# FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

## OFFICE OF CURRICULUM AND INSTRUCTION

## MEDICAL SCIENCES

# HONORS BIOCHEMISTRY/CELL PHYSIOLOGY

**COURSE DESCRIPTION**

Grade Level: 11

Department: Medical Sciences

Course Title: Honors Biochemistry/Cell Physiology

Credits: 5

Course Code: 161650

**Board of Education adoption date: August 22, 2011**

# FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

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# Introduction - Honors Biochemistry/Cell Physiology

## Introduction

## Course Philosophy

The Biochemistry and Cell Physiology course generates basic knowledge of organic chemistry, applied biochemistry and cell physiology. The coursework provides a basic understanding of cellular processes, which is the foundation upon which modern biological theory is built. Students gain an understanding of the relationship between biochemical processes within the living cell and its application to biomedical research and medical diagnosis is emphasized.

## Course Description

Within the Biochemistry and Cell Physiology curriculum students will learn all the major classifications of organic compounds, how they react and form the substance of living cells, and how disruption in function leads to disease. Students will understand medical research and interpret such information in terms of its significance upon modern biological theory and its application in clinical research. Students will engage in multimedia presentations summarizing the course work, laboratory experiments and projects, and both oral and written assessments.

## Course Map and Proficiencies/Pacing

## Course Map

| Relevant Standards | Enduring Understandings | Essential Questions | Assessments | | |
|---|---|---|---|---|---|
| | | | Diagnostic | Formative | Summative |
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2 | The safe and appropriate use of instruments will result in a clearer understanding of experimental results. | Why is safety essential for successful laboratory investigation?<br><br>How are chemicals and equipment handled safely?<br><br>Why is it necessary to have a control in an experiment?<br><br>To what extent do valuable test results depend on accurate and precise laboratory skills?<br><br>How are the results analyzed and written in a lab report? | Pre-lab | Safety review<br><br>Review of procedures | Lab report |
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2<br>5.2.12.Ab,2,f<br>5.2.12.B,B2<br>5.3.12.A1 | The structure of each organic family determines its name and function. | How are the different organic families named?<br><br>How does the addition of functional groups, halogens or multiple bonds affect function?<br><br>How does the structure of organic compounds relate to their physical properties, such as solubility, density, melting point and boiling point?<br><br>How does the structure of organics relate to their chemical properties? | Student responses<br><br>HW review<br><br>Guided practice problems | Homework<br><br>Pre-labs<br><br>Study guides | Mid unit quiz<br><br>Lab report<br><br>Project<br><br>Unit exam |

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|---|---|---|---|---|---|
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2<br>5.2.12.Ab,2,f<br>5.2.12.B,B2<br>5.3.12.A1 | There are different ways to represent the structures of organic compounds. | How are the chemical formulas of organic compounds modified to show structure?<br><br>Why are condensed and line bond formulas written?<br><br>When is a Fischer projection used?<br><br>Why are Haworth structures drawn for carbohydrates? | Student responses<br><br>HW review<br><br>Guided practice problems | Homework<br><br>Pre-labs<br><br>Study guides | Mid unit quiz<br><br>Lab report<br><br>Project<br><br>Unit exam |
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2<br>5.2.12.Ab,2,f<br>5.2.12.B,B2<br>5.3.12.A1 | Organic families have different functional groups which determine their physical and chemical properties. | How do the different functional groups of the different organic families affect their names?<br><br>Why are physical properties affected by these functional groups?<br><br>How are chemical properties affected by these functional groups? | Student responses<br><br>HW review<br><br>Guided practice problems | Homework<br><br>Pre-labs<br><br>Study guides | Mid unit quiz<br><br>Lab report<br><br>Project<br><br>Unit exam |
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2<br>5.2.12.Ab,2,f<br>5.2.12.B,B2<br>5.3.12.A1 | Changes in the structure of organic compounds change the name and properties of these isomers. | What are isomers?<br><br>How are the names of isomers derived?<br><br>How are the properties of isomers different from one another? | Student responses<br><br>HW review<br><br>Guided practice problems | Homework<br><br>Pre-labs<br><br>Study guides | Mid unit quiz<br><br>Lab report<br><br>Project<br><br>Unit exam |
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2<br>5.2.12.Ab,2,f<br>5.2.12.B,B2<br>5.3.12.A1 | Organic compounds react in different ways and play an important role in biological systems. | What role do organic compounds have in living organisms?<br><br>How do organic compounds react in important biological systems? | Student responses<br><br>HW review<br><br>Guided practice problems | Homework<br><br>Pre-labs<br><br>Study guides | Mid unit quiz<br><br>Lab report<br><br>Project<br><br>Unit exam |

