UNIT 1: What is Biology?

1. **TIMELINE**

2. **ESSENTIAL QUESTION/STATEMENT**

   HOW IS THE SCIENTIFIC METHOD USED TO SOLVE PROBLEMS?

3. **STANDARDS**

   **Alabama Course of Study**
   1. Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an experiment
      a. Describing the steps of the scientific method
      b. Comparing controls, dependent variables, and independent variables
      c. Identifying safe laboratory procedures when handling certain chemicals and using Bunsen burners and laboratory glassware
      d. Using appropriate SI units for measuring length, volume, and mass

   **ACT Quality Core**
   A. Exploring and Defining the Fundamental Unifying Concepts, Organization, and Inquiry Techniques Underlying the Science of Biology
   
   1. **Scientific Inquiry**
      i. Identify and clarify biological research questions and design experiments
      ii. Manipulate variables in experiments using appropriate procedures
      iii. Collect, organize and analyze data accurately and precisely
      iv. Interpret results and draw conclusions, revising hypotheses as necessary and/or formulating additional questions or explanations
      v. Write and speak effectively to present and explain scientific results, using appropriate terminology and graphics
      vi. Safely use laboratory equipment and techniques when conducting scientific investigations

   2. **Mathematics and Measurement in Science**
      vii. Use appropriate SI units for length, mass, time, temperature, quantity, area, volume, and density, and describe the relationships among SI unit prefixes and how SI units are related to analogous English units
      viii. Calculate the mean of a set of values
ix. Use graphical models, mathematical models, and simple statistical models to express patterns and relationships determined from sets of scientific data

3. **Science in Practice**
   i. Describe the fundamental assumptions of science
   ii. Assess how scientific and technological progress has affected other fields of study, careers, and aspects of everyday life
   iii. Recognize and apply criteria that scientists use to evaluate the validity of scientific claims and theories
   iv. Explain why scientific investigations must meet certain criteria
   v. Explain why all scientific knowledge is subject to change as new evidence

4. **Foundations**
   i. Design and conduct investigations appropriately using essential processes of scientific inquiry
   ii. Use mathematics to enhance the scientific inquiry process

4. **UNIT VOCABULARY**

  Biology
  Organism
  Organization
  Reproduction
  Species
  Growth
  Development
  Environment
  Stimulus
  Response
  Homeostasis
  Energy
  Adaptation
Evolution
Scientific methods
Hypothesis
Experiment
Control
Independent variable
Dependent variable
Safety symbol
Data
Theory
Ethics
Technology
Qualitative information
Quantitative information
SI System
Milli
Centi
Deci
Kilo
Hecto
Deka
Unit 2: THE LIFE OF A CELL (Chapters 6, 7, 8, 9)

1. **TIMELINE**

2. **ESSENTIAL QUESTION/STATEMENT**
   What is the biological importance of the 4 organic compounds of life?
   How do organelles help the cell function?

3. **STANDARDS**
   **Alabama Course of Study**
   2. Describe cell processes necessary for achieving homeostasis, including active and passive transport, osmosis, diffusion, exocytosis, and endocytosis
      a. Identifying functions of carbohydrates, lipids, proteins, and nucleic acids in cellular activities
      b. Comparing the reaction of plant and animal cells in isotonic, hypotonic, and hypertonic solutions
      c. Explaining how surface area, cell size, temperature, light, and pH affect cellular activities
      d. Applying the concept of fluid pressure to biological systems
   3. Identify reactants and products associated with photosynthesis and cellular respiration and the purposes of these two processes.
   4. Describe similarities and differences of cell organelles, using diagrams and tables.
      a. Identifying scientists who contributed to the cell theory
      b. Distinguishing between prokaryotic and eukaryotic cells
      c. Identifying various technologies used to observe cells
   5. Identify cells, tissues, organs, organ systems, organisms, populations, communities, and ecosystems as levels of organization in the biosphere
      a. Recognizing that cells differentiate to perform specific functions

   **ACT Quality Core**

   A. Exploring and Defining the Fundamental Unifying Concepts, Organization, and Inquiry Techniques Underlying the Science of Biology
      a. Identify subatomic particles and describe how they are arranged in atoms
      b. Describe the difference between ions and atoms and the importance of ions in biological processes
c. Compare the types of bonding between atoms to form molecules

d. Show how chemical reactions can be represented by chemical formulas

e. Explain the difference between organic and inorganic compounds

f. Explain the fundamental principles of the pH scale and the consequences of having the different concentrations of hydrogen and hydroxide ions

g. Describe the general structure and function(s), including common functional groups of monosaccharides, disaccharides, polysaccharides, carbohydrates, fatty acids, glycerol, glycerides, lipids, amino acids, dipeptides, polypeptides, proteins, and nucleic acids

