Biology

Grades 10-12

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TABLE OF CONTENTS

Biology

Hazelwood School District

Mission Statement

In a culture of high expectations and excellence, our students will become lifelong learners equipped with 21st Century skills for success as global citizens.

Core Value Statements

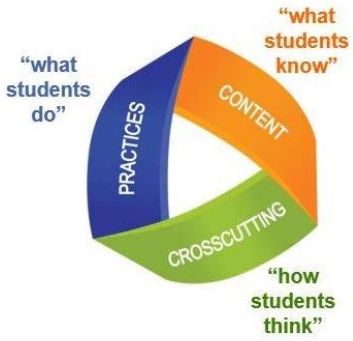
- High student achievement based on multiple measures as we prepare students to become global citizens.
- A diverse staff that is caring, culturally competent, well trained, and highly effective in their roles.
- Holding ourselves accountable for a culture of excellence with high standards in both academics and behavior.
- Maintaining fiscal responsibility of the district's assets and resources while utilizing best financial practices.
- A supportive learning environment that fosters healthy socio-emotional development for all students.
- Preparing students with global thinking and skills to make them productive in college, career, and life in the 21st century.
- Community involvement that drives high parental and community/stakeholder engagement, effective partnerships, and positive relationships with informative communication.

Goals

Goal 1 – Improve Student Achievement
Goal 2 – Differentiate and Expand Resources and Services for Students
Goal 3 – Enhance Professional Growth
Goal 4 – Maintain Fiscal Responsibility
Goal 5 – Increase Parent and Community Involvement

Curriculum Overview

In 2014, the Department of Elementary and Secondary Education (DESE) adopted the new Missouri Learning Standards (MLS) for Science. Modeled closely after the Next Generation Science Standards (NGSS), the new standards support a three dimensional learning framework to facilitate science content understanding. The three pillars of the 3-D model include Disciplinary Core Ideas, Crosscutting Concepts, and Science and Engineering Practices. These dimensions are designed to foster a deeper understanding of science through hands-on investigations, engaging in rich discourse and explaining phenomena.



In May 2018, DESE piloted a Field Test for Biology that was aligned to the new Missouri Learning standards. The new assessment differed from the previous assessment for Biology which consisted largely of recall and basic application questions. The new assessment format consists of performance tasks that aim to assess students' ability to think critically about phenomena while demonstrating understanding and application of the science and engineering practices and the crosscutting concepts.

Biology is a laboratory-based course that investigates the structure and function of living things, interdependent relationships in the environment, heredity, human impact and adaptations to changing environments. Students will progress through the 5-E instructional model (Engage, Explore, Explain, Elaborate, Evaluate) to develop a comprehensive understanding of organisms and the factors that affect their structure, function, growth, and development.

COURSE TITLE: Biology

GRADE LEVEL: 10-12

CONTENT AREA: High School Science

Course Description:
Biology is devoted to the study of living things and their processes. Throughout the year this course provides opportunities for students to develop scientific process skills, laboratory techniques, and an understanding of the diversity of living organisms and their ecological roles, cellular structures and their functions, cellular processes like photosynthesis, cellular respiration, and cell reproduction. An end of course exam (EOC) will be administered in April, which covers objectives for both semesters. (Prerequisites: Chemistry or Honors Chemistry)
Course Rationale:
Biology is a survey course where students explore aspects of different branches of biological sciences including molecular biology, genetics, and ecology. This course builds upon the life science concepts students learned in middle school. Students will develop the skills required for using the science and engineering practices and crosscutting concepts with hands-on exercises.

Course Scope and Sequence	
First Semester	
Unit 1: From Cells to Organisms StemScopes Modules: • Cell Division and Complex Organisms • DNA to Proteins 10 class periods	Unit 2: Inheritance and Variation of Traits StemScopes Modeules: • Inheritance of Traits • Variation of Traits 12 class periods
Unit 3: Homeostasis StemScopes Modules: • Organization of Systems • Feedback & Homeostasis 10 class periods	Unit 4, Part 1: Bioenergetics StemScopes Module: • Bioenergetics 8 class periods

Second Semester	
Unit 4, Part 2: Bioenergetics This is an add-on unit (Not STEMScopes): • Photosynthesis • Macromolecules 8 class periods	Unit 5: Matter and Energy in Ecosystems StemScopes Modules: • Flow of Matter and Energy in Ecosystems • Carbon Flow in Ecosystems 10 class periods
Unit 6: Maintaining Ecosystems StemScopes Modules: • Carrying Capacity • Biodiversity and Changes in Ecosystems • Minimizing Human Impacts 10 class periods	Unit 7: Common Ancestry and Natural Selection StemScopes Modules: • Evidence of Common Ancestry • Factors of Evolution • Results of Natural Selection 10 class periods

