1. **Students will demonstrate understanding of scientific reasoning, logic, and the nature of science through investigation. Students will be able to...**

- conduct investigations in the classroom and in the field.
- critically examine investigations.
- observe and record qualitatively and quantitatively.
- hypothesize about and test cause and effect.
- identify independent and dependent variables, constants, and controls.
- write clear, replicable procedures.
- create, use, and discuss diagrams of data and its meaning.
- argue a case logically based upon data.

2. Students will investigate and understand the chemical and biochemical principles essential for life.
Students will be able to...

- explain what makes water vital for life and why.
- identify the main components of living cells. (CHONPS)
- explain what makes the four categories of macromolecules important and why.
- describe and diagram how enzymes catalyze reactions.
- illustrate how and why light is a major energy source.
- correlate photosynthesis with respiration.

3. Students will investigate and understand how cells are structured and how they function.
Students will be able to...

- outline the history of cell theory.
- compare and contrast prokaryotic and eukaryotic cells.
- compare and contrast single cell organelles and whole organisms.
- identify the form and function of essential cell structures.
- illustrate how selective permeability, diffusion, osmosis, active transport, and surface area impact solubility.

4. Students will investigate and understand life functions of bacteria and eukarya.
Students will be able to...

- characterize metabolism for various life forms.
- theorize and illustrate organism response to environmental change.
- compare and contrast eukarya based on cells, movement, reproduction, and response to environmental change.
- illustrate the main factors that affect human health.
- illustrate the form and function of human body systems.
- compare and contrast viruses and cells.
- describe germ theory.

5. Students will investigate and understand how and why traits are inherited through proteins.
Students will be able to...

- describe and diagram the stages of and processes within mitosis and meiosis.
- compare and contrast mitosis and meiosis, and why each occurs.
- demonstrate the importance of cell specialization in multicellular organisms.
- illustrate heredity, patterns of inheritance, and traits expressed by a genotype.
- use a Punnet square to show all possible gamete combinations and the likelihood of each combination occurring.
- evaluate a karyotype chart to determine individual gender and genetic health.
- rationalize genetic diversity and its advantage.
- illustrate lethal, harmful, and beneficial mutations.
- describe the form and function of DNA and its replication.
- outline the history of development of the DNA model.
- write a complimentary mRNA strand for a given DNA sequence.
- illustrate the protein synthesis process, including transcription and translation.
- meaningfully debate various sides of arguments regarding genetic engineering.

6. Students will investigate and understand the bases of modern classification.
Students will be able to...

- construct and use dichotomous keys to classify objects and organisms.
- describe relationships based on homologous structures.
- compare structural characteristics of an extinct organism evidenced by its fossil record with present and familiar organisms.
- describe similarities and relationships between diverse embryonic stages.
- compare biochemical evidence and describe relationships between them.
- interpret a cladogram or phylogenic tree.
- apply classification systems to flora and fauna in the field.

7. Students will investigate and understand how populations change through time.
Students will be able to...

- determine the relative age of a fossil, based on its position in the rock and radioactive decay.
- differentiate between relative and absolute fossil dating.
- illustrate the impact of reproductive strategies and adaptations on the survivability of an organism or population.
- illustrate how genetic variation and natural selection leads to gradual changes and new species.
- predict the impact of environmental change on a population.
- compare and contrast punctuated equilibrium to gradual change over time.

8. Students will investigate and understand dynamic equilibrium.
Students will be able to...

- graph and interpret a population's growth curve and carrying capacity.
- predict changes in a population as the result of population interaction.
- model key processes in water, carbon, and nitrogen cycles.
- identify each producer, consumer, and decomposer in a food chain or web.
- identify and describe an ecosystem.
- interpret how the flow of energy occurs between trophic levels in ecosystems.
- describe patterns of succession in water and land ecosystems in Virginia.
- compare and contrast primary and secondary succession.
- model a climax community.
- apply ecological principles to local ecosystems in the field, as appropriate.
- evaluate negative and positive impacts of humans on Virginia's ecosystems.