B. Investigating Life Processes at the Cellular Level and Understanding BOTH How These processes work and how they are maintained and regulated

a. Analyze the similarities and differences among plant vs. animal cells and eukaryotic vs. prokaryotic cells

b. Describe the functions of all major cell organelles, including nucleus, ER, RER, golgi apparatus, ribosome, mitochondria, microtubules, microfilaments, lysosomes, centrioles, and cell membrane

d. Contrast the structure and function of subcellular components of motility

e. Explain how the cell membrane controls movement of substances both into and out of the cell and within the cell

f. Explain how the cell membrane maintains homeostasis

g. Describe and contrast these types of cell transport: osmosis, diffusion, facilitated diffusion, and active transport

4. VOCABULARY

Element
Atom
Nucleus
Isotope
Compound
Covalent bond
Molecule
Ion
Ionic bond
Metabolism
Mixture
Solution
Ph
Acid
Base
Polar molecule
Hydrogen bond
Diffusion
Dynamic equilibrium
Isomer
Polymer
Carbohydrate
Lipid
Protein
Amino acid
Peptide bond
Enzyme
Nucleic acid
Nucleotide
Cell
Cell theory
Compound light microscope
Electron microscope
Eukaryote
Nucleus
Organelle
Prokaryote
Fluid mosaic model
Phospholipid bilayer
Plasma membrane
Selective permeability
Transport proteins
Cell wall
Chloroplast
Chlorophyll
Chromatin
Cilia
Cytoplasm
Cytoskeleton
Endoplasmic reticulum
Flagella
Golgi apparatus
Lysosome
Microfilament
Microtubule
Mitochondria
Nucleolus
Plastid
Ribosome
Vacuole
ATP
Cellular Respiration
UNIT 3: GENETICS

1. TIMELINE

2. ESSENTIAL QUESTION/STATEMENT

COMPARE THE PROCESSES OF MITOSIS AND MEIOSIS.

HOW IS DNA AND RNA INVOLVED IN THE TRANSMISSION OF GENETIC INFORMATION?

3. STANDARDS

Alabama Course of Study

6. Describe the roles of mitotic and meiotic divisions during reproduction, growth, and repair of cells

7. Apply Mendel’s law to determine phenotypic and genotypic probabilities of offspring

8. Identify the structure and function of DNA, RNA, and protein

ACT Quality Core

C. Delving into heredity by investigating how genetic structures and processes provide the mechanism for continuity and variety among organisms

   A. Describe the basic structure and function of DNA, Mrna, TRNA, amino acids, polypeptides, and proteins

   B. Describe the experiments of major scientists in determining both the structure of DNA and the central dogma

   C. Use mRNA codon charts to determine amino acid sequences of example polypeptides

   E. Describe how gene expression is regulated in organisms such that specific proteins are synthesized only when they are needed by the cell

   F. Describe the basic process of meiosis

G. Identify and explain Mendel’s law of segregation and law of independent assortment

I. Define and provide an example of the following: genotype, phenotype, dominant allele, recessive allele, codominant allele, incompletely dominant alleles, homozygous, heterozygous, and carrier

J. Explain sex-linked patterns if inheritance in terms of some genes being absent from the smaller Y chromosome, and thus males (XY) having a different chance of exhibiting certain traits than do females

K. Construct and interpret punnett squares and pedigree charts
L. infer parental genotypes and phenotypes from offspring data presented in pedigree charts and from the phenotypic and genotypic ratios of offspring

M. describe the mode of inheritance in commonly inherited disorders

4. **Vocabulary**

Anaphase
Cell cycle
Centriole
Centromere
Chromatin
Chromosome
Cytokinesis
Interphase
Metaphase
Mitosis
Organ
Organ system
Prophase
Sister chromatid
Spindle
Telophase
Tissue
Cancer
Gene
Allele
Dominant
Fertilization
Gamete
Genetics
Genotype
Heredity
Heterozygous
Homozygous
Hybrid
Law of independent assortment
Law of segregation
Phenotype
Pollination
Recessive
Trait
Zygote
Crossing over
Diploid
Egg
Genetic recombination
Haploid
Homologous chromosome
Meiosis
Nondisjunction
Sexual reproduction
Sperm
DNA replication
Double helix
Nitrogenous base
Codon
Messenger RNA
Ribosomal RNA
Transcription
Transfer RNA
Translation
Chromosomal mutation
Frameshift mutation
Mutagen
Mutation
Point mutation
Carrier
Fetus
Pedigree
Autosome
Codominant allele
Incomplete dominance
Multiple allele
Polygenic inheritance
Sex chromosome
Sex-linked trait
Karyotype
UNIT 4: ECOLOGY