Proposed Course Materials and Resources:

STEMScopes – Digital Science Curriculum, High School Biology – 3D

Essential Terminology/Vocabulary

Unit 1:
Adenine, Anaphase, Cell, Cell Cycle, Cell Division, Centriole, Centromere, Chromatin, Chromosome, Cytokinesis, Cytosine, Daughter Cell, Differentiation, Diploid, DNA, Double Helix, Enzyme, Genes, G1 Phase, Guanine, Haploid, Hydrogen Bond, Interphase, Meiosis, Messenger RNA (mRNA), Metaphase, Mitosis, Nitrogen Bases, Nuclear Envelope, Nucleic Acid, Nucleotide, Organisms, Prophase, Protein Synthesis, RNA, Sister Chromatid, Specialized Cells, Spindle Fibers, Stem Cells, Telophase, Thymine, Transcription, Translation, and Uracil.

Unit 2:
Allele, Base Pairs, Centromere, Chromosomes, Crossing Over, DNA, DNA Replication, Dominant Allele, Environmental Factors, Fertilization, Gamete, Gene Expression, Genes, Genetic Variation, Genetics, Genome, Genotype, Heterozygous, Homologous Chromosomes, Homozygous, Independent Assortment, Inheritance, Meiosis, Mutation, Noncoding DNA, Offspring, Phenotype, Probability, Proteins, Punnett Square, Recessive Allele, Sister Chromatid, Trait, and Trait Variation.

Unit 3:
Cancer, Cell, Circulatory System, Control Center, Digestive System, Effectors, Endocrine System, Equilibrium, Excretory System, Feedback, Feedback Mechanisms, Function, Gene Expression, Hierarchical, Homeostasis, Hormone, Hypothalamus, Integumentary System, Internal Equilibrium, Multicellular, Musculoskeletal System, Negative Feedback, Nervous System, Organ, Organ System, Organism, Pathogen, Phloem, Positive Feedback, Receptors, Reproductive System, Stimuli, Structure, System, Tissue, and Xylem.

Unit 4:
Adenosine Triphosphate ATP, Alcohol Fermentation, Autotrophic, Bioenergetics, Biomass Pyramid, Carbohydrate, Carbon, Carbon Cycle, Carbon Dioxide, Carbon Fixation, Cellular Respiration, Compound, Dark Reactions, Decomposition, Element, Geological Pathway, Geosphere, Glucose, Glycolysis, Heterotroph, Hydrosphere, Inorganic, Lactic Acid Fermentation, Light Reactions, Mitochondrion, Organic, Oxygen, Photosynthesis, Products, Reactants, and Trophic Level.

Unit 5:
Autotrophic, Biomass, Carnivores, Consumer, Decomposers, Detritivore, Ecological Pyramid, Ecosystem, Energy, Energy Flow, Energy Pyramid, Food Chain, Food Web, Herbivores, Heterotrophs, Keystone Species, Matter, Omnivore, Predator, Primary Consumer, Producer, Pyramid of Biomass, Pyramid of Energy Flow, Secondary Consumer, Tertiary Consumer, and Trophic Level.

Unit 6:
Abiotic, Adaptations, Agriculture, Anthropogenic Change, Biodiversity, Biotic, Boundaries, Carrying capacity, Climate, Climate Change, Climax Community, Commensalism, Community, Competition, Consumption, Deforestation, Ecosystem, Energy Usage, Environmental Impact, Habitat, Habitat Destruction, Interdependent Relationships, Invasive Species, Keystone Species, Latitude, Limiting Factor, Microscopic, Mutualism, Niche, Organisms, Overexploitation, Overpopulation, Parasitism, Pollution, Population, Predation, Primary Success, Recycle, Reduce, Resilience, Resources, Reuse, Secondary Succession, Species, Succession, and Sustainable Farming and Fishing.

Unit 7:
Adaptation, Allele, Amino Acid Sequences, Anatomical Homologies, Biodiversity, Biogeography, Biological Evolution, Charles Darwin, Cladogram, Common Ancestor, Continental Drift, Developmental Homologies, Diversity, DNA Sequences, Embryological Homology, Empirical Evidence, Fossil Record, Gene Pool, Generation, Genetic Isolation, Genetic Variation, Gradualism, Heritable, Homology, Microevolution, Molecular Homologies, Mutation, Natural Selection, Organism, Pangea, Population, Punctuated Equilibrium, Reproductive Success, Species, Stasis, Structural Homology, Trait Variation, and Variation.