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|---|---|---|---|---|---|
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2<br>5.2.12.Ab,2,f<br>5.2.12.B,B2<br>5.3.12.A1 | Reactions within living organisms are regulated by enzymes, neurotransmitters and other environmental and hereditary factors. | How are cellular reactions regulated?<br><br>How does the structure of a regulating compound affect its function?<br><br>What are the different types of regulation found in the cell?<br><br>How is the transcription of a gene regulated? | Student responses<br><br>HW review<br><br>Guided practice problems | Homework<br><br>Pre-labs<br><br>Study guides | Mid unit quiz<br><br>Lab report<br><br>Project<br><br>Unit exam |
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2<br>5.2.12.Ab,2,f<br>5.2.12.B,B2<br>5.3.12.A1,b,2,6<br>5.3.12.Da,1,b,2 | Regulation of cellular reactions, as well as the regulation and mutations of genes, play a major role in disease. | Why are cofactors and vitamins needed for enzyme function?<br><br>Which types of disease result from deficiencies in the chemicals needed in cellular reactions?<br><br>How are different types of mutations responsible for disease? | Student responses<br><br>HW review<br><br>Guided practice problems | Homework<br><br>Pre-labs<br><br>Study guides | Mid unit quiz<br><br>Lab report<br><br>Project<br><br>Unit exam |
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2<br>5..12.2Ab,2,f<br>5.2.12.B,B2<br>5.3.12.A1,b,2,6 | Carbohydrates, lipids and proteins are built from organic compounds and in turn comprise the cellular structure of living organisms. | How and where are carbohydrates formed?<br><br>How and where are lipids formed?<br><br>How and where are proteins formed? | Student responses<br><br>HW review<br><br>Guided practice problems | Homework<br><br>Pre-labs<br><br>Study guides | Mid unit quiz<br><br>Lab report<br><br>Project<br><br>Unit exam |
| 5.1.12.Ac<br>5.1.12.Ba,1,b,d<br>5.1.12.C1,2<br>5.1.12.Da,1,b,2<br>5.2.12.Ab,2,f<br>5.2.12.B,B2<br>5.3.12.A1,b,2,6<br>5.3.12.Be,f | Metabolism of carbohydrates, lipids and proteins takes place within the structure of cell organelles to produce the energy and new materials essential for life. | What role do carbohydrates play in metabolism?<br><br>What role do lipids play in metabolism?<br><br>What role do proteins play in metabolism? | Student responses<br><br>HW review<br><br>Guided practice problems | Homework<br><br>Pre-labs<br><br>Study guides | Mid unit quiz<br><br>Lab report<br><br>Project<br><br>Unit exam |

## Proficiencies and Pacing

| Unit Title | Unit Understanding(s) and Goal(s) | Recommended Duration |
|---|---|---|
| Unit 1:<br>The Hydrocarbons | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br><br>Students will be able to draw and name alkanes, alkenes and alkynes.<br>Students will be able to describe the physical and chemical properties of organic compounds. | 5 weeks |
| Unit 2: Alcohols, Phenols, Esters and Thiols | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br><br>Students will be able to draw and name alcohols, phenols, esters and thiols.<br>Students will be able to describe the physical and chemical properties of alcohols, phenols, esters and thiols. | 3 weeks |
| Unit 3 - Aldehydes, Ketones and Chiral Molecules | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br>4. Organic families have different functional groups which determine their physical and chemical properties.<br>5. Changes in the structure of organic compounds change the name and properties of their isomers.<br><br>Students will be able to draw and name aldehydes, ketones and chiral molecules.<br>Students will be able to describe the physical and chemical properties of aldehydes, ketones and chiral molecules. | 3 weeks |