1. TIMELINE
2. ESSENTIAL QUESTION/STATEMENT
   How can change in one part of an ecosystem affect change in other parts of the ecosystem?

3. STANDARDS

   **Alabama Course of Study**
   12. Describe protective adaptations of animals, including mimicry, camouflage, beak type, migration, and hibernation

   13. Trace the flow of energy as it decreases through the trophic levels from producers to the quaternary level in food chains, food webs, and energy pyramids

   14. Trace biogeochemical cycles through the environment, including water, carbon, oxygen, and nitrogen

   15. Identify biomes based on the environmental factors and native organisms

   16. Identify density-dependent and density-independent limiting factors that affect populations in an ecosystem

   **ACT Quality Core**

   D. Investigating processes that allow populations to change in response to different environmental and genetic pressures

   b. Explain the biological definition of evolution

   d. Discuss Darwin’s principle of survival of the fittest and explain what Darwin meant by natural selection

   g. Provide examples of behaviors that have evolved through natural selection

   h. Design, perform, and analyze a laboratory simulation of natural selection on a working population

   F. Analyzing the ecological processes by which living things interact with their environments and with each other

   a. Define and provide examples of biosphere, biome, ecosystem, community, population, species, habitat, and niche
b. Discuss biotic and abiotic factors that affect land and aquatic biomes

d. Explain how energy flows through ecosystems in one direction

e. Explain how the amount of life any environment can support is limited by the available matter and energy and by the ability of ecosystems to recycle the residue of dead organic materials

g. Diagram the flow of energy using food webs, food chains, and pyramids

h. Describe examples of competition, symbiosis, and predation

i. Explain the concept of carrying capacity

k. Explain the process of ecological succession, and describe the different communities that result

4. **VOCABULARY**

Abiotic factor

Biological community

Biosphere

Biotic factor

Commensalism

Ecology

Ecosystem

Habitat

Mutualism

Niche

Parasitism

Population

Symbiosis

Autotroph

Biomass
Exponential growth
Life-history pattern
Age structure
Birthrate
Death rate
Demography
Doubling time
Acid precipitation
Biodiversity
Edge effect
Endangered species
Exotic species
Extinction
Habitat degradation
Habitat fragmentation
Ozone layer
Threatened species
Captivity
Conservation biology
Habitat corridors
Natural resources
Reintroduction programs
Sustainable use
Analogous structure
Artificial selection
Camouflage
Embryo
Homologous structure
Mimicry
Natural selection
Vestigial structure
Adaptive radiation
Allelic frequency
Convergent evolution
Directional selection
Disruptive selection
Divergent evolution
Gene pool
Genetic drift
Genetic equilibrium
Geographic isolation
Gradualism
Polyploid
Punctuated equilibrium
Reproductive isolation
Speciation
Stabilizing selection
UNIT 5: KINGDOMS AND ORGANIZATION

1. **TIMELINE**

2. **ESSENTIAL QUESTION/STATEMENT**
   - How can scientists use levels of organization to describe scales of study?
   - What characteristics are used to group and classify living things?
   - How can the kingdoms of life be compared and contrasted?
   - What are some examples of organisms in each kingdom and what characteristics place them in that kingdom?
   - How can kingdoms be further divided into subgroups?

