Western Technical College

10806186 Introduction to Biochemistry

Course Outcome Summary

Course Information

Description	Provides students with skills and knowledge of organic and biological chemistry necessary for application with Medical Lab Technician, Nursing, and other Allied Health careers. Emphasis is placed on recognizing the structure, physical properties and chemical reactions of organic molecules, body fluids, and acids. Additional emphasis is placed on proteins, lipids, carbohydrates and DNA, and the major metabolic pathways.
Instructional Level	Associate Degree Courses
Total Credits	4
Total Hours	90

Pre/Corequisites

Prerequisite	10806134 General Chemistry (OR) 77856761 Developmental Chemistry (OR) HS/Postsecondary Chemistry

Textbooks

Open Educational Resource: The Basics of General, Organic and Biological Chemistry. Copyright 2012. Publisher: Saylor Academy. http://saylordotorg.github.io/text_the-basics-of-general-organic-and-biological-chemistry/index.html. Required.

Open Educational Resource: *Microbiology*. Publisher: Open Stax. https://openstax.org/details/books/microbiology. Required.

Learner Supplies

Safety Splash Goggles, ALLSAFE goggle, ANSI Z87.1, Fisher Scientific 19-181-504 or 19-181-502. **Vendor:** Campus Shop. Required.

Basic calculator (phone is acceptable). **Vendor:** To be determined. Required.

Disposable Lab Coat. **Vendor:** Campus Shop. Required.

Webcam. **Vendor:** Campus Shop. Required for Online class only.

Success Abilities

1. Live Responsibly: Embrace Sustainability
2. Refine Professionalism: Improve Critical Thinking
3. Refine Professionalism: Participate Collaboratively
4. Refine Professionalism: Practice Effective Communication

Course Competencies

1. Use appropriate scientific equipment, methods, and safety precautions.

Assessment Strategies

1.1. Skill Demonstration in the lab

Criteria

You will know you are successful when

1.1. you identify hazards and safety equipment in the chemistry lab.
1.2. you use appropriate personal protective equipment.
1.3. you follow all laboratory practice expectations within your college.
1.4. you use appropriate pipetting devices.
1.5. you never eat or drink in the laboratory.
1.6. you routinely wash hands.
1.7. you de-contaminate lab surfaces and work areas before and after use.
1.8. you use approved techniques for cleaning up spills.
1.9. you report or correct unsafe conditions observed in the classroom.
1.10. you report or correct unsafe conditions observed in the lab.
1.11. you use universal precautions with blood and other body fluids.
1.12. you follow the requirements of the O.S.H.A. Bloodborne Pathogen Standard.
1.13. you locate appropriate safety equipment.
1.14. you properly dispose of waste.
1.15. you report all injuries to instructor.
1.16. you acknowledges or use proper steps for emergency steps.

Learning Objectives

1.a. Describe the scientific method.
1.b. Demonstrate correct use of particular lab equipment.
1.c. Describe safe lab practices for each hazardous chemical inan experiment.
1.d. Describe or demonstrate use of lab safety equipment, as appropriate.

2. Predict the effects of pH on biochemical reactions and its role in homeostasis.

Assessment Strategies

2.1. Analysis

Criteria

You will know you are successful when

2.1. you describe the function of a bicarbonate buffer in the blood.
2.2. you relate the pH to the hydronium and hydroxide ion concentration.
2.3. you predict effects of pH on chemical structure and solubility.

Learning Objectives

2.a. Explore the three blood buffering systems.
2.b. Relate acidity/ basicity to solubility of organic chemicals.
2.c. Predict effects on amino acids and proteins of changing pH.

3. Summarize the structure, physical properties, and chemical reactions of hydrocarbons.

Assessment Strategies

3.1. Report (oral, graphic, or written)

Criteria

You will know you are successful when

3.1. you determine structure from IUPAC name.
3.2. you determine structure from common name.
3.3. you classify hydrocarbons by family.
3.4. you characterize the physical properties of hydrocarbons.
3.5. you convert between condensed and expanded structural formulas.
3.6. you predict the product of common reactions of hydrocarbons.
3.7. you recognize geometric and structural isomers.
3.8. you relate hydrocarbons to biological significance.
3.9. you predict the product of common reactions (including oxidation and reduction).

Learning Objectives

3.a. Draw the structure of an organic compound from its IUPAC or common name.
3.b. Analyze an organic structure to determine what functional groups are present.
3.c. Predict physical and chemical properties based on functional groups.
3.d. Convert between different types of organic structures.
3.e. Determine if there is chirality in an organic structure.
3.f. Predict the major organic product of functional group reactions.
3.g. Recognize geometric isomers, including the name of each.
3.h. Relates structural characteristics of different parts of large molecules to their biological activity.