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| Unit 4 - Carboxylic Acids and Esters | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br>4. Organic families have different functional groups which determine their physical and chemical properties.<br>5. Changes in the structure of organic compounds change the name and properties of their isomers.<br><br>Students will be able to draw and name carboxylic acids and esters.<br>Students will be able to describe the physical and chemical properties of carboxylic acids and esters. | 3 weeks |
| Unit 5 - Amines and Amides | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br>4. Organic families have different functional groups which determine their physical and chemical properties.<br>5. Changes in the structure of organic compounds change the name and properties of their isomers.<br><br>Students will be able to draw and name amines and amides.<br>Students will be able to describe the physical and chemical properties of amines and amides. | 3 weeks |
| Unit 6 - Carbohydrates | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br>4. Organic compounds react in different ways and play an important role in biological systems.<br>5. Carbohydrates, lipids and proteins are built from organic compounds and in turn comprise the cellular structure of living organisms.<br><br>Students will understand that carbohydrates play an important role in biological systems.<br>Students will understand that there are different ways to represent the names and structures of carbohydrates. | 3 weeks |

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| Unit 7 - Lipids | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br>4. Organic compounds react in different ways and play an important role in biological systems.<br>5. Carbohydrates, lipids and proteins are built from organic compounds and in turn comprise the cellular structure of living organisms.<br><br>Students will understand that lipids, glycerides, fatty acids, phospholipids, triacylglycerols, prostaglandins, fats, oils, and waxes play an important role in biological systems.<br>Students will understand that the lipid components of cell membrane structure in the lipid bilayer of the Fluid Mosaic Model are important in cell transport and cell recognition. | 3 weeks |
| Unit 8 - Amino Acids and Proteins | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br>4. Organic compounds react in different ways and play an important role in biological systems.<br>5. Carbohydrates, lipids and proteins are built from organic compounds and in turn comprise the cellular structure of living organisms.<br><br>Students will understand that amino acids and proteins play an important role in biological systems.<br>Students will understand that there are twenty different amino acids that join together with a peptide bond to form the proteins in the cell membrane important in cell transport and cell recognition. | 3 weeks |
| Unit 9 - Enzymes and Vitamins | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br>4. Organic compounds react in different ways and play an important role in biological systems.<br>5. Reactions within living organisms are regulated by enzymes, neurotransmitters and other environmental and hereditary factors.<br>6. Regulation of cellular reactions, as well as the regulation and mutations of genes, play a major role in disease.<br><br>Students will understand that enzymes and vitamins play an important role in biological systems.<br>Students will understand that there are different models of enzyme activity. | 3 weeks |

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| Unit 10 - Nucleic Acids and Protein Synthesis | 1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.<br>2. The structure of each organic family determines its name and function.<br>3. There are different ways to represent the structures of organic compounds.<br>4. Organic compounds react in different ways and play an important role in biological systems.<br>5. Reactions within living organisms are regulated by enzymes, neurotransmitters and other environmental and hereditary factors.<br>6. Regulation of cellular reactions, as well as the regulation and mutations of genes, play a major role in disease.<br><br>Students will understand that nucleic acids and proteins play an important role in biological systems.<br>Students will understand that there are five basic nucleic acids found in living systems that are formed in a specific sequence giving information for cell development and growth. | 3 weeks |
| Unit 11 - Metabolic Pathways of Carbohydrates, Lipids and Amino Acids | 1. The structure of each organic family determines its name and function.<br>2. There are different ways to represent the structures of organic compounds.<br>3. Organic compounds react in different ways and play an important role in biological systems.<br>4. Carbohydrates, lipids and proteins are built from organic compounds and in turn comprise the cellular structure of living organisms.<br>5. Metabolism of carbohydrates, lipids and proteins takes place within the structure of cell organelles to produce the energy and new materials essential for life.<br><br>Students will understand that metabolism of carbohydrates, lipids and amino acids takes place within the structure of cell organelles.<br>Students will understand that metabolism takes place in different stages which require various coenzymes and ATP to store the released energy. | 4 weeks |

# Unit 01 - Honors Biochemistry/Cell Physiology

## Unit 1- Simple Hydrocarbons - Alkanes, Alkenes and Alkynes

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds.

