المدرسة الأمريكية الدولية
American International School
kuwait

HIGH SCHOOL

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

SCIENCE SCOPE AND SEQUENCE
BIOLOGY AND ADVANCE BIOLOGY
AY 26-27

STRAND	STANDARDS/SKILLS (Common Core)	9th	10th	11th/12th
From Molecules to Organisms: Structures and Processes	**HS-LS1-1.** *Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.*	*Students will learn that regions of DNA called genes determine the structure of proteins, which carry out the essential functions of life through systems of specialized cells.*		*Students will utilize their knowledge of biological molecules to construct explanations for the synthesis of proteins.* *Students will determine the sequence of proteins from the base DNA and RNA sequences.*
	HS-LS1-2. *Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.*	*Students develop a model to help identify and describe the relevant parts (e.g., organ system, organs, and their component tissues) and processes (e.g., transport of fluids, motion) of body systems in multicellular organisms. They will describe the relationships between components. Ex: Skeletal and Muscular system. Students will look at how all body systems are interacting and connected together.*		*Students will describe the relationship between cells, tissues, organs, organ systems, and organisms. Students will define and state an example of emergent properties. Students will explain how the nervous and endocrine systems signal to the rest of the body to maintain bodily functions.* *Students will explain the function of circadian rhythms and determine the impacts of disrupting a circadian rhythm on the body.* *Students will explain the bodily processes that occur in a fight or flight response.* *Students will explain the functions of the autonomic nervous system.* *Students will compare and contrast the autonomic and somatic nervous systems.*
	HS-LS1-3. *Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.*	*Students learn what homeostasis is and learn how the body uses feedback mechanisms to respond to internal/external stimuli. This can also be applied when the Immune system responds to invasions of*		*Students will describe the ranges within which human bodies function. Students will define, describe, and explain feedback mechanisms (positive and negative).*

		bacteria or viruses and how it responds to return to homeostasis.		*Students will determine what type of feedback mechanism regulates a particular response.* *Students will explain the examples of blood glucose regulation and thermoregulation in the context of homeostasis and feedback mechanisms.*
	HS-LS1-4. *Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.*	*Students use a model based on evidence to illustrate the relationship between mitosis and organism growth.*		
	HS-LS1-5. *Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.*	*Students will learn that photosynthesis transforms light energy into stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. This allows for the understanding that transfer of matter and flow of energy between the organism and its environment happens during photosynthesis.*		*Students will describe the sources of the substrates and energy used in photosynthesis.* *Students will describe the destinations for photosynthesis products. Students will evaluate the change in the molecular structure of the reactants to the products of photosynthesis.*
	HS-LS1-6. *Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.*	*Student will learn that carbon, hydrogen, and oxygen atoms from sugar molecules formed in or ingested by an organism and those same atoms found in amino acids and other large carbon-based molecules.* *Students will learn that all organisms take in matter (allowing growth and maintenance) and rearrange the atoms in chemical reactions*		*Students will explain the importance of the types of biological molecules for the functioning of human and plant cells and explain the process of producing polymers from monomers of each of the types of biomolecules.*
	HS-LS1-7. *Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.*	*Students will identify and describe matter in the form of food molecules, oxygen, and the products of their reaction (e.g., water and CO2) and the breaking and formation of chemical bonds where carbon dioxide and water are produced from sugar and oxygen by the process of cellular respiration which release energy*		*Students will describe the sources of the substrates and energy used in cellular respiration.* *Students will describe the destinations for the products of cellular respiration.* *Students will compare and contrast photosynthesis and cellular respiration.*
Ecosystems: Interactions,	**HS-LS2-2.** *Use mathematical representations to support and revise explanations based on evidence about factors*	*Students identify and describe the components in the given mathematical representations (which include trends, averages,*		

Energy, and Dynamics	*affecting biodiversity and populations in ecosystems of different scales.*	*and graphs of the number of organisms per unit of area in a stable system) that are relevant to supporting and revising the given explanations about factors affecting biodiversity and ecosystems*		
	HS-LS2-3. *Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.*	*Students identify and describe evidence to construct an explanation for the cycling of matter.*		
	HS-LS2-4. *Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.*	*Students use a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems.*		
	HS-LS2-5. *Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.*	*Students will create a model in which they identify and describe the relationship between the exchange of carbon (through carbon-containing compounds) between organisms and the environment and the role of storing carbon in organisms (in the form of carbon-containing compounds) as part of the carbon cycle.*		
	HS-LS2-6. *Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.*	*Students are exposed to many theories of ecosystem interactions (such as predation, symbiosis, etc.) and must discuss the principle that they all lead to one conclusion: the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.*		*Students will differentiate between a species, population, community, habitat, ecosystem, and biome.* *Students will define tipping points and keystone species.* *Students will explain the different methods of defining species and populations. Students will define carrying capacities.* *Students will Explain the various factors affecting population growth.* *Students will interpret graphs depicting changes in population growth.*
	HS-LS2-7. *Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*	*Students design a solution that involves reducing the negative effects of human activities on the environment and biodiversity, and that relies on scientific knowledge of*		*Students will differentiate between normal planetary cycles of temperatures and anthropogenic climate change.* *Students will describe the various impacts of climate change on biotic*

		the factors affecting changes and stability in biodiversity.		*and abiotic factors of several biomes.* *Students will relate climate change to feedback mechanisms and describe the feedback mechanisms controlling climate change.* *Students will describe carbon sources and sinks and their impacts on climate change.* *Students will explain the impact of ecosystem loss.* *Students will analyze sources supporting climate change and the biodiversity crisis.* *Students will describe the evidence supporting the biodiversity crisis.* *Students will explain the impact of human activity on various biomes.* *Students will explain how changes in human activity can ameliorate or deteriorate the rate of climate change.* *Explain the importance of species conservation.*
Heredity: Inheritance and Variation of Traits	**HS-LS3-1.** *Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.*	*Students learn that DNA codes for proteins which are shown as traits that are visibly passed from parents to offspring.*		*Students will differentiate between individual and group behaviours.* *Students will describe the various individual and group behaviours.* *Students will explain the advantage of different group behaviours for various organisms.* *Students will analyze evidence supporting group behaviours.* *Students will infer why a group behaviour might be occurring based on prior knowledge.*
	HS-LS3-2. *Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.*	*Students learn genetic mutations can occur due to errors during replication of DNA (such as during mitosis) or from environmental factors, like smoking.* *Students will learn how to read a karyogram and identify genetic disorders from that arise due to meiosis leading to variation.*		*Students will explain how meiosis leads to increased genetic diversity.* *Students will compare meiosis and mitosis and explain their purposes for living cells.*

	HS-LS3-3. *Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.*	*Students learn to apply mathematics to describe the probability of traits, using a Punnett square.*		*Students will describe how genes from two parents combine to form offspring and how the genetic diversity of both parents contributes to a diverse array of possible offspring.* *Students will discuss the potential errors that occur during DNA replication, mitosis, and meiosis, and the impacts of these events on the DNA of cells.*
Biological Evolution: Unity and Diversity	**HS-LS4-1.** *Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.*	*Students learn that modifying or making changes to DNA can be possible, by either fixing mutations/diseases or introducing new traits that help an organism survive. This with time results in evolution.*		
	HS-LS4-5. *Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.*	*Students evaluate the degree to which the given empirical evidence can be used to construct logical arguments that identify causal links between environmental changes and changes in the number of individuals or species based on environmental factors that can determine the ability of individuals in a species to survive and reproduce.*		