

BIOLOGY

Students should be able to use science and engineering practices and understand the following content:

Science and Engineering Practices

- Development of habits of mind that are necessary for scientific thinking and that allow students to engage in science in ways similar to those used by scientists and engineers
- Asking and answering questions about the natural world
- Developing and using models to (1) build understanding of phenomena, processes and relationships, (2) test devices or solutions, or (3) communicate ideas to others
- Conducting structured investigations to answer scientific questions, test predictions, and develop explanations
- Collecting and analyzing data from investigations to construct explanations and communicate results
- Using mathematical and computational thinking in collecting and communicating data
- Using technology to collect data and in communication of results

Biology (Cells as a System)

- Demonstrate an understanding that the essential functions of life take place in cells or systems of cells
- Explain how the structures of carbohydrates, lipids, proteins, and nucleic acids are related to their functions
- Plan and investigate how factors like temperature and pH affect reaction rates
- Develop and use models to explain how cellular organelles work
- Compare and contrast prokaryotic and eukaryotic cells
- Discuss how viruses differ from cells
- Describe ways in which cells maintain homeostasis
- Describe and model how materials move across a membrane
- Construct models to illustrate cell division and differentiation
- Describe and discuss what occurs during the cell cycle
- Explain how the cell cycle is regulated
- Discuss the pros and cons of biotechnological applications

Biology (Energy Transfer)

- Demonstrate an understanding that most of the energy that supports life is derived from the Sun via photosynthesis
- Explain energy transfers that occur in organisms
- Develop and use models of how chemical reactions among ATP, ADP, and inorganic phosphate are involved in energy transfer
- Develop models to describe energy transfer in anaerobic and aerobic respiration
- Discuss and explain the impacts of exercise on cellular respiration
- Plan and conduct investigations that examine fermentation and cellular respiration
- Explain how the basic structure of common natural and synthetic polymers is related to their bulk properties (proteins, nucleic acids, starches, plastics)
- Calculate empirical formulas and percentage composition of compounds

Biology (Heredity-Inheritance and Variation of Traits)

- Demonstrate an understanding of the specific mechanisms by which characteristics/traits are transferred via genes from generation to generation
- Describe and discuss the functions of DNA and RNA
- Describe and discuss the process of mitosis
- Describe the biotechnical applications and tools used for DNA sequencing and analysis
- Describe and discuss the process of meiosis
- Analyze data to determine patterns of inheritance
- Explain how meiosis contributes to genetic diversity
- Develop and use models to analyze types of mutations

Biology (Evolution-Unity and Diversity)

- Demonstrate an understanding of biological evolution and the diversity of life
- Discuss evidence from anatomy, embryology, biochemistry, and paleontology that is used as support for evolution
- Examine phylogenetic trees that show evidence of relationships among organisms
- Explain the potential benefits of genetic variability and diversity
- Use models to show how classification schemes have changed over time

Biology (Ecosystem Dynamics)

- Demonstrate an understanding that ecosystems are complex, interactive systems that include both biological communities and physical components of the environment
- Analyze and interpret data that show changes in biotic and abiotic components over time
- Use mathematical and computational thinking to analyze data related to limiting factors and populations
- Develop and use models of the carbon cycle to evaluate the effects on ecosystems releasing more carbon dioxide
- Analyze and interpret atmospheric data to explain potential impacts of greenhouse gases on the carbon cycle and global climate
- Construct explanations to support claims that changes in biotic and abiotic components can impact the homeostasis of ecosystems
- Design and discuss solutions to reduce human impacts on the environment

Activities:

- Visit a nature center. Take a walk. Visit a park. Describe the kinds of interactions you note. What kinds of life do you see? What water sources do you note? What evidence of human activity do you note?
- Discuss ways that you and your community can recycle materials.
- Visit a medical facility where you can learn about ways in which biotechnology is used.
- Get to know South Carolina. What levels of biodiversity exist? What kinds of habitats are present?

- Take nature photos.
- Investigate careers that require a background in biology.

Web Sites

- American Chemical Society - <http://www.acs.org/content/acs/en.html>
- Biology Simulations - <https://phet.colorado.edu/en/simulations/category/biology>
- Chemistry Simulations - <https://phet.colorado.edu/en/simulations/category/chemistry>
- Encyclopedia of Life - <http://eol.org>
- Exploratorium - <http://www.exploratorium.edu>
- Franklin Institute - <https://www.fi.edu>
- Genetics Learning Center - <http://learn.genetics.utah.edu>
- Howard Hughes Medical Institute - <http://www.hhmi.org>
- Journey North - <https://www.learneg/jnorth/>
- NASA Science - <http://science.nasa.gov>
- Periodic Table <http://www.rsc.org/periodic-table>
- National Wildlife Federation - <http://www.nwf.org/Kids.aspx>
- South Carolina Department of Natural Resources – www.dnr.state.sc.us
- Tree of Life Web Project - <http://tolweb.org/tree/phylogeny.html>