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals and handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are the different organic families named?
6. How does the addition of functional groups, halogens or multiple bonds affect function?
7. How does the structure of organic compounds relate to their physical properties, such as solubility, density, melting point and boiling point?
8. How does the structure of organics relate to their chemical properties?
9. How are the chemical formulas of organic compounds modified to show structure?
10. Why are condensed and line bond formulas written?

**Unit Goals:**

Students will be able to draw and name alkanes, alkenes and alkynes.

Students will be able to the describe physical and chemical properties of organic compounds

**Recommended Duration: 5** weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How are simple hydrocarbons named and drawn? | Represent the structure of alkanes, alkenes and alkynes several ways and name them | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments<br><br>Lab structures of alkanes | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How does the structure of a simple hydrocarbon relate to its physical properties such as solubility, density, melting point and boiling point? | Describe how the physical properties of solubility, density, melting point and boiling point relate to structure | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| How does the addition of functional groups, halogens or multiple bonds affect isomeric structure and function? | Draw hydrocarbons with different functional groups, halogens or with multiple bonds. Name the different isomers produced<br>Relate the structure of the isomer with its properties and function | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments - Lab- Studies in Structural Organic Chemistry - Isomerism | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How does the structure of a simple hydrocarbon relate to its chemical properties of hydration, addition, substitution, halogenation, hydrohalogenation, nitration and sulfonation? | Write the equations for hydration, addition, substitution, halogenation, hydrohalogenation, nitration and sulfonation reactions | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments - Lab- Studies in Structural Organic Chemistry - Hydrocarbons | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| What is the importance of the benzene ring of aromatics to the field of biochemistry and industry? | Draw benzene and several derived aromatics<br>Describe everyday and industrial uses | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| SCI.9-12.5.1.12.A.c | Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. |
| SCI.9-12.5.1.12.B.a | Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations. |
| SCI.9-12.5.1.12.B.d | Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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.2 | Account for the differences in the physical properties of solids, liquids, and gases. |
| SCI.9-12.5.3.12.A.1 | Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. |

## Differentiation

The Medical Sciences Learning Center students are a homogeneous group.  Students with different learning styles are provided for in each unit/lesson by presenting the material orally thru descriptions, explanations and examples, visually with Multimedia presentation presentations and board illustrations and kinesthetically with laboratory activities.

## Technology

Technology is used in multimedia presentations and for student project presentations throughout the course.

## College and Workplace Readiness

Biochemistry is a college level course introducing organic chemistry and cell metabolism in detail. Students are exceptionally prepared for college. Many biochemical advances and current applications are discussed throughout the course and students are further presented with various medical careers in a field trip to CentraState Medical Center.

# Unit 02 - Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds.

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals and equipment handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are alcohols, phenols, esters and thiols named?
6. How does the structure of alcohols, phenols, esters and thiols relate to their physical properties, such as solubility, density, melting point and boiling point?
7. How does the structure of alcohols, phenols, esters and thiols relate to their chemical properties?
8. How are the chemical formulas of organic compounds modified to show structure?
9. Why are condensed and line bond formulas written?

**Unit Goals:**

Students will be able to draw and name alcohols, phenols, esters and thiols.
Students will be able to describe the physical and chemical properties of alcohols, phenols, esters and thiols.

