KS5 Biology Curriculum Map

KEVI HWGA Biology Curriculum Map 2022-2023

Curriculum Purpose:		
Context	Beyond KEVI HWGA:	**Biological Careers**: Aerobiologist - Agricultural Scientist – Bioinformatician – Biomechanics Engineer – Biomedical engineer or researcher – Biophysicist – Biostatistician – Cell Biologist – Conservationist – Cryobiologist – Cytologist – Ecologist – Exotoxicologist – Embryologist – Endocrinologist – Entomologist – Forensic Psychologist – Forensic Scientist – Geneticist – Genomics – Immunologist – Marine Biologist – Molecular Biologist – Pharmacologist – Teaching - Toxicologist – Veterinarian – Virologist – Zoologist
	KS5 Intent	KS5 Biologists will be taken on a journey that inspires and nurtures a passion for the subject through an in-depth study of Biological Molecules, Cells, Organisms, Genetics, Energy Transfers and links with the environment which is taught through theory, research, independent study and practical work. We will provide an enriched, broad and stimulating curriculum that empowers students to make decisions, critically evaluate scientific and technological developments that impact society and equip them with the knowledge and skills to pursue further study and rewarding careers.
	HPL skills	Key HPL skills such as strategic planning, precision, analyse, evaluate, critical or logical thinking are embedded within the practical experience which complement the scientific investigative skills and assessment objectives set by the exam board. Further HPL skills and teaching toolkit are applied such as big picture thinking, connection finding, generalisation, self-regulation and meta-cognition will be developed through this broad curriculum; enriched with a range of opportunities from presenting, project work, research, discussion, trips and independent work.

KEVI HWGA Curriculum Map

YEAR 13						
	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
	How do plants convert the light energy to chemical energy create in the form of carbohydrates?	***How does cellular respiration provide ATP for metabolic processes in living organisms?***	***What do offspring look similar to their parents?*** ***How does the combination of alleles contribute to variation in a species?***	***What is the impact of external factors on gene expression?*** ***How can we manipulate our genome so as to treat***	Exams	Exams

Big Qs ***Linked to NC***	***How are messages transmitted across synapses? What mechanisms control contraction of muscles? How and why do multicellular organisms respond to stimuli both within and outside their bodies?***	***Why is maintaining a constant internal environment essential for living organisms? How does our lifestyle impact metabolic diseases such as diabetes?***	***How can we use statistics to determine the probability of a genotype in a population? Why are some inherited diseases more common in males?How does affect evolution and can geographic isolation cause the evolution of a new species? What can we do to encourage biodiversity?***	***disease, for medical, forensic and breeding purposes? What is the connection between epigenetics and cancer?***		
Key Content	**Topic 5: Energy transfers in and between organisms – Photosynthesis** learning how energy is transferred in bioenergetics reactions. In photosynthesis, light is absorbed by chlorophyll and this is linked to the production of ATP. The process of photosynthesis is common in all photoautotrophic organisms. 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. **Topic 6: Organisms respond to changes in their internal and external environments** Covering how a stimulus is detected by a receptor and a coordinator formulates a suitable response to a stimulus. An effector produces a response. Receptors are	**Topic 5: Energy transfers in and between organisms – Respiration** In respiration, the hydrolysis of 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 respiration is common in all organisms, providing indirect evidence for evolution. **Topic 6: Organisms respond to changes in their internal and external environments** Mammalian hormones stimulate their target cells via the blood	**Topic 7: Genetics, populations, and ecosystems,** - All new species arise from an existing species, resulting in different species sharing a common ancestry, as represented in phylogenetic classification. Common ancestry can explain the similarities such as common chemistry, physiological, 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, inherited 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. A change in the allele frequency of a population is evolution. 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. Competition occurs within and between these populations for	**Topic 8: Control of gene expression** – Cells are able to control their metabolic activities by regulating gene expression. 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 gene expression, some are external, environmental factors, and 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. This should lead to an appreciation of common ailments resulting from a breakdown of these control mechanisms and the use of	**Revision Topics 1-8** **Synoptic Essay Practice** **Practical Question Practice**	

