The American School in London

Science 10 - High school NGSS aligned integrated science course

Unit 1: Ecosystem stability & change

Essential Questions	Why and how do populations change over time? Is the human population above its carrying capacity? What makes some ecosystems stable and others not?
Summary	Students use population change evidence to develop a model of interactions in ecosystems.
Standards Assessed	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. HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems (populations? DLP) at different scales. Hs-LS2-2. HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

Unit 2: Cell division, organization & homeostasis

Essential Questions	Why aren't humans just a blob of cells? Or just one large cell? How can organisms live in such a wide variety of environments?
Summary	Students develop models for mitosis and interacting systems in multicellular organisms to inform their investigation of homeostatic feedback mechanisms.
Standards Assessed	HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Unit 3: Inheritance & variation of traits

Essential Questions	What factors determine which traits are displayed in offspring? Why can the same parents have offspring with such different characteristics? How can we predict what characteristics offspring will display if we know about the previous generations? Can the characteristics that organisms display change?
Summary	Students use evidence from meiosis, replication and environment to reason about sources of genetic variation.
Standards Assessed	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. 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. 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.

Unit 4: Evolution of Life

Essential	Why is there so much variety to life on earth?

Questions	Is there evidence for the evolution of life on Earth? How do we know? Why is life so focused on reproduction?
Summary	Students develop an understanding of evolution while reasoning through the evidence for natural selection.
Standards Assessed	HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. 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.

Unit 5: Heat and Energy Exchanges

Essential Questions	What determines the direction of a chemical reaction? Where does the energy to cause a chemical reaction come from? Where does it go? How do temperature and concentration affect the direction that equilibrium will shift in a reaction?
Summary	Students develop the rules governing energy exchanges in chemical reactions by designing, refining, and performing investigations into exothermic and endothermic reactions.
Standards Assessed	HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*

Unit 6: The Production of Usable Energy

Essential Questions	What are the ways that we produce usable energy? Is a perpetual motion machine possible? What does it mean to “run out” of energy?
Summary	Students investigate the ways in which we produce electrical energy, and recognize and explore the difference between technological limitations and physical limitations.
Standards Assessed	HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction HS-PS4-2. Evaluate questions about the advantages of using a digital transmission and storage of information. HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.*

Unit 7: Climate variation & human impact

Essential Questions	How does energy flow in and out of Earth systems relate to climate change? How fast is our climate likely to change?

	What impact does human activity have on Earth systems?
Summary	Students use a computational representation or model to describe and explore energy changes in Earth systems.
Standards Assessed	HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth systems result in changes in climate. HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.*

Unit 8: Engineering Solutions to reduce human impact

Essential Questions	How can we mitigate our impact on the environment and biodiversity? How can we simulate relationships among natural resource management, sustainability of human populations and biodiversity?
Summary	Students engage in the design process to simulate and test a solution to mitigate adverse environmental impacts of human activity.
Standards Assessed	HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.* HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.