**Recommended Duration: 3** weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How are alcohols, phenols, esters and thiols named and drawn? | Represent the structure of alcohols, phenols, esters and thiols several ways and name them | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing | Higher order critical thinking questions<br><br>Guided and practice example problems on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How does the addition of functional groups affect structure and function? | Describe how the physical properties of solubility, density, melting point and boiling point relate to structure | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing | Higher order critical thinking questions<br><br>Guided and practice example problems on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| How are branched and unbranched isomers drawn for alcohols, ethers, phenols and thiols?<br>How are the names of isomers derived?<br>How are the properties of isomers different from one another? | Changes in the structure of organic compounds change the name and properties of their isomers | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing | Higher order critical thinking questions<br><br>Guided and practice example problems on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab- Alcohols, Ethers, Thiols, and Amines<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How does the structure of alcohols, phenols, esters, and thiols relate to their chemical properties? | The chemical reactions of combustion, dehydration, formation of ethers, and oxidation reactions of these organic compounds affect their physical and chemical properties.<br><br>Apply Saytzeff's rule to find the products of primary and secondary alcohols. | Multimedia presentation<br><br>Text<br><br>Overhead Projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing | Higher order critical thinking questions<br><br>Guided and practice example problems on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs - Oxidation of alcohols projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| Organic compounds react in different ways and play an important role in biological systems. | Draw, name and describe the importance of various phenol derivatives. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing | Higher order critical thinking questions<br><br>Guided and practice example problems on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| SCI.9-12.5.1.12.A.c | Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. |
| SCI.9-12.5.1.12.B.1 | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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.2 | Account for the differences in the physical properties of solids, liquids, and gases. |
| SCI.9-12.5.3.12.A.1 | Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. |

## Differentiation

The Medical Sciences Learning Center students are a homogeneous group.

Students with different learning styles are provided for in each unit/lesson by presenting the material orally thru descriptions, explanations and examples, visually with Multimedia presentations and board illustrations and kinesthetically with laboratory activities.

## Technology

Technology is used in multimedia presentations and for student project presentations throughout the course.

## College and Workplace Readiness

Biochemistry is a college level course introducing organic chemistry and cell metabolism in detail. Students are exceptionally prepared for college. Many biochemical advances and current applications are discussed throughout the course and students are further presented with various medical careers in a field trip to CentraState Medical Center.

# Unit 03 - Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds
4. Organic families have different functional groups which determine their physical and chemical properties
5. Changes in the structure of organic compounds change the name and properties of their isomers

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals and handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are the different organic families named?
6. How does the addition of functional groups, halogens or multiple bonds affect function?
7. How does the structure of organic compounds relate to their physical properties, such as solubility, density, melting point and boiling point?
8. How does the structure of organics relate to their chemical properties?
9. What are isomers?
10. How are the names of isomers derived?
11. How are the properties of isomers different from one another?

**Unit Goals:**

Students will be able to draw and name aldehydes, ketones and chiral molecules.
Students will be able to describe the physical and chemical properties of aldehydes, ketones and chiral molecules.

**Recommended Duration: 3** weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How are aldehydes and ketones drawn and named? | Name and draw structures of aldehydes and ketones using both the IUPAC system and common names. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab - Oxidation of carbonyl Compounds<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How does the structure of aldehydes and ketones relate to their physical properties of solubility and boiling point? | Explain how the physical properties of solubility and boiling point are related to the structure of aldehydes and ketones. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab - Saponification of Methyl Benzoate<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| How can the isomeric structures of aldehydes and ketones be represented in different ways? | Draw isomers of chiral molecules using Fischer projections. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How are acetals and hemiacetals important to living systems? What is the importance of phenol derivatives to the field of biochemistry and industry? | Describe and give examples of important aldehydes and ketones. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| What are the oxidation products of aldehydes and ketones and how are acetals and hemiacetals formed? | Write equations for the oxidation and reduction reactions, addition reactions, the formation of acetals, hemiacetals and cyclic acetals and describe the Tollens and Benedicts test for aldehydes and ketones. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| SCI.9-12.5.1.12.A.c | Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. |
| SCI.9-12.5.1.12.B.1 | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. |
| SCI.9-12.5.1.12.B.d | Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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. |

## Differentiation

The Medical Sciences Learning Center students are a homogeneous group.
Students with different learning styles are provided for in each unit/lesson by presenting the material orally thru descriptions, explanations and examples, visually with PowerPoint presentations and board illustrations and kinesthetically with laboratory activities.