4. Summarize the structure, physical properties, and chemical reactions of carboxylic acids and their derivatives.

Assessment Strategies

4.1. Report (oral, graphic, or written)

Criteria

You will know you are successful when

4.1. you classify according to functional group.
4.2. you characterize physical properties of carboxylic acids and their derivatives.
4.3. you convert between condensed and expanded structural formulas.
4.4. you predict the product of common reactions of carboxylic acids and their derivatives.
4.5. you relate carboxylic acids and their derivatives to biological significance.

Learning Objectives

4.a. Indentify structures of carboxylic acids, esters, and other acid derivatives.
4.b. Draw structures from common or IUPAC names.
4.c. Predict physical properties of carboxylic acids, esters and other acid derivatives.
4.d. Convert between different structural formulas.
4.e. Predict the major organic product of reactions of carboxylic acids, esters and other acid derivatives.
4.f. Discuss the polarity of the parts of the molecules.
4.g. Predict the behavior of the functional groups in biomolecules.

5. Summarize the structure, physical properties and chemical reactions of amines and amides.

Assessment Strategies

5.1. Report (oral, graphic, or written)

Criteria

You will know you are successful when

5.1. you determine structure from the common name.
5.2. you classify according to functional group.
5.3. you characterize the physical properties.
5.4. you convert between condensed and expanded structural formulas.
5.5. you predict the product of common reactions.
5.6. you relate each to biological significance.

Learning Objectives

5.a. Indentify structures of amines and amides.
5.b. Draw structures from common or IUPAC names.
5.c. Predict physical properties of amines and amides.
5.d. Convert between different structural formulas.
5.e. Predict the major organic product of reactions of amines and amides.
5.f. Discuss the polarity of the parts of the amines and amides.
5.g. Predict the behavior of the amine and amide functional groups in biomolecules.

6. Summarize the structure, physical. and chemical properties of alcohols, ethers, thiols, aldehydes, and ketones.

Assessment Strategies

6.1. Report (oral, graphic, or written)

Criteria

You will know you are successful when

6.1. you determine structure from the common name.
6.2. you determine structure from IUPAC name.
6.3. you classify according to functional group.
6.4. you characterize the physical properties.
6.5. you convert between condensed and expanded structural formulas.
6.6. you predict the product of common reactions.
6.7. you relate each to biological significance.

Learning Objectives

6.a. Indentify structures of aldehydes and ketones.
6.b. Indentify structures of alcohols, ethers and thiols.
6.c. Draw structures from common or IUPAC names.
6.d. Predict physical properties of aldehydes and ketones.
6.e. Predict physical properties of alcohols, ethers, and thiols.
6.f. Convert between different structural formulas.
6.g. Predict the major organic product of reactions of aldehydes and ketones.
6.h. Predict the major organic product of reactions of alcohols, ethers, and thiols.
6.i. Discuss the polarity of the parts of the molecules.
6.j. Predict the behavior of the functional groups in biomolecules.

7. Correlate the molecular structure and function of proteins to their roles in biological systems.

Assessment Strategies

7.1. Analysis (written, graphic, or oral)

Criteria

You will know you are successful when

7.1. you illustrate the structure of a given written, graphic or oral peptide.
7.2. you explain the four levels of protein structure and the types of interactions responsible for each level.
7.3. you explain the causes and mechanisms of protein denaturation.
7.4. you relate the structure of a protein to its function.
7.5. you identify the roles of selected proteins.
7.6. graphic, written, or oral product or process identifies chiral carbons.
7.7. you recognize the biological significance of chirality.

7.8. you illustrate the common reactions of proteins.

Learning Objectives

7.a. Draw the backbone of a two, three, or four amino acid polypeptide.
7.b. Draw the 20 amino acids.
7.c. Name the 20 amino acids including accepted abbreviation(s).
7.d. Discuss the various functions of proteins in biological systems.
7.e. Identify the means of denaturing proteins.
7.f. Determine if a protein side group is chiral.
7.g. Explain the effect of chirality on reactions with proteins.

8. Correlate the structure of enzymes to their biological function.

Assessment Strategies

8.1. Analysis (written, graphic, or oral)

Criteria

You will know you are successful when

8.1. you contrast the characteristics of enzymes versus inorganic catalysts.
8.2. you recognize factors that affect enzyme activity.
8.3. you describe the role of co-factors, vitamins, and co-enzymes in enzyme function.
8.4. you explain the mechanisms of enzyme regulation.
8.5. you give examples of how selected enzymes can be used in medical diagnosis.
8.6. you recognize the biological significance of chirality.

