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| **Ecology** Number of Days: 35-40  **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.**[Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [*Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.*  **HS-LS1-5**  **Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.** [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [*Assessment Boundary: Assessment does not include specific biochemical steps.*]  **HS-LS2-1**  **Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.** [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [*Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.*]  **HS-LS2-4**  **Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.** [Clarification Statement: Emphasis is on using 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. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [*Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.*]  **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.** [Clarification Statement: Examples of models could include simulations and mathematical models.] [*Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.*] | |
| General | CP |
| **Populations**   * Limiting factors   + Carrying capacity   + Abiotic factors   + Competition * Population growth - R v. K * Human population growth   + demographics   **Communities**   * Energy flow   + Trophic levels * Keystone species * Niches * Biotic Relationships   + Mutualism   + Parasitisms   + Commensalism * Competition   **Ecosystems**   * Succession * Biological magnification * Niche * Nutrient cycling - carbon   + Photosynthesis and cellular respiration - mention- to be taught more fully in metabolism * Chemosynthesis - exposure not mastery * Properties of water - (polarity)   + Specific heat   + Density - review   **Human impact**   * Invasive species * Climate change * Habitat destruction | Expectation that CP students would come to this class with good background knowledge of the water cycle  **Populations**   * Mathematical models   + Logarithmic models   + Logistics   **Communities**   * Mathematical models   + Indices of diversity (Shannon Weiner)   **Ecosystems**   * Extend ecosystems to more foreign ecosystems (aquatic) * Nitrogen cycling (phosphorus if time)   **Human impact**   * Human interaction - predicting human impact * Ocean acidification * Laws and regulation if time |
| **Metabolism** Number of Days: 10-15  **HS-LS1-5**  **Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.** [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [*Assessment Boundary: Assessment does not include specific biochemical steps.*]  **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.**[Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [*Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.*]  **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.** [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [*Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.*] | |
| General | CP |
| **Enzymes**   * structure/function * Catalyst   **Purpose of cellular respiration and photosynthesis** -   * (ATP, glucose, chemical equation, Oxygen and Carbon dioxide, Carbon fixation) * Where in the cell each process occurs * Anabolic v. catabolic - inputs and outputs - energy flow   **Macromolecules** - monomer, polymer and basic function   * Lipids, carbohydrates, protein (food sources) * Nucleic acids (exposure only) * Hydrolysis and dehydration synthesis - models | **Enzyme -**   * Structure and function as related to activation energy   **Purpose of cellular respiration and photosynthesis** -   * Glycolysis - end product of the cycle is energy * Kreb’s cycle - exposure NOT mastery - (what goes in and out, not individual steps) * Electron transport chain - exposure   + Cell transport -in order to talk about electron transport - energy needed     - Diffusion (chemiosmosis)     - Active transport |
| **Homeostasis** Number of Days: 20-25  **HS-LS1-2**  **Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [*Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.*]  **HS-LS1-3**  **Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.** [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [*Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.*]  **HS-LS1-4**  **Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.** [*Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*] | |
| **General** | CP |
| Students have knowledge of Circulatory, respiratory, digestive, nervous systems. Tie relevance of the following to body systems.  **Regulation and control**   * Properties of water - (polarity)   + Specific heat   + Hydrophilic   + Hydrophobic   + Ph   + Solubility * Positive and Negative feedback loops   + Hormone regulation     - Insulin     - glycogen * Cells   + Cell cycle   + Replication (mitosis) - no memorization of steps!   + communication   + Inhibition   + Differentiation   + Cancer   **Cell transport**   * Diffusion * Osmosis   + Hypertonic   + Isotonic   + Hypotonic   + Polarity * Active transport   **Surface Area and Volume ratio - for nutrient/ gas uptake**   * Cell division * tissue specialization such as cilia, alveoli, villi, sulci | **Regulation and control**   * structure/ function comparative anatomy   **Cell transport**   * Design a lab r/t osmosis   **Surface Area and Volume ratio - for nutrient/ gas uptake** |
| **Genetics** Number of Days: 35-40  **HS-LS1-4**  **Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.** [*Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*  **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.** [*Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*]  **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.** [*Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.*]  **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.** [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]  **HS-LS3-3**  **Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.**[Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [*Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.*] | |
| General | CP |
| **Gene to Protein**   * Nucleic Acids   + Structure (nucleotide - understanding what and how bonds work)     - Covalent bonds for phosphate and sugar backbone     - Hydrogen bonding for the nitrogen bases     - Complementary base pairing     - DNA vs. RNA * Transcription/translation   + function of mRNA and tRNA   + Coding - amino acids (codons)   + Mutations   + Structure of proteins (shape equals function) * Applications   + Genetic modification   + Genetic Engineering   + Genetic diseases and disorders   **Probability**   * Application of Punnett Squares   + Dihybrid crosses   + Ratio multiplication * Pedigree review -   **Variation**   * Asexual vs. Sexual reproduction   + Meiosis vs. Mitosis   + Cloning vs. recombination * Environmental factors   + Epigenetics (general definition and examples)   + Mutation     - Toxins     - Radiation | **Gene to Protein**   * Transcription/translation   + Gene regulation     - Hox gene   + Folding     - Temperature     - Hydrophilic     - Hydrophobic     - Ph   + Anticodons * Applications   + Biotechnology   + Understand electrophoresis     - Introns and exons     - Non coding DNA   **Probability**  Chi squared  **Variation** |
| **Evolution** Number of Days: 35-40  **HS-LS4-1**  **Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.** [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]  **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.** [Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.] [*Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.*]  **HS-LS4-4**  **Construct an explanation based on evidence for how natural selection leads to adaptation of populations.** [Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading 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. [Clarification** Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]  **HS-LS3-3**  **Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.**[Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [*Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.*] | |
| General | CP |
| **Natural selection**   * Heritable vs. acquired traits * Adaptations and variation * Mutations * Survival of “fittest” (ability to increase in number) * Competition * Extinction * Patterns of selection   + Directional   + Stabilizing   + Disruptive   **Evidence**   * DNA * Fossil * Artificial selection (domestication) * Resistance   + Bacterial   + Viral   + Pesticides * Anatomical structures   + Analogous and homologous structures   + Embryology   + Vestiges * Biogeography - distribution of evolutionary lines across the planet   + Continental drift (access prior knowledge)   + Convergent evolution (flying squirrel vs. sugar glider)   + Endemics   **Speciation**   * Define biological species * Types of isolation   + Geographic   + Temporal   + Behavioral   + Mechanical   + Gametic   + Hybrid sterility   **Variation and distribution - changes in gene frequency**   * Mutation * Recombination * Drift * Refer back to Natural selection * Sexual selection * Artificial selection (domestication) * biotic/ abiotic - selective factors | * Hardy-Weinberg calculations * DNA comparative sequences * Fossil sequences * Evolutionary evidence to build cladograms * Gradualism vs. punctuated evolution |