## Technology

Technology is used in multimedia presentations and for student project presentations throughout the course.

## College and Workplace Readiness

Biochemistry is a college level course introducing organic chemistry and cell metabolism in detail. Students are exceptionally prepared for college. Many biochemical advances and current applications are discussed throughout the course and students are further presented with various medical careers in a field trip to CentraState Medical Center.

# Unit 04 - Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds
4. Organic families have different functional groups which determine their physical and chemical properties
5. Changes in the structure of organic compounds change the name and properties of their isomers

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals and handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are the different organic families named?
6. How does the addition of functional groups, halogens or multiple bonds affect function?
7. How does the structure of organic compounds relate to their physical properties, such as solubility, density, melting point and boiling point?
8. How does the structure of organics relate to their chemical properties?
9. What are isomers?
10. How are the names of isomers derived?
11. How are the properties of isomers different from one another?

**Unit Goals:**

Students will be able to draw and name carboxylic acids and esters.
Students will be able to describe the physical and chemical properties of carboxylic acids and esters.

**Recommended Duration: 3** weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How are carboxylic acids and esters drawn and named? | Name and draw structures of carboxylic acids and esters using both the IUPAC system and common names | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How does the structure of carboxylic acids and esters relate to their physical properties of solubility and boiling point? | Explain how the physical properties of solubility and boiling point are related to the structure of carboxylic acids and esters. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab- Esterification - Synthesis of Methyl Salicylate and other Pleasant Odors<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| How does the structure of carboxylic acids and esters relate to their reactivity? | Describe the acidic nature and formation of salts of carboxylic acids. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab - Alcohols, Ethers, Thioalcohols and Amines<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| What are the hydrolysis products of carboxylic acids and esters? | Describe and write equations for the acid hydrolysis of esters. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| What is the importance of phosphate esters and carboxylic acid salts to the field of biochemistry and industry? | Describe and give examples of important phosphate esters and carboxylic acid salts | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| SCI.9-12.5.1.12.B.a | Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations. |
| SCI.9-12.5.1.12.B.1 | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. |
| SCI.9-12.5.1.12.B.b | Mathematical tools and technology are used to gather, analyze, and communicate results. |
| SCI.9-12.5.1.12.B.d | Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. |
| SCI.9-12.5.1.12.C.1 | Reflect on and revise understandings as new evidence emerges. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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.2 | Describe oxidation and reduction reactions, and give examples of oxidation and reduction reactions that have an impact on the environment, such as corrosion and the burning of fuel. |

## Differentiation

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## Technology

Technology is used in multimedia presentations and for student project presentations throughout the course.

## College and Workplace Readiness

Biochemistry is a college level course introducing organic chemistry and cell metabolism in detail. Students are exceptionally prepared for college. Many biochemical advances and current applications are discussed throughout the course and students are further presented with various medical careers in a field trip to CentraState Medical Center.

# Unit 05 – Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds
4. Organic families have different functional groups which determine their physical and chemical properties
5. Changes in the structure of organic compounds change the name and properties of their isomers

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals and handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are the different organic families named?
6. How does the addition of functional groups, halogens or multiple bonds affect function?
7. How does the structure of organic compounds relate to their physical properties, such as solubility, density, melting point and boiling point?
8. How does the structure of organics relate to their chemical properties?
9. What are isomers?
10. How are the names of isomers derived?
11. How are the properties of isomers different from one another?

**Unit Goals:**

Students will be able to draw and name amines and amides.
Students will be able to describe the physical and chemical properties of amines and amides.