	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.	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.	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.	DNA technology in the diagnosis and treatment of human diseases.		
Key Knowledge, Concepts, and skills	Making synaptic links with AS modules e.g. Labelling different stages of the cycles, structure and function chloroplast and organelles within, various proteins used in transport of ions such as potassium/sodium pump. Practical competencies during practical work	Labelling various organs, dissecting kidney and liver 10 and 11. Data analysis and interpretation of graphs and data. Practical skills. Role of negative feedback in thermoregulation and osmoregulation. Importance of homeostasis. practical competencies during practical work	Chi square, Hardy Weinberg principles, calculating ratios and probability, drawing genetic diagrams, predicting genotypes and phenotypes, analysing family pedigree trees, and explaining linkage. Conservation methods, how succession occurs, Data analysis and calculations based on data. Practical competencies during practical work	Gene expression, recombinant DNA technology, gene location, screening and counselling, practical competencies		
Assessment objectives:	AO1: Demonstrate knowledge and understanding of scientific ideas, processes, techniques, and procedures AO2: Apply knowledge and understanding of scientific ideas, processes, techniques, and procedures: in a theoretical context, in a practical context, when handling qualitative data, when handling quantitative data AO3: Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to make judgements and reach conclusions develop and refine practical design and procedures.					
Feedback & Assessment	Baseline AS Test **CPAC assessment RP 7**	Fortnightly Test **CPAC assessment RP 8 and 10**	Fortnightly Test **CPAC assessment RP 9**	Fortnightly Test **CPAC assessment RP 11 and 12**	Synoptic Essay **CPAC assessment RP AS practical catch-up**	Mock Exam
Year 12	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Big Qs ***Linked to NC***	***Why are carbon based biological molecules important to the survival of living organisms and how does water serve a wide range of roles in living organisms despite its small and simple nature.***	***Why are biological molecules important in the transport of substances across cell surface membranes?*** ***How are cell surface membranes adapted to***	***How are living organisms such as mammals, fish, insects and plants specialised in order to efficiently exchange substances with their environment?***	***What is the role of mass transport in exchange and transport of substances such oxygen in blood and tissue fluid through the lymphatic system?***	***Why do mistakes such as mutations cause distinct differences in individuals?*** ***How does meiosis ensure that variation occurs in a population?***	***How do organisms maintain their energy requirements?*** ***How can we investigate energy transfer in organisms?*** ***How do plants obtain the necessary nutrients in***

	How is genetic material replicated and how does this impact on characteristics of individuals including the inheritance of genetic disorders through mutations. What is the role of ATP in various processes in the body and how is this molecule made available to cells?	***enable efficient transport of essential molecules? How does the selectivity of the cell surface membrane contribute to the transport of molecules into and out of cells?*** ***How does the body defend itself from pathogens? How do different types of white blood cells recognize and bring about responses that are specific and appropriate? How do vaccination programmes help eradicate disease?***	***How is the digestive system organised in order to carry out absorption efficiently?*** .	***How does the nervous system determine the functioning of the cardiac cycle?*** ***Why do larger organisms need specialised transport systems and how are these systems adapted to perform effectively?*** ***How does sexual reproduction lead to variation and what are the benefits of this?*** ***How is this genetic material Tran scripted and translated in order to create the correct proteins in living organisms? Evidence for a universal genetic code?***	***How does genetic diversity enable natural selection and survival of species? What is the impact of natural selection on the development of antibiotic resistant superbugs and how could we reduce the creation of these? How does selection ensure survival of a species?***	***spite of hostile conditions?***
Key Content	**Topic 1: Biological molecules –** (biochemistry) covering key biological molecules found in living things and this provides indirect evidence for evolution. Carbohydrates used by cells as respiratory substrates and as structural components in plasma membranes and cell walls. Lipids uses, including the bilayer of plasma membranes, certain hormones, and as respiratory substrates. **Topic 2 Cells –** studying the basic features in common and the differences between cells which are due to the addition of extra features. This also 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.	**Topic 1: Biological molecules –** Proteins form many cell structures. They are also important as enzymes, chemical messengers, and components of the blood. Nucleic acids carry the genetic code to produce 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. **Topic 2 Cells –** The basic structure of these plasma membranes is the same and enables control of the passage of substances across exchange surfaces by	**Topic 3: Organisms exchange substances with the environment –** covering the exchange of substances between the internal and external environments takes place at exchange surfaces, 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 **Topic 4: Genetic information, variation, and relationships between organisms** - A gene is a	**Topic 3: Organisms exchange substances with the environment –** 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. **Topic 4: Genetic information, variation, and relationships between organisms** learning what biodiversity is – in the 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. s	**Topic 3: Organisms exchange substances with the environment –** 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. **Topic 4: Genetic information, variation, and relationships between organisms** Differences between individuals within a species could be the result of genetic factors, of environmental factors, or a combination of both. Biodiversity within a community can be	**Synoptic essay practice** **Revision Topics 1-4** **Y12 Finals** **Topic 5: Energy transfers in and between organisms** – learning how energy is transferred in bioenergetics reactions. In photosynthesis, light is absorbed by chlorophyll, and this is linked to the production of ATP.

