



Unit 2: Chemistry of Life

Subject Area: Science	Course: Anatomy & Physiology		
Unit Title: Chemistry of Life	Grade(s): 11 & 12	Start: September/ February	End: September/ February
Unit Summary: This unit covers some basic chemistry concepts that are important to understand in order to comprehend the chemical basis of life. The unit begins with an overview of atoms and their subatomic particles, such as protons, neutrons, and electrons. It then covers the different types of chemical bonds, including covalent, ionic, and hydrogen bonds, and explains how they contribute to the formation of molecules and compounds. The unit also discusses some of the important properties of water, such as its high heat capacity and ability to dissolve other substances, which make it a crucial molecule for life. Additionally, the unit covers some of the main types of organic molecules found in living organisms, including carbohydrates, lipids, proteins, and nucleic acids, and discusses their basic structure and function. Finally, the unit concludes with a brief overview of the concept of pH and its importance in maintaining the proper chemical environment for biological processes to occur.			

Stage 1: Desired Results

Massachusetts Learning Standards

LS1. From Molecules to Organisms: Structures and Processes

- HS-LS1-3. Provide evidence that homeostasis maintains internal body conditions through both bodywide feedback mechanisms and small-scale cellular processes.
- HS-LS1-6. Construct an explanation based on evidence that organic molecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur, and phosphorus to form monomers that can further combine to form large carbon-based macromolecules.



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Vision of a Graduate Performance Outcome(s)

Innovative Thinker

An innovative thinker is someone who:

- Uses reasoning to question, process, and evaluate Information.
- Is curious, creative, resourceful, and adaptable when looking for solutions.

Approaches challenges as opportunities for growth.

Balanced Life

An individual with a balanced life is someone who:

- Identifies and maintains the characteristics of relationships that support overall personal health and wellness.
- Demonstrates skills for self-awareness, self-regulation, and self-advocacy.
- Applies strategies to prioritize, manage time, and organize responsibilities, and adjusts routines accordingly to support health and happiness.
- Identifies and maintains interests and/or passions that foster overall health and happiness.

Lifelong Learner

A lifelong learner is someone who:

- Explores a variety of learning opportunities and experiences to inform life decisions.
- Takes ownership of their learning by adapting to change, responding to feedback, and demonstrating persistence.
- Finds the curiosity and motivation within themselves to identify opportunities for personal growth and self-improvement.



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Effective Communicator

An effective communicator is someone who:

- Selects, uses, and interprets types of communication (verbal, non-verbal, digital) according to context and audience.
- Collaborates with others in order to achieve desired learning outcomes.
- Engages others with differing opinions through thoughtful, healthy discourse.
- Presents information in a purposeful manner to a variety of audiences in order to inform, influence, motivate, and/or entertain.

Transfer (Authentic, relevant application of learning to new situations)

Students will be able to independently use their learning to...

Design an experiment to investigate the properties of enzymes and the effect of various factors on enzyme activity.

Instructions:

1. Choose an enzyme to study, such as amylase or lactase, and gather the necessary materials, including the enzyme, substrate, buffer solution, and equipment for measuring enzyme activity.
2. Prepare a series of test tubes, each containing a fixed amount of enzyme, substrate, and buffer solution at a specific pH and temperature.
3. Measure the initial rate of enzyme activity in each test tube by observing the production of product over time.
4. Alter the pH, temperature, or concentration of substrate in each test tube to investigate the effect on enzyme activity.
5. Record the results and analyze the data to determine how each factor affected the rate of enzyme activity.
6. Interpret the findings and discuss how they relate to the physiological role of enzymes in the body and the importance of maintaining optimal conditions for enzymatic activity.

Bonus task: Based on your experiment, design a simple dietary intervention or lifestyle modification that would optimize enzyme activity and improve overall health.

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Meaning	
Enduring Understandings Students will understand that... - Enzymes are essential biological catalysts that accelerate biochemical reactions in the body by lowering the activation energy required for those reactions. - Enzyme activity is influenced by various factors such as temperature, pH, and substrate concentration, and maintaining optimal conditions for enzymatic activity is critical for normal physiological function. - Different types of enzymes have specific functions within the body, and disruptions in enzymatic activity can contribute to diseases and disorders. - Experimental techniques such as spectrophotometry and colorimetry can be used to measure enzyme activity and provide insight into enzyme function. - An understanding of enzyme function is essential for the development of therapeutic interventions for diseases and the optimization of industrial and agricultural processes. - Advances in enzyme technology have the potential to improve human health and enhance industry and agriculture, but also raise ethical considerations related to safety, accessibility, and sustainability.	Essential Questions Students will consider... - What are enzymes, and how do they catalyze biochemical reactions in the body? - What are the factors that affect enzyme activity, and how do they impact enzyme function? - What is the importance of maintaining optimal conditions for enzymatic activity, and how do disruptions in these conditions affect physiological function? - What are the different types of enzymes found in the body, and what are their specific functions? - How can experimental techniques be used to measure enzyme activity, and what are some common methods used for this purpose? - How can an understanding of enzyme function be applied to the development of therapeutic interventions for diseases? - What are the ethical implications of using enzymes in medical research and treatment? - How do enzymes contribute to the breakdown of food in the digestive system? - What is the role of enzymes in cellular metabolism, and how do disruptions in enzyme function contribute to diseases such as metabolic disorders?

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- Enzymes play critical roles in cellular metabolism, including the breakdown of food in the digestive system, and disruptions in enzymatic activity can contribute to metabolic disorders.
- The study of enzymes provides insight into fundamental principles of biochemistry and has implications for fields such as medicine, agriculture, and environmental science.

- How do advances in enzyme technology impact industry and agriculture, and what are some potential benefits and risks associated with this technology?

Acquisition

Knowledge

Students will know...

- The chemical properties of enzymes and how they catalyze biochemical reactions in the body.
- The factors that affect enzyme activity, including pH, temperature, and substrate concentration.
- The importance of maintaining optimal conditions for enzymatic activity to ensure normal physiological function.
- The different types of enzymes found in the body and their specific functions.
- The experimental techniques used to measure enzyme activity, such as spectrophotometry or colorimetry.
- A basic understanding of chemistry concepts, including chemical reactions, pH, and concentration.

Skills

Students will be skilled at...

- Scientific inquiry: Students should be able to formulate testable hypotheses and design experiments to test those hypotheses.
- Experimental design: Students should be able to design an experiment that is well-controlled, includes appropriate controls, and produces reliable data.
- Data analysis: Students should be able to analyze the data collected during the experiment using appropriate statistical methods.
- Critical thinking: Students should be able to evaluate the results of the experiment, interpret the data, and draw logical conclusions.



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They should also have experience with experimental design and data analysis.

- Communication: Students should be able to communicate their experimental design, results, and conclusions effectively in writing or verbally.
- Collaboration: Students should be able to work collaboratively with peers to plan and carry out the experiment and analyze the data.
- Time management: Students should be able to manage their time effectively to complete the experiment within the given timeframe.