**Recommended Duration: 3** weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How are amines and amides drawn and named? | Name and draw structures of amines, aromatic and heterocyclic amines, and amides using both the IUPAC system and common names | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab- Alcohols, Ethers, Thioalcohols and Amines<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How does the structure of amines and amides relate to their physical properties of solubility and boiling point? | Explain how the physical properties of solubility and boiling point are related to the structure of amines and amides<br><br>Analyze the basicity of ammonium ions and the formation of amine salts. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| How does the structure of amines and amides relate to their reactivity? | Describe the preparation of amides and write the equations for amidation reactions of a carboxylic acid with amines/ ammonia | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions.<br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| Describe and write equations for the hydrolysis products of amides? | Write equations for both the acid and base hydrolysis of amides | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| How are amines and amides, especially heterocyclic amines, important to living systems?<br><br>What is the importance of amine salts to the field of biochemistry and industry? | Describe the properties and give examples of heterocyclic amines and amine salts found in everyday life | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| SCI.9-12.5.1.12.A.c | Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. |
| SCI.9-12.5.1.12.B.a | Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations. |
| SCI.9-12.5.1.12.B.1 | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. |
| SCI.9-12.5.1.12.B.b | Mathematical tools and technology are used to gather, analyze, and communicate results. |
| SCI.9-12.5.1.12.B.d | Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. |
| SCI.9-12.5.1.12.C.1 | Reflect on and revise understandings as new evidence emerges. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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. |

## Differentiation

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## Technology

Technology is used in multimedia presentations and for student project presentations throughout the course.

## College and Workplace Readiness

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# Unit 06 - Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds
4. Organic compounds react in different ways and play an important role in biological systems.
5. Carbohydrates, Lipids and Proteins are built from organic compounds and in turn comprise the cellular structure of living organisms.

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals and handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are the different organic families named?
6. How do the different functional groups of the different families of organics affect their names?
7. Why are physical properties affected by these functional groups?
8. How are chemical properties affected by these functional groups?
9. How and where are carbohydrates formed?

**Unit Goals:**

Carbohydrates play an important role in biological systems.
There are different ways to represent the name and structure of carbohydrates.

**Recommended Duration: 3** weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How are the different types of carbohydrates named and how can the structure and isomers of chiral carbohydrates be represented using Fischer projections and Haworth structures? | Describe and classify the types of carbohydrates.<br><br>Draw D and L Fischer projections and cyclic structures, Haworth structures, of the important monosaccharides, including D-glucose, D-galactose and D-fructose. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab- Qualitative Analysis of Carbohydrates<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How does the structure of carbohydrates relate to their physical properties? | Describe the glycosidic bonds, alpha and beta, found in disaccharides and the acetal bridge in the formation of maltose, lactose and sucrose. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab -Qualitative Analysis of Carbohydrates<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| How does the structure of carbohydrates relate to their reactivity during oxidation and reduction reactions, and acetal formation? | Describe the chemical properties of a monosaccharide, writing equations for oxidation and reduction reactions, and acetal formation. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab Carbohydrates- Chirality via Molecular Models<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |
| How does the type of glycosidic bond affect the structure and function of the disaccharides and polysaccharides formed?<br><br>How do the structures and functions of glycogen and cellulose compare? | Compare the structure of alpha and beta 1, 4 glycosidic linkages and how this affects the molecules function.<br><br>Analyze the plant starches - amylase and amylopectin and the animal starch – glycogen. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab- Carbonyl compounds<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| How are carbohydrates important to the health of living systems and to the field of biochemistry and industry? | Analyze the enzymes needed for the digestion and fermentation of sugars.<br><br>Discuss the importance of these biochemicals to human health. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and graphic organizers<br><br>Lab reports<br><br>Quizzes and examinations |

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| SCI.9-12.5.2.12.B | Substances can undergo physical or chemical changes to form new substances. Each change involves energy. |
| SCI.9-12.5.1.12.B.1 | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. |
| SCI.9-12.5.1.12.B.b | Mathematical tools and technology are used to gather, analyze, and communicate results. |
| SCI.9-12.5.1.12.B.d | Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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.2 | Describe oxidation and reduction reactions, and give examples of oxidation and reduction reactions that have an impact on the environment, such as corrosion and the burning of fuel. |
| SCI.9-12.5.3.12.A.1 | Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. |

## Differentiation

The Medical Sciences Learning Center students are a homogeneous group.