		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 cells 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.	section of DNA located at a particular site on a DNA molecule. The base sequence of each gene carries the coded genetic information that determines the sequence of amino acids during protein synthesis. The genetic code used is universal, providing 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.		measured using species richness and an index of diversity. **Statistics**	
Key Knowledge, Concepts, and skills	Synoptic links: bridging gap between GCSE and A-level Biology Using graticules to calculate sizes of organelles, transposing equation to calculate image size, magnification, and actual size of organelles, calculating mitotic index. **Practical competencies during practical work**	Synoptic links: bridging gap between GCSE and A-level Biology Structure and function of cell surface membrane, different modes of transport, defence mechanisms, cell mediated and humoral Reponses, vaccination, and HIV. RP skills, maths skills, evaluating data, drawing calibration curves, increase/decrease in percentage mass calculations.	Structure and function of gas exchange surfaces. Explore the different parts of the digestive system, its adaptations and function in absorption of nutrients, opportunity to link to GCSE,. Calculate rates of absorption, ventilation rates and ways to reduce the loss of water from gas exchange surfaces. Mechanism of ventilation and contrasting of breathing mechanisms in various organisms. **Practical competencies during practical work**	Dissection of various organs, label various organs, learn their structural adaptations, sequence of cardiac cycle, creation of lymph and transport of glucose and water in plants. Genes and the triplet code, comparing different types of RNA. **Practical competencies during practical work**	Natural selection, cell division, sexual reproduction, genetic diversity, directional and stabilising selection, biodiversity. Calculating index of diversity, human impact on diversity, random sampling and normal distribution curves, mode, median, mean, standard deviation. Using log function, histograms, sampling techniques. **Practical competencies during practical work**	Calculating percentage efficiency of energy transfer, interpreting data tables and graphs, cycles of nitrogen and phosphorous. Impact of nitrogen-based fertilisers and eutrophication. **Practical competencies during practical work**

		Practical skills, evaluating data on enzymes and calculating molarity and rates of reaction. Drawing tangents and applying structure of biological structures to their functions **Practical competencies during practical work**				
Assessment objectives:	AO1: Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures AO2: Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: in a theoretical context, in a practical context, when handling qualitative data, when handling quantitative data AO3: Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to: make judgements and reach conclusions develop and refine practical design and procedures.					
Feedback & Assessment	**Baseline Test** **Fortnightly Test** CPAC Practical	**Fortnightly Test** CPAC Practical	**Fortnightly Test** CPAC Practical	**Fortnightly Test** CPAC Practical	**Fortnightly Test** CPAC Practical	**Mock Exam**