Unit 02: Biochemistry

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **6-7 Weeks**
Status: **Published**

Summary

Introduction:

The focus of this unit is to investigate how biological molecules serve as the foundation of life. Basic chemistry will be reviewed and built upon to relate the chemical properties of atoms to their bonding capabilities. Students will make connections between how the chemical characteristics of water molecules result in the specific properties of water that support life. Students will also investigate how climate change impacts the acidity of water. Students will learn how dehydration synthesis and hydrolysis reactions make and break the chemical bonds of the biological molecules that support life. The structure and function of the four classes of biological molecules important to life will be taught.

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Standards

9.1.12.CFR	Civic Financial Responsibility
HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
	Brainstorming can create new, innovative ideas.
LA.RL.9-10.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
9.4.2.CT	Critical Thinking and Problem-solving
	Critical thinkers must first identify a problem then develop a plan to address it to effectively solve the problem.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.

9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).
PS1.A	Structure and Properties of Matter
9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
PS2.B	Types of Interactions
	Individuals should practice safe behaviors when using the Internet.
	Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
PS1.A	Structure and Properties of Matter
PS1.B	Chemical Reactions
	Individuals from different cultures may have different points of view and experiences.
	Patterns
9.4.2.IML	Information and Media Literacy
	Digital tools can be used to display data in various ways.
	Information is shared or conveyed in a variety of formats and sources.
PS2.B	Types of Interactions
HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
MA.A-REI.A	Understand solving equations as a process of reasoning and explain the reasoning
MA.A-REI.B	Solve equations and inequalities in one variable
	Collaboration can simplify the work an individual has to do and sometimes produce a better product.
PS1.A	Structure and Properties of Matter
LA.W.9-10.2.E	Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
LA.W.9-10.2.F	Provide a concluding paragraph or section that supports the information or explanation presented (e.g., articulating implications or the significance of the topic).
	Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
MA.A-REI.D	Represent and solve equations and inequalities graphically
PS1.B	Chemical Reactions
HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
	Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
PS1.B	Chemical Reactions
	Energy and Matter
	Obtaining, Evaluating, and Communicating Information

	Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
LS1.A	Structure and Function
HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
	Planning and Carrying Out Investigations
	Planning and carrying out in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.
	Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.
	Energy and Matter
HS-LS1-6	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
	Constructing Explanations and Designing Solutions
	Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
LS1.C	Organization for Matter and Energy Flow in Organisms
	Energy and Matter
	Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.
LS1.C	Organization for Matter and Energy Flow in Organisms
	Energy and Matter

Essential Questions/ Enduring Understanding

Essential Questions:

How do chemical reactions make and break chemical bonds as a result of the subatomic particles of atoms result in the physical and chemical properties of the atom?

How does water's chemical composition result in the properties of water important to life?

How is pH related to homeostasis and how is it maintained by buffers?

How does the structure of the biological molecules of life result in their function and the importance of each biological molecule to living organisms?

Enduring Understandings:

Living things are composed of matter that is formed by making and breaking chemical bonds during chemical

reactions.

The properties of water important to life are a result of its polarity.

The structure of biological molecules result in their specific functions.

Organic molecules are carbon-containing.

Objectives

Students will know Key Vocabulary: atom, electron, proton, neutron, nucleus, valence electrons, shell, element, molecule, compound, ion, isotope, chemical reaction, reactant, product, biological reaction, catalyst, enzyme, activation energy, water, polar, hydrogen bond, solution, pH, buffer, organic, macromolecule, carbohydrate, lipid, protein, nucleic acid, monomer, polymer.

Students will know the subatomic particles and chemical characteristics.

Students will know how elements are organized on the Periodic Table of Elements.

Students will know the elements that makeup living things.

Students will know how compounds and molecules are formed during chemical reactions.

Students will know how the structure of an ion results in its function in living organisms.

Students will know how the structure of an ion results in its function in living organisms.

Students will know how chemical reactions make and break chemical bonds.

Students will know how chemical reactions demonstrate the law of conservation of matter.

Students will know how water's polarity contributes to its various properties.

Students will know how water chemistry is impacted by climate change.

Students will know how pH is important in maintaining homeostasis in living organisms.

Students will know how organic molecules are different from inorganic molecules.

Students will know how the structure of the four macromolecules results in their functions.

Students will know how monomers are related to polymers.

Students will be skilled at drawing electron diagrams of atoms to how atoms react.

Students will be skilled at identifying the group an element belongs to on the Periodic Table of Elements.

Students will be skilled at explaining how chemical bonds result in the formation of molecules or compounds.

Students will be skilled at explaining the formation of ions.

Students will be skilled at balancing the reactants and products of a chemical reaction.

Students will be skilled at connecting the polarity of water to its properties.

Students will be skilled at relating the structure of each macromolecule to its function and importance to living organisms.

Learning Plan

Unit Notes: Students will record detailed notes in a notebook that cover the learning goals of the unit.

Basic Chemistry Pretest: Students will take a test on basic chemistry at the start of the unit. The test will include information on subatomic particles, the periodic table of elements, and chemical bonds.

Ocean Acidification Lab: Students will investigate how carbon dioxide released by the bringing of fossil fuels is absorbed by the oceans by completing a laboratory demonstration. Students will mix baking soda and vinegar to create carbon dioxide gas in order to measure the change in the pH of the solution.

Properties of Water Demonstration Presentation: Students will use items in the classroom to design and implement an experimental demonstration of one of the properties of water. Students will explain how the water molecule's chemical properties result in the specific property investigated and explain how that property is important to living organisms. Students will present the information and their demonstration to the class.

Nutrient Analysis Lab: Students will investigate which macromolecules are present in an unknown food using chemical indicators during a laboratory inquiry. Students will be provided with known and unknown food samples which they will use to determine the identity of an unknown food substance. Students will write a

formal lab report on their findings.

Macromolecule Menu Project: Students will create a “menu” that includes the information on the chemical structure and the function of the four classes of biological molecules. The menu will include examples of the monomers and polymers of each macromolecule. The menu will also explain the importance of each biological molecule to living organisms and examples of foods that contain each biological molecule.

Assessment

Formative:

Do Now Questions about prior knowledge and upcoming course content

Exit Ticket Questions to summarize material learned

Whole Class Discussion Participation

Small Group Discussion Participation

Think-Pair-Share Participation

Individual Student Questions/Responses

Independent Assignments (Basic Chemistry Pre Test)

Projects and Presentations (Macromolecule Menu Project)

Labs (Nutrient Analysis Lab, Ocean Acidification Lab)

Summative:

Formal Lab Report (Nutrient Analysis Lab)

Unit Test

Quizzes (Properties of Water, Biochemistry)

Benchmark:

Honors Biology Midterm Exam

Alternative Assessments:

Guided Formal Lab Report

Unit Study Guide/Guided Test

Current Event on Nutrition: students will research and summarize a current event related to nutrition. Students will make connections between the article and course content information.

CER Poster on the best diet: students will make a claim on what they believe is the best diet. They will research the diet to find supporting evidence and make connections to course content information as reasoning.

Materials

Textbook: Biology Concepts and Connections (Pearson Education) by Campell, Reece, Taylor, Simon, Dickey (2009)

Unit Learning Outline

Technology: computers for student and teacher, SmartBoard projector

Teacher Slide Presentations

Whiteboard + Accessories

Guided Notes/Worksheets

Lab Report Outline and Rubric

Personal Protective Equipment: safety glasses, gloves

Lab Equipment: beakers, water, ice, water kettle, thermometers, sponge animal capsules, timers/stopwatches, stirring rods

Graphing paper, rulers, colored pencils/markers