Unit 2: The Chemistry of Life

Content Area: **Science**
Course(s): **AP Biology**
Time Period: **Semester 1**
Length: **3 weeks**
Status: **Published**

Standards

SCI.9-12.5.1.12	All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.
SCI.9-12.5.1.12.B	Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.
SCI.9-12.5.2.12	All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.
SCI.9-12.5.2.12.A.b	Differences in the physical properties of solids, liquids, and gases are explained by the ways in which the atoms, ions, or molecules of the substances are arranged, and by the strength of the forces of attraction between the atoms, ions, or molecules.
SCI.9-12.5.2.12.A.f	Acids and bases are important in numerous chemical processes that occur around us, from industrial to biological processes, from the laboratory to the environment.
SCI.9-12.5.2.12.B	Substances can undergo physical or chemical changes to form new substances. Each change involves energy.
SCI.9-12.5.2.12.D.b	The driving forces of chemical reactions are energy and entropy. Chemical reactions either release energy to the environment (exothermic) or absorb energy from the environment (endothermic).
SCI.9-12.5.2.12.D.e	Chemical equilibrium is a dynamic process that is significant in many systems, including biological, ecological, environmental, and geological systems. Chemical reactions occur at different rates. Factors such as temperature, mixing, concentration, particle size, and surface area affect the rates of chemical reactions.
SCI.9-12.5.3.12	All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.
SCI.9-12.5.3.12.A.a	Cells are made of complex molecules that consist mostly of a few elements. Each class of molecules has its own building blocks and specific functions.
SCI.9-12.5.3.12.A.b	Cellular processes are carried out by many different types of molecules, mostly by the group of proteins known as enzymes.
TECH.8.2.12.C.CS3	The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.

Enduring Understandings - College Board AP Biology

2.A: Growth, reproduction, and maintenance of the organization of living systems require free energy and matter.

2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's

environment.

4.A: Interactions within biological systems lead to comple properties

4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment

Essential Questions

How are unique bonding properties of atoms responsible for creating molecules integral to life's processes?

How does the structure of an atom contribute to its biological properties and bonding patterns?

How do the unique chemical and physical properties of water make life on earth possible?

How is the role of carbon important in the molecular diversity of life?

How do the structures of biologically important molecules (carbohydrates, proteins, lipids and nucleic acids) account for their functions?

How do cells synthesize and catabolize macromolecules?

How do enzymes regulate the rate of chemical reactions?

How does the specificity of an enzyme depend on its structure?

How is the activity of an enzyme regulated?

Knowledge and Skills

Students will understand and be able to demonstrate knowledge of:

- the basic properties of atoms, bonds
- The polarity of water and how it produces cohesion and adhesion, specific heat, role as solvent
- pH and its effect on biochemical processes
- Organic molecules and their roles in organisms – describe the structures of carbohydrates, lipids, proteins and nucleic acids and relate to functions
- Synthesis and Hydrolysis of macromolecules
- Properties of molecules change as monomers become polymers

- Free energy Changes – what is required to release energy?
- Enzymes as organic catalysts – how does an enzyme affect activation energy?
- Regulation of enzyme activity

Resources

Readings: Chapters 2 and 3 of Principles of Life

Labs:

- Exploration of the Properties of Water
- Modeling of Carbon Compounds - use organic model kits
- Protein Folding: Model possible folding configurations of a polypeptide given a number of bonding rules. Compare with actual structure of the given polypeptide and explore its function. Use Amino Acid Starter Kit (Molecular Designs) for modeling.
- AP Investigation 13: Enzyme Activity – Use Vernier Gas Pressure sensor to measure production of O_2 resulting from decomposition of H_2O_2.
- *Virtual Lab* - http://www.wiley.com/college/pratt/0471393878/student/animations /enzyme_kinetics/index.html

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit