Key Stage 4 Curriculum Overview

Progression from Key Stage 3 and optional progression through Post-16 : Biology

	Autumn Term	Spring Term	Summer Term
Year 9			Students at the end of Key Stage 3 will be able to: Have an understanding of the fundamentals of living organisms and life processes including the 'big ideas; in biology, including: links between structure and funtion in living organisms, factors affecting life processes such as respiration and photosynthesis, effects of varitaion and inheritance on biodiversity and how humans affect the natural world around us. Have an understanding of key scientific investigative proceedures and understand how to answer scientific questions about the natural world around them, including recording, collection and analysisng data, evaluating proceedures and identify further questions. Be able to critially think about the uses and implications of science and scientific advancements today and for the future Be devloping the ability to read and interpret scientific text Describe associated processes and key characteristics in common language, beginning to use technical terminology accurately and precisely building an extended specialist vocabulary. Be able to apply their mathematical knowledge to their understanding of science, including collecting, presenting and analysing data, using numerical values and mathematical representations.

			Be able to relate scientific explanations to phenomena in the world around them and use modelling and abstract ideas to develop and evaluate explanations.
Year 10	1. Cells- Osmosis and Active transport, cell cycle and mitosis 2. Organisation- food tests, factors affecting enzymes, blood vessels and gas exchange. Transpiration in plants 3. Infection and response- communicable disease, human defence systems, antibiotics and painkillers, drug development	4. Bioenergetics- rate of photosynthesis and uses of glucose 5. Homeostasis – reaction times and reflex action, endocrine system and control of menstrual cycle and blood glucose.	6. Inheritance- genetic inheritance, genetic engineering and extinction and fossils and classification. 7. Ecology- sampling, competition, adaptations, human impacts on biodiversity.
Year 11	1. Cells- stem cells 2. Organisation- CHD, types of disease, vaccination, 3. Infection and response- cancer 4. Bioenergetics- making the most of photosynthesis, respiration 5. Homeostasis- negative feedback, IVF	6. Inheritance- genetic diagrams and sex linkage, inherited disorders, antibiotic resistance. 7. Ecology- sampling- water and carbon cycle, land and water pollution, air pollution, deforestation, global warming	Revision and exam preparation each class to have a bespoke plan based on PLC's

By the end of Key Stage 4 students should be able to:

Students should be helped to understand how, through the ideas of biology, the complex and diverse phenomena of the natural world can be described in terms of a number of key ideas which are of universal application, and which can be illustrated in the separate topics set out below.

Cell biology • cells as the basic structural unit of all organisms; adaptations of cells related to their functions; the main sub-cellular structures of eukaryotic and prokaryotic cells • stem cells in animals and meristems in plants Science – key stage 4 8 • enzymes • factors affecting the rate of enzymatic reactions • the importance of cellular respiration; the processes of aerobic and anaerobic respiration • carbohydrates, proteins, nucleic acids and lipids as key biological molecules.

Transport systems • the need for transport systems in multicellular organisms, including plants • the relationship between the structure and functions of the human circulatory system.

Health, disease and the development of medicines • the relationship between health and disease • communicable diseases including sexually transmitted infections in humans (including HIV/AIDs) • non-communicable diseases • bacteria, viruses and fungi as pathogens in animals and plants • body defences against pathogens and the role of the immune system against disease • reducing and preventing the spread of infectious diseases in animals and plants • the process of discovery and development of new medicines • the impact of lifestyle factors on the incidence of non-communicable diseases.

Coordination and control • principles of nervous coordination and control in humans • the relationship between the structure and function of the human nervous system • the relationship between structure and function in a reflex arc • principles of hormonal coordination and control in humans • hormones in human reproduction, hormonal and non-hormonal methods of contraception Science • homeostasis.

Photosynthesis • photosynthesis as the key process for food production and therefore biomass for life • the process of photosynthesis • factors affecting the rate of photosynthesis.

Ecosystems • levels of organisation within an ecosystem • some abiotic and biotic factors which affect communities; the importance of interactions between organisms in a community • how materials cycle through abiotic and biotic components of ecosystems • the role of microorganisms (decomposers) in the cycling of materials through an ecosystem • organisms are interdependent and are adapted to their environment • the importance of biodiversity • methods of identifying species and measuring distribution, frequency and abundance of species within a habitat • positive and negative human interactions with ecosystems.

Evolution, inheritance and variation • the genome as the entire genetic material of an organism • how the genome, and its interaction with the environment, influence the development of the phenotype of an organism • the potential impact of genomics on medicine • most phenotypic features being the result of multiple, rather than single, genes • single gene inheritance and single gene crosses with dominant and recessive phenotypes • sex determination in humans • genetic variation in populations of a species • the process of natural selection leading to evolution Science – key stage 4 10 • the evidence for evolution • developments in biology affecting classification • the importance of selective breeding of plants and animals in agriculture • the uses of modern biotechnology including gene technology; some of the practical and ethical considerations of modern biotechnology

- **Working scientifically – across all science disciplines**
- pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility
- understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review
- Evaluate risks.
- ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- make predictions using scientific knowledge and understanding
- select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate
- use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety
- make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements
- apply sampling techniques.
- apply mathematical concepts and calculate results
- present observations and data using appropriate methods, including tables and graphs
- interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- present reasoned explanations, including explaining data in relation to predictions and hypotheses
- evaluate data, showing awareness of potential sources of random and systematic error
- identify further questions arising from their results.
- understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature
- use and derive simple equations and carry out appropriate calculations
- undertake basic data analysis including simple statistical techniques.