Unit 1

The Science of Biology (Chapter 1)
Introductions, What is Biology, Characteristics of Life, and Scientific Method

BIO.1 Demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations

a) observe living organisms in the lab and field, and record data
b) formulate hypotheses based on observations and scientific literature
c) define variables and design investigations to test hypotheses
d) use graphing and arithmetic calculations in data analysis
e) form conclusions based on quantitative and qualitative data
f) identify and discuss sources of error inherent in experimental design
g) determine the validity of data
h) practice safe use of chemicals and equipment
i) use technology including computers, graphing calculators, and probeware
j) utilize scientific literature in research
k) distinguish between a scientific hypothesis, theory, and law
l) recognize and analyze alternative scientific explanations and models
m) use current applications of biological concepts

Unit 2

Biochemistry (Chapter 2)
Water, pH, Macromolecules, and Enzymes

BIO.2 Investigate and understand the chemical and biochemical principles essential for life

a) water chemistry and its impact on life processes
b) the structure and function of macromolecules
c) the nature of enzymes

Unit 3

Cells (Chapters 2 and 7)
Microscopes, Cell Theory, Cell Form and Function, Cell Membrane, Diffusion/Osmosis and Transport

BIO.3 Investigate and understand relationships between cell structure and function

a) evidence supporting the cell theory
b) characteristics of prokaryotic and eukaryotic cells
c) similarities between organelles and a whole organism
d) the cell membrane model
e) the impact of surface area to volume ratio

Cell Energy (Chapter 8 and 9)
Photosynthesis and Cellular Respiration

BIO.2 Investigate and understand the chemical and biochemical principles essential for life

d) photosynthesis and respiration

Unit 4

Cell Cycle/Mitosis and Meiosis (Chapters 10)

BIO.5 Investigate and understand common mechanisms of inheritance and protein synthesis
- a) cell growth and division
- b) gamete formation
- c) cell specialization

DNA and Protein Synthesis (Chapter 12 and 13)

DNA History and Structure, Replication, Protein Synthesis, and Mutations

BIO.5 Investigate and understand common mechanisms of inheritance and protein synthesis
- e) historical development of the structural model of DNA
- g) the structure, function, and replication of nucleic acids
- h) events involved in the construction of proteins

Genetics (Chapters 11-15)

Mendelian Genetics and Punnett Squares, Human Genetics, and Genetic Technologies

BIO.5 Investigate and understand common mechanisms of inheritance and protein synthesis
- f) genetic variation
- d) prediction of inheritance of traits based on the Mendelian laws of heredity
- i) use, limitations, and misuse of genetic information
- j) exploration of the impact of DNA technologies

BENCHMARK TEST

Unit 5

Evolution (Chapters 16, 17 and 19)

Fossils, Early Earth, Biogenesis/Spontaneous Generation, Natural Selection, Adaptations

BIO.7 Investigate and understand how populations change through time
- a) fossil records
- b) genetic variation, reproductive strategies, and environmental pressures impact the survival of populations
- c) natural selection
- d) emergence of new species
- e) scientific evidence and explanations for biological evolution

Unit 6

Classification (Chapter 18)

Domains-Species, Comparative Anatomy, Biochemistry, and Embryology, Binomial Nomenclature, Dichotomous Keys

BIO.6 Investigate and understand bases for modern classification systems
- 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
e) systems of classification that are adaptable to new scientific discoveries

Unit 7

Viruses, Bacteria, Protists and Fungi (Chapters 20 and 21)

Viruses, Koch's Postulates, Archaea, Bacteria, Eukarya, Protista, and Fungi

BIO.4 Investigate and understand life functions of Archaea, Bacteria and Eukarya
a) comparison of 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
f) evidence supporting the germ theory of infectious disease

Plants (Chapters 22-24)

Plantae Classification, Roots, Stems, Leaves, Reproduction, Anatomy, Hormones

BIO.4 Investigate and understand life functions of Archaea, Bacteria and Eukarya
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

Unit 8

Ecology (Chapters 3-6)

Biomes, Succession, Energy Transfer/Pyramids, Chains and Webs, Population Dynamics, Carrying Capacity and Limiting Factors, Nutrient Cycling

BIO.8 Investigate and understand dynamic equilibria within populations, communities, and ecosystems.
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
e) analysis of the flora, fauna, and microorganisms of Virginia ecosystems

BIO.7 Investigate and understand how populations change through time
b) genetic variation, reproductive strategies, and environmental pressures impact the survival of populations

Invertebrates, Vertebrates, and Human Anat. and Physiol. (Chapters 25-29)

Animal Characteristics, Invertebrate Phyla, Vertebrates, Human Anatomy and Physiology

BIO.4 Investigate and understand life functions of Archaea, Bacteria and Eukarya
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