information and communication technology (ICT), to answer scientific questions and solve scientific problems.
- HSW4 Carry out experimental and investigative activities, including appropriate risk management, in a range of contexts.
- HSW5 Analyse and interpret data to provide evidence, recognising correlations and causal relationships.
- HSW6 Evaluate methodology, evidence and data, and resolve conflicting evidence.
- HSW7 Know that scientific knowledge and understanding develops over time.
- HSW8 Communicate information and ideas in appropriate ways using appropriate terminology.
- HSW9 Consider applications and implications of science and evaluate their associated benefits and risks.
- HSW10 Consider ethical issues in the treatment of humans, other organisms and the environment.
- HSW11 Evaluate the role of the scientific community in validating new knowledge and ensuring integrity.
- HSW12 Evaluate the ways in which society uses science to inform decision making.

KS4 Skills:

- M1 Arithmetic and numerical computation.
- M2 Handling data.
- M3 Algebra.
- M4 Graphs.
- M5 Geometry and trigonometry.
- AT 1 Use of appropriate apparatus to make and record a range of measurements accurately, including length, area, mass, time, temperature, volume of liquids and gases, and pH (links to A-level AT a).
- AT 2 Safe use of appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater (links to A-level AT a).
- AT 3 Use of appropriate apparatus and techniques for the observation and measurement of biological changes and/or processes.
- AT 4 Safe and ethical use of living organisms (plants or animals) to measure physiological functions and responses to the environment (links to A-level AT h).
- AT 5 Measurement of rates of reaction by a variety of methods including production of gas, uptake of water and colour change of indicator.
- AT 6 Application of appropriate sampling techniques to investigate the distribution and abundance of organisms in an ecosystem via direct use in the field (links to A-level AT k).
- AT 7 Use of appropriate apparatus, techniques and magnification, including microscopes, to make observations of biological specimens and produce labelled scientific drawings (links to A-level AT d and e).
- AT 8 (Biology only) Use of appropriate techniques and qualitative reagents to identify biological molecules and processes in more complex and problem-solving contexts including continuous sampling in an investigation (links to A-level AT f).