Unit Objectives:

Unit 1:

1. I can observe and describe the structural differences between different types of cells.
2. I can conduct an experiment to extract DNA from cells.
3. I can describe the structure of the DNA molecule.
4. I can explore a genetic disorder to explain how DNA is responsible for creating proteins and identify some of the problems that may arise if errors or mutations occur.
5. I can explore how mitosis is a process of predictable steps, and examine reasons why organisms undergo mitosis.
6. I can model how cell differentiation creates complex organisms.
7. I can examine specialized cells to explain how differentiation helps produce and maintain complex organisms.

Unit 2:

1. I can create an analogy for each part of the genome.
2. I can distinguish between transcription and translation.
3. I can use a model to simulate protein synthesis.
4. I can explain how differential gene expression occurs.
5. I can explain how small changes in instructions relate to the genetic diversity among species.
6. I can model meiosis and compare and contrast it to mitosis.
7. I explain how meiosis leads to genetic variation.
8. I can discuss the impact of mutations during meiosis leads to genetic variation among species.
9. I can explain how different environmental factors cause mutations.
10. I can predict genotypic and phenotypic Mendelian crosses.
11. I can predict genotypic and phenotypic non-Mendelian crosses.
12. I can conduct an investigation using plants to show how traits are inherited from parent generations to second generations.
13. I can model and demonstrate co-dominance in traits.

Unit 3:

1. I can develop a model to display and explain the levels of organization in organisms.
2. I can refine a model to show interactions between systems in organisms.
3. I can compare and contrast system interactions in plants and in animals.
4. I can distinguish between positive and negative feedback.
5. I can create a map/diagram of a feedback system and explain how it regulates functions in living things.
6. I can demonstrate how different body systems react to changing conditions.
7. I can explain how homeostasis is regulated in both plants and animals.

Unit 4:

1. I can distinguish between aerobic and anaerobic respiration.
2. I can differentiate between different types of anaerobic respiration.
3. I can conduct an investigation to determine the effect of variables on energy production during alcohol fermentation.
4. I can explain how processes like photosynthesis and cellular respiration drive the cycling of matter and flow of energy under aerobic and anaerobic conditions.

Unit 5:

1. I can use a model to demonstrate the transfer of energy in an ecosystem.
2. I can use a game-based structure to explore the movement of matter between the four spheres of Earth.
3. I can demonstrate how biomass is impacted as energy is transferred through a food chain.
4. I can construct and explanation for how energy flows through an ecosystem using population numbers and a food web.
5. I can use proportional equations to solve for the amount of biomass available in each level of a biomass pyramid.
6. I can analyze and sort data about the carbon cycle.
7. I can describe how carbon cycles through different parts of the Earth spheres.
8. I can discuss interactions between Earth's spheres and provide examples.
9. I can use evidence to construct an explanation for the mechanisms of carbon flow through all Earth's systems.
10. I can develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the Earth's spheres.
11. I can model and illustrate the processes of photosynthesis and cellular respiration.

Unit 6:

1. I can differentiate between symbiotic relationships in ecosystems.
2. I can predict how environmental or population changes in the ecosystem might affect other populations.
3. I will use a presentation to provide a solution to an environmental issue.
4. I can use a computational model to explain factors that impact the carrying capacity of ecosystems.
5. I can sort a set of succession cards and discuss.
6. I can use a simulated ecological succession model to describe the effects of primary and secondary succession on plant and animal life.
7. I will compare and contrast different biomes.
8. I can use a mathematical model to provide evidence on the effect of changing environmental conditions on ecosystem stability.
9. I can distinguish between density dependent and density independent limiting factors.

10. I can use a model to explain how ecosystems are impacted as a result of complex interactions between organisms (e.g., predation, crowding, disease, density dependent and density independent limiting factors.).

Unit 7:

1. I can analyze the 3 types of homologies (anatomical, developmental, and molecular) in provide evidence to support common ancestry.
2. I can use data to investigate common ancestry among species by comparing illustrations of prehistoric mammals to present day mammals.
3. I can determine how the amino acid sequence of several organisms compare and, I can use that information to construct a cladogram as evidence of common descent.
4. I can analyze allele frequencies in a population to understand the effects of natural selection on the population.
5. I can show how the change of allele frequencies in a population indicate differential reproductive success.
6. I can explore how natural selection and mutations can change the allele frequencies of the distribution of the sickle cell trait in humans.
7. I can provide examples of how each of the factors of evolution influence variation in ecosystems.
8. I can explain that as the number of species grow, competition for resources arises.
9. I can graph and analyze data to explain how organisms with advantageous traits tend to increase in a population more than organisms without these traits.
10. I can evaluate a claim about why and how the distribution of alleles in a population change.
11. I can identify examples of environmental conditions that have promoted changes in organisms over time.