3. **STANDARDS**

   **Alabama Course of Study**

   5. Identify cells, tissues, organs, organ systems, organisms, populations, communities, and ecosystems as levels of organization in the biosphere

   9. Differentiate between the previous five-kingdom and current six-kingdom classification systems

   **ACT Quality Core**

   E. Identifying and Deciphering the distinguishing characteristics of all categories of living things and establishing the genetic, ancestral, and behavioral relationships among them

   a. Explain how organisms are classified into a hierarchy of groups and subgroups based on similarities that reflect their evolutionary relationships

   b. List each of the major levels in the hierarchy of taxa: kingdom, phylum, class, order, family, genus, and species

   c. Explain the binomial nomenclature system.

   d. Construct and use a dichotomous taxonomic key.

   e. Distinguish between and among viruses, bacteria, and protists, and give examples of each

   f. Explain classification criteria for fungi, plants, and animals

   g. Compare the major division of animals

   a. Define and provide examples of biosphere, biome, ecosystem, community, population, species, habitat, and niche
4. VOCABULARY
   Binomial nomenclature
   Class
   Classification
   Division
   Family
   Genus
   Kingdom
   Order
   Phylum
   Specific epithet
   Taxonomy
   Cladistics
   Cladogram
   Eubacteria
   Fungus
   Phylogeny
   Prokaryote
   Bacteriophage
   Capsid
   Host cell
   Lysogenic
   Lytic cycle
   Prion
   Provirus
   Retrovirus
   Reverse transcriptase
   Viroid virus
   Binary fission
   Chemosynthesis
   Conjugation
   Endospore
   Nitrogen fixation
   Obligate aerobe
   Obligate anaerobe
   Toxin
   Alga
   Asexual reproduction
   Ciliate
   Flagellate
   Protozoan
   Pseudopodia
   Spore
   Sporozoan
Alternation of generations
Colony
Fragmentation
Gametophyte
Sporophyte
Thallus
Plasmodium
Budding
Chitin
Haustoria
Hypha
Mycelium
Sporangium
Ascosphore
Ascus
Basidiospore
Basidium
Conidiophore
Conidium
Gametangium
Lichen
Mycorrhiza
Rhizoid
Stolon
Zygospor
Unit 6: Plants

How are the functions of basic plant organs related to their structure?

Alabama Course of Study

3. Identify reactants and products associated with photosynthesis and cellular respiration and the purposes of the two processes.

10. Distinguish between monocots and dicots, angiosperms and gymnosperms, and vascular and nonvascular plants.

ACT Quality Core

E. Identifying and Deciphering the distinguishing characteristics of all categories of living things and establishing the genetic, ancestral, and behavioral relationships among them.

a. Describe the basic mechanisms of plant processes, especially movement of materials and plant reproduction.

b. Explain the functions of unique plant structures, including the cell wall, chloroplasts, and critical parts of the flower and the seed.

Vocabulary

Cuticle
Leaf
Nonvascular plant
Root
Seed
Stem
Vascular plant
Vascular tissue
Cone
Frond
Archegonium
Antheridium
Prothallus
Rhizome
Sorus
Strobilus
Annuals
Biennials
Cotyledon
Deciduous plant
Dicotyledons
Embryo
Fruit
Monocotyledons
Ovule
Perennials
Pollen grains
Apical meristem
Collenchyma
Companion cell
Cork cambium
Epidermis
Guard cell
Meristem
Parenchyma
Phloem
Sclerenchyma
Sieve tube
Stomata
Tracheid
Trichome
Vascular cambium
Vessel element
Xylem
Cortex
Endodermis
Mesophyll
Pericycle
Petiole
Root cap
Sink
Translocation
Transpiration
Auxin
Cytokinin
Ethylene
Gibberellin
Hormone
Nastic movement
Tropism
Megaspore
Micropyle
Microspore
Protonema
Vegetative reproduction
Anther
Day-neutral plant
Long-day plant
Ovary
Petals
Photoperiodism
Pistil
Sepals
Short-day plant
Stamen
Dormancy
Double fertilization
Endosperm
Germination
Hypocotyl
Polar nuclei
Radicle
UNIT 7: Animals

1. **TIMELINE**

2. **ESSENTIAL QUESTION/STATEMENT**

   How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?

3. **STANDARDS**

   **Alabama Course of Study**

   11. Classify animals according to type of skeletal structure, method of fertilization and reproduction, body symmetry, body coverings, and locomotion.

   12. Describe protective adaptations of animals, including mimicry, camouflage, beak type, migration, and hibernation.

   **ACT Quality Core**

   E. Identifying and Deciphering the distinguishing characteristics of all categories of living things and establishing the genetic, ancestral, and behavioral relationships among them

4. **VOCABULARY**

   Ectoderm
   Endoderm
   Sessile
   Anterior
   Bilateral symmetry
   Dorsal
   Endoskeleton
   Exoskeleton
   Invertebrate
   Posterior
   Radial symmetry
   Symmetry
   Ventral
   Vertebrate
   External fertilization
   Filter feeding
Internal fertilization
Appendage