

Oakwood City School District Biology Science Standards

One goal of science education is to help students become scientifically literate citizens able to use science as a way of knowing about the natural and material world. All students should have sufficient understanding of scientific knowledge and scientific processes to enable them to distinguish what is science from what is not science and to make informed decisions about career choices, health maintenance, quality of life, community and other decisions that impact both themselves and others.

Biology is a high school level course, which satisfies the Ohio Core science graduation requirements of Ohio Revised Code Section 3313.603. This section of Ohio law requires three units of science.. Each course should include inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

This course investigates the composition, diversity, complexity and interconnectedness of life on Earth. Fundamental concepts of heredity and evolution provide a framework through inquiry-based instruction to explore the living world, the physical environment and the interactions within and between them.

Students engage in investigations to understand and explain the behavior of living things in a variety of scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications.

Biology Standards

Heredity

- A. Cellular genetics
 - a. Describe the structure and function of chromosomes.
 - b. Explain the difference between sex chromosomes and autosomes.
 - c. Identify and describe the phases of mitosis and meiosis.
 - d. Compare and contrast mitosis and meiosis, including the difference between haploid and diploid cells.
 - e. Compare and contrast asexual reproduction and sexual reproduction.
 - f. Discuss the importance of sexual reproduction and genetic diversity.
- B. Structure and function of DNA in cells
 - a. Cite the research contributions of specific scientists in the discovery and functions of DNA.
 - b. Compare and contrast the structure and function of DNA and RNA.
 - c. Identify the general structure of a nucleotide.
 - d. Describe the process of DNA synthesis (replication).
 - e. Describe the process of RNA synthesis (transcription).
 - f. Describe the process of Protein synthesis (translation).
- C. Genetic mechanisms and inheritance
 - a. Identify Mendel's contributions to the science of genetics and discuss his three Laws of Inheritance.
 - b. Explain that a unit of heredity information is called a gene, and genes may occur in different forms called alleles.
 - c. Use the concepts of Mendelian and non-Mendelian genetics to explain inheritance.
 - d. Explain the relationship between an organism's genotype and phenotype.
 - e. Demonstrate the use of Punnett Squares in solving genetics both monohybrid and dihybrid genetics problems.
 - f. Explain the concept of sex-linked traits.
 - g. Analyze pedigree charts.
- D. Mutations
 - a. Describe that spontaneous changes in DNA are mutations, which are a source of genetic variation.
 - b. Discuss the differences between gene and chromosomal mutations and their effects on the organism and offspring.
 - c. Contrast normal versus abnormal karyotypes.
- E. Modern genetics
 - a. Explain how electrophoresis is used to evaluate DNA results.

Evolution

A. Mechanisms

- a. Natural selection
 - i. Explain how natural selection has affected a species.
 - ii. Compare the work of Lamarck, Darwin and Wallace.
- b. Mutation
 - i. Describe that spontaneous changes in DNA are mutations, which are a source of genetic variation.
- c. Genetic Drift and Gene Flow
 - i. Differentiate between gene flow and genetic drift.
 - ii. Identify the types of genetic drift: founder and bottle-neck effect.
- d. Sexual selection
 - i. Describe the process of sexual selection citing specific examples from the animal kingdom.

B. Speciation

- a. Explain how biological classification expanded as a result of molecular evidence.
- b. Demonstrate how population genetics and gene frequency impact the variation of organisms within a species.

Diversity and Interdependence of Life

A. Biodiversity

- a. Genetic diversity
 - i. Identify organisms with high and low genetic diversity. Recognize that species with low genetic diversity are more likely to become extinct.
- b. Species diversity
 - i. Investigate species diversity using the example of the wolf population that was reintroduced into Yellowstone National Park.

B. Ecosystems

- a. Equilibrium and disequilibrium
 - i. Predict how predator/prey population cycles will change if there are changes in the numbers of either species.
 - ii. Explain how humans can impact predator/prey relationships.
 - iii. Investigate an invasive species, analyze its impacts and predict the ecological and economic impacts on communities.
- b. Carrying capacity
 - i. Identify and interpret various features of population growth curves.
 - ii. Describe the characteristics of exponential and logistical growth.
 - iii. Analyze population data for patterns in population cycles to determine carrying capacities.
 - iv. Identify and explain correlations between variables in population data.

C. Loss of Diversity

- a. Climate change

- i. List examples of local environmental impacts caused by climate change.
 - ii. Examine biogeochemical cycles.
- b. Anthropocene effects
 - i. Identify anthropogenic factors and correlate these influences with their impacts on the environment.
- c. Extinction
 - i. Identify possible impacts species extinction has on biological communities.
- d. Invasive species
 - i. Describe common ways invasive species are introduced to a new habitat.
 - ii. Describe the characteristics of successful invasive species.

Cells

- A. Cell structure and function
 - a. Structure, function and interrelatedness of cell organelles
 - i. Compare the structure, function and interrelatedness of cell organelles in eukaryotic and prokaryotic cells.
 - b. Eukaryotic cells and prokaryotic cells
 - i. Identify and explain the key differences between these types of cells.
- B. Cellular processes
 - a. Characteristics of life regulated by cellular processes
 - i. Identify different types of transport.
 - ii. Determine how materials move across a selectively permeable membrane.
 - b. Photosynthesis, chemosynthesis, cellular respiration, biosynthesis of macromolecules
 - i. Identify key organelles, as well as the inputs and outputs of matter and energy, utilized by photosynthesis and cellular respiration.
 - ii. Compare and contrast anaerobic and aerobic respiration.
 - iii. Identify basic building blocks, functions, and location of biomolecules.
 - iv. Identify the structure and function of enzymes
 - v. Model enzyme substrate complexes.