SCIENCE - BIOLOGY

BIO.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- a) observations of living organisms are recorded in the lab and in the field;
- b) hypotheses are formulated based on direct observations and information from scientific literature;
- c) variables are defined and investigations are designed to test hypotheses;
- d) graphing and arithmetic calculations are used as tools in data analysis;
- e) conclusions are formed based on recorded quantitative and qualitative data;
- f) sources of error inherent in experimental design are identified and discussed;
- g) validity of data is determined;
- h) chemicals and equipment are used in a safe manner;
- i) appropriate technology including computers, graphing calculators, and probeware, is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions;
- j) research utilizes scientific literature;
- k) differentiation is made between a scientific hypothesis, theory, and law;
- l) alternative scientific explanations and models are recognized and analyzed; and
- m) current applications of biological concepts are used.

BIO.2 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include
- a) water chemistry and its impact on life processes;
- b) the structure and function of macromolecules;
- c) the nature of enzymes; and
- d) the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

BIO.3 The student will investigate and understand relationships between cell structure and function. Key concepts include
- a) evidence supporting the cell theory;
- b) characteristics of prokaryotic and eukaryotic cells;
- c) similarities between the activities of the organelles in a single cell and a whole organism;
- d) the cell membrane model; and
- e) the impact of surface area to volume ratio on cell division, material transport, and other life processes.

BIO.4 The student will investigate and understand life functions of Archaea, Bacteria and Eukarya. Key concepts include
- a) comparison of their metabolic activities;
- b) maintenance of homeostasis;
- c) how the structures and functions vary among and within the Eukarya kingdoms of protists, fungi, plants, and animals, including humans;
- d) human health issues, human anatomy, and body systems;
- e) how viruses compare with organisms; and
- f) evidence supporting the germ theory of infectious disease.

BIO.5 The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include
- a) cell growth and division;
- b) gamete formation;
- c) cell specialization;
- d) prediction of inheritance of traits based on the Mendelian laws of heredity;
- e) historical development of the structural model of DNA;
- f) genetic variation;
- g) the structure, function, and replication of nucleic acids;
- h) events involved in the construction of proteins;
- i) use, limitations, and misuse of genetic information; and
- j) exploration of the impact of DNA technologies.

BIO.6 The student will investigate and understand bases for modern classification systems. Key concepts include
- a) structural similarities among organisms;
- b) fossil record interpretation;
- c) comparison of developmental stages in different organisms;
- d) examination of biochemical similarities and differences among organisms; and
- e) systems of classification that are adaptable to new scientific discoveries.

BIO.7 The student will investigate and understand how populations change through time. Key concepts include
- a) evidence found in fossil records;
- b) how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations;
- c) how natural selection leads to adaptations;
- d) emergence of new species; and
- e) scientific evidence and explanations for biological evolution.

BIO.8 The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include
- a) interactions within and among populations including carrying capacities, limiting factors, and growth curves;
- b) nutrient cycling with energy flow through ecosystems;
- c) succession patterns in ecosystems;
- d) the effects of natural events and human activities on ecosystems; and
- e) analysis of the flora, fauna, and microorganisms of Virginia ecosystems.