Learning Objectives

8.a. Describe the catalytic properties of enzymes.
8.b. Discuss co-factors and prosthetic groups necessary for enzyme function.
8.c. Explain how concentration affects the regulation of enzyme activity.

9. Correlate the structure to the functions of key carbohydrates.

Assessment Strategies

9.1. Analysis (written, graphic, or oral)

Criteria

You will know you are successful when

9.1. you differentiate among common carbohydrates.
9.2. you relate the structural differences to the biological significance of selected carbohydrates.
9.3. you illustrate the common reactions of carbohydrates.
9.4. you recognize the biological significance of chirality.

Learning Objectives

9.a. Explore monosaccharides, disaccharides and polysaccharides.
9.b. Distinguish between aldo-and keto- saccharides.
9.c. Draw the ring structure form from a pentose or hexose.
9.d. Interpret a ring structure to label it alpha or beta.
9.e. Identify the names and structures of glucose, fructose, ribose, andgalactose.
9.f. Identify the names and structures of lactose, maltose, sucrose, andcellobiose.
9.g. Identify the names and structures of cellulose, amylose, amylopectin and glycogen.
9.h. Identify the type of glycosidic bonds in di- and poly- saccharides.

10. Correlate the structure to the functions of key lipids.

Assessment Strategies

10.1. Analysis (written, graphic, or oral)

Criteria

You will know you are successful when

10.1. you differentiate among common lipids.
10.2. you relate the structural differences to the biological significance of selected lipids.
10.3. you illustrate the common reactions of lipids.
10.4. you discuss the structure and function of cellular membranes.

Learning Objectives

10.a. Identify the physical properties the determine what compounds are lipids.
10.b. Describe the various types of lipids.
10.c. Diagram major products of the reactions of triglycerides.
10.d. Examine solubility of lipid components in cell membranes.
10.e. Describe various functions of cholesterol in animals.

11. Examine carbohydrate metabolism.

Assessment Strategies

11.1. Diagram

Criteria

You will know you are successful when

11.1. you idenitfy the major incoming and outgoing metabolites of aerobic and anaeorbic glycolysis, Krebs Cycle (citric acid), and electron transport and oxidative phosphorylation.
11.2. you discuss the impact of diabetes on metabolism.
11.3. you explain the relationships among diabetes mellitus, glucose metabolism, and ketosis.
11.4. you compare energy yield of various metabolic pathways.
11.5. you explain how oxidation and reduction are involved in metabolism.
11.6. you identify key precursors of carbohydrates.
11.7. you contrast the general characteristics of catabolism and anabolism

Learning Objectives

11.a. Diagram the entire Krebs cycle.
11.b. Diagram glycolysis pathway.

12. Examine protein and lipid metabolism.

Assessment Strategies

12.1. Diagram

Criteria

You will know you are successful when

12.1. you identify major incoming and outgoing metabolites of fatty acid oxidation.
12.2. you identify major incoming and outgoing metabolites of the urea cycle.
12.3. you identify key precursors of proteins and lipids.
12.4. you compare energy yield of various metabolic pathways.
12.5. you explain how oxidation and reduction are involved in metabolism.
12.6. you discuss the impact of diabetes on metabolism.

Learning Objectives

12.a. Describe beta oxidation of fatty acids.
12.b. Calculate the energy released by the metabolic processes.

13. Correlate the molecular structure and function of DNA and RNA to their roles in biological systems.

Assessment Strategies

13.1. Summary (graphic, written, or oral)

Criteria

You will know you are successful when

13.1. you show a correlation between the structure of DNA and RNA.
13.2. you describe the roles of the various RNA molecules in protein synthesis.
13.3. you explain the process of basic DNA replication.
13.4. you discuss the biological significance of RNA and DNA.
13.5. you explain the role of RNA and DNA in heredity and genetic expression.
13.6. you describe DNA fingerprinting using PCR and gel electrophoresis, and genetic engineering using recombinant DNA technology.

Learning Objectives

13.a. Diagram a nucleotide.
13.b. Diagram a sample of RNA.
13.c. Diagram a sample of DNA.
13.d. Characterize the differences between DNA and RNA.
13.e. Discuss replication of DNA.
13.f. Discuss transcription of DNA to make RNA.
13.g. Discuss translation of the RNA into a protein.
13.h. Describe the PCR process for replicating DNA or RNA.
13.i. Describe DNA fingerprinting with PCR and gel electophoresis, and genetic engineering with recombinant DNA technology.