Students with different learning styles are provided for in each unit/lesson by presenting the material orally thru descriptions, explanations and examples, visually with PowerPoint presentations and board illustrations and kinesthetically with laboratory activities.

## Technology

Technology is used in multimedia presentations and for student project presentations throughout the course.

## College and Workplace Readiness

Biochemistry is a college level course introducing organic chemistry and cell metabolism in detail. Students are exceptionally prepared for college. Many biochemical advances and current applications are discussed throughout the course and students are further presented with various medical careers in a field trip to CentraState Medical Center.

# Unit 07 - Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds
4. Organic compounds react in different ways and play an important role in biological systems.
5. Carbohydrates, Lipids and Proteins are built from organic compounds and in turn comprise the cellular structure of living organisms.

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals and handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are the different organic families named?
6. How do the different functional groups of the different families of organics affect their names?
7. Why are physical properties affected by these functional groups?
8. How are chemical properties affected by these functional groups?
9. How and where are lipids formed?

**Unit Goals:**

Lipids, glycerides, fatty acids, phospholipids, triacylglycerides, prostaglandins, fats, oils and waxes play an important role in biological systems.
The lipid component of cell membrane structure in the lipid bilayer of the fluid mosaic model is important in cell transport and cell recognition.

**Recommended Duration: 3weeks**

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
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| How are the different types of lipids named and drawn? | Describe the different types of lipids including their common features and components.<br><br>Draw and name mixed triacylglycerides containing 2-3 different fatty acids. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab- Models of Lipids, Amino Acids and Peptides<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |
| How does the structure of different types of lipids relate to their physical properties such as melting point? | Describe the physical properties and uses of fatty acids, prostaglandins, waxes, and triacylglycerides, fats and oils. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab - Introduction to The Properties of Lipids<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| How does the structure of lipids relate to their reactivity during hydrolysis, hydrogenation, oxidation, and esterification reactions? | Draw reactions for hydrogenation, oxidation and hydrolysis of ester bonds. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |
| How the many different lipids are necessary for human physiology formed and how are they important to the health of living systems? | Describe the structure of glycerophospholipids and the importance of lecithin and cephalins.<br><br>Differentiate between two types of sphingolipids, sphingomylin and cerebrosides.<br><br>Analyze the structure of cholesterol, bile salts, and steroid hormones. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| How are fatty acids incorporated into cell membrane structure?<br><br>How is cholesterol esters formed?<br><br>How are compounds on the surface of the cell responsible for cell recognition? | Lipids, glycerides, fatty acids, phospholipids, triacylglycerols, prostaglandins, fats, oils, and waxes play an important role in biological systems.<br><br>Examine the importance of various steroids to human biology.<br><br>Describe and draw the lipid component of the cell membranes and the importance of the lipid bilayer. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| SCI.9-12.5.1.12.A.c | Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. |
| SCI.9-12.5.1.12.B.a | Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations. |
| SCI.9-12.5.1.12.B.1 | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. |
| SCI.9-12.5.1.12.B.b | Mathematical tools and technology are used to gather, analyze, and communicate results. |
| SCI.9-12.5.1.12.B.d | Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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.2 | Describe oxidation and reduction reactions, and give examples of oxidation and reduction reactions that have an impact on the environment, such as corrosion and the burning of fuel. |
| SCI.9-12.5.3.12.A.1 | Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. |

## Differentiation

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## Technology

Technology is used in multimedia presentations and for student project presentations throughout the course.

## College and Workplace Readiness

Biochemistry is a college level course introducing organic chemistry and cell metabolism in detail. Students are exceptionally prepared for college. Many biochemical advances and current applications are discussed throughout the course and students are further presented with various medical careers in a field trip to CentraState Medical Center.

# Unit 08 - Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds
4. Organic compounds react in different ways and play an important role in biological systems.
5. Carbohydrates, Lipids and Proteins are built from organic compounds and in turn comprise the cellular structure of living organisms.

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals and handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are the different organic families named?
6. How do the different functional groups of the different families of organics affect their names?
7. Why are physical properties affected by these functional groups?
8