

BIO-1100: INTRODUCTION TO BIOLOGICAL CHEMISTRY

Cuyahoga Community College

Viewing: BIO-1100 : Introduction to Biological Chemistry

Board of Trustees:

March 2022

Academic Term:

Fall 2024

Subject Code

BIO - Biology

Course Number:

1100

Title:

Introduction to Biological Chemistry

Catalog Description:

Basic principles of inorganic chemistry, organic chemistry and biochemistry necessary for study of human physiology. Physiological applications of the chemical processes of cellular transport, communication and metabolism emphasized. Laboratory includes use of metric system, basic chemistry techniques and physiological applications.

Credit Hour(s):

3

Lecture Hour(s):

2

Lab Hour(s):

2

Other Hour(s):

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Requisites

Prerequisite and Corequisite

Completion of MATH-0955 Beginning Algebra; or co-enrollment in a co-requisite pairing of MATH-0930 Essential Skills for Algebraic & Quantitative Reasoning and MATH-1190 Algebraic & Quantitative Reasoning; or co-enrollment in a co-requisite pairing of MATH-0970 Essential Skills for Elementary Probability and Statistics I and MATH-1410 Elementary Probability and Statistics; or qualified Math placement.

Outcomes

Course Outcome(s):

Apply fundamental knowledge of inorganic chemistry to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Objective(s):

1. Describe the similarities and differences between the states of matter.
2. Discuss the role of energy in chemical reactions.
3. Distinguish between solutions, colloids, and suspensions.
4. Apply the concept of tonicity to osmosis and dialysis.
5. Describe the properties of acids and bases; use the pH scale.
6. Apply knowledge of buffers to physiological systems.
7. Identify important physiological electrolytes.
8. Explain the relationship between pressure, temperature, volume, and moles using gas laws.
9. Relate the gas laws to human respiration.
10. Define radioactivity and identify medical uses of radioactive isotopes.

11. Use the Periodic Chart of Elements to locate atomic number and atomic mass, to determine the charge of an ion, to determine the molar mass of an element, and to calculate formula mass of a molecule or compound.
12. Differentiate between covalent and ionic compounds based on composition and chemical and physical properties.
13. Explain the difference between ionic, covalent, and hydrogen bonding.
14. Recognize and name ionic compounds.
15. Properly combine ions to form a balanced ionic formula.
16. Compare and contrast the properties of molecules and compounds.
17. Distinguish between polar and nonpolar covalent bonds and relate polarity to properties such as solubility and dissociation.
18. Write and balance a chemical equation using appropriate symbols and recognize major types of chemical reactions.
19. Apply foundational knowledge and discipline-specific concepts to solve problems using Avogadro's number, the mole concept, and solution concentration.
20. Explain how inorganic chemistry concepts could be used to understand the modern world and understand the impact of inorganic chemistry on the contemporary world.

Course Outcome(s):

Apply fundamental knowledge of organic chemistry to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Objective(s):

1. List the major classes of organic molecules.
2. Define a functional group.
3. Identify major organic functional groups and explain the properties of each.
4. Discuss how the properties of a functional group alter the chemical properties of an organic molecule.
5. Using the International Union of Pure and Applied Chemistry (IUPAC) nomenclature, properly name simple organic compounds.
6. Using the International Union of Pure and Applied Chemistry (IUPAC) nomenclature, provide the suffix for each class of organic molecule.
7. Explain the difference between a structural isomer and a stereoisomer.
8. Define chirality and how it affects the chemical nature of organic molecules.
9. Explain how organic chemistry concepts could be used to understand the modern world and understand the impact of organic chemistry on the contemporary world.

Course Outcome(s):

Apply fundamental knowledge of biological chemistry to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Objective(s):

1. Describe the cellular functions and physical properties of carbohydrates, lipids, proteins, and nucleic acids.
2. Describe the cellular functions and physical properties of common monosaccharides, disaccharides and polysaccharides.
3. Define a glycosidic bond.
4. Identify the major classes of lipids.
5. Discuss the nature by which lipids form cellular membranes.
6. Compare and contrast the primary, secondary, tertiary and quaternary protein structure.
7. Define a peptide bond.
8. Compare and contrast the structure of DNA and RNA.
9. Describe the processes of DNA replication, transcription and translation.
10. Use the genetic code to determine an amino acid sequence from a sequence of DNA nucleotides.
11. Explain how enzymes work and relate the importance of enzymes to the chemistry of a living cell.
12. Differentiate between digestion and metabolism.
13. Identify the following metabolic pathways: glycolysis, gluconeogenesis, glycogenesis, glycogenolysis, lipogenesis, beta-oxidation, deamination, protein synthesis, TCA cycle, and electron transport.

Course Outcome(s):

Apply scientific methods of inquiry to biochemical laboratory investigations to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Distinguish among an observation, hypothesis, experiment, conclusion, and theory.
 2. Distinguish between scientific and non-scientific methods of inquiry.
 3. Apply current knowledge of biochemistry to solve problems or explain biochemical phenomena.
 4. Use scientific methods of inquiry to gather data and document experimental results in a written format.
 5. Demonstrate the ability to analyze experimentally collected data and communicate the results of experimental procedures pertaining to biochemical processes with others to demonstrate that scientific data is reproducible but can have limitations.
 6. Use lab equipment/tools to properly collect and analyze data pertaining to biochemical processes.
 7. Demonstrate safe and proper use of lab equipment and respond appropriately to instructor's feedback as given.
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Methods of Evaluation:

1. Written exams
2. Quizzes
3. Assigned homework problems
4. Participation
5. Lab reports
6. Lab practicals

Course Content Outline:

1. The chemistry of life
 - a. Atoms
 - b. Ions
 - c. Isotopes
 - d. Radioactive isotopes
2. Compounds and molecules
 - a. Inorganic
 - b. Organic
3. Bonding
 - a. Ionic bonds
 - b. Covalent bonds
 - i. polar
 - ii. nonpolar
 - c. Hydrogen bonds
4. Chemical reactions
 - a. Writing and balancing chemical equations
 - b. Types of reactions
 - c. Energy in chemical reactions
5. Water and solutions
 - a. Properties of water
 - b. Functions of water in the body
 - c. Mixtures
 - i. solutions
 - ii. colloids
 - iii. suspensions
 - d. Concentration
 - e. Fluid and electrolyte balance
6. pH and buffer systems
 - a. Electrolytes
 - b. pH scale
 - c. Acids
 - d. Bases

- e. Neutralization
- f. Buffer systems
- 7. Organic molecules
 - a. Hydrocarbons
 - b. Functional groups
 - c. Types of organic reactions
 - d. Carbohydrates
 - e. Lipids
 - f. Protein/enzymes
 - g. Nucleic acids
- 8. The cell
 - a. Plasma membrane
 - i. structure
 - ii. receptors
 - iii. transport
 - b. Organelles
 - c. Metabolism (chemical reactions in cells)
 - i. cellular energy -ATP
 - ii. anabolic reactions
 - iii. catabolic reactions
- 9. Additional physiological applications
 - a. Chemical digestion
 - b. Respiration and gas laws
 - c. Blood gases
- 10. Laboratory topics
 - a. Metric system
 - b. Matter and energy
 - c. Chemical reactions
 - d. Solutions: solubility and concentrations
 - e. pH: acids, bases, and buffers
 - f. Organic molecules
 - g. Carbohydrates
 - h. Lipids
 - i. Proteins
 - j. Enzymes
 - k. DNA
 - l. The microscope and the cell
 - m. Diffusion, osmosis, and dialysis
 - n. Gas laws

Resources

Boldyref, Roman. *Health Careers Chemistry Lab*. 20th ed. Van Griner, 2019.

Campbell, Mary K, Shawn O. Farrell, and Owen M. McDougal. *Biochemistry*. 9th ed. Boston, MA: Cengage Learning, 2019.

Gorzynski Smith, J. *General, Organic, and Biological Chemistry*. 4th ed. New York, NY: McGraw-Hill Publishing, 2019.

Krieger, P. *A Visual Analogy Guide to Chemistry*. 2nd ed. Englewood, CA: Morton Publishing, 2018.

Odian, G and Blei, I. *Schaum's Outlines: General, Organic, and Biochemistry for Nursing and Applied Health*. 2nd ed. New York, NY: McGraw-Hill Publishing, 2009.

Timberlake, Karen. *Chemistry: An Introduction to General, Organic, and Biological Chemistry*. 13th ed. New York, NY: Pearson, 2018.

Tymoczko, John L. *Biochemistry: A Short Course*. New York, NY: W.H. Freeman and Company, 2019.

Instructional Services

OAN Number:

Ohio Transfer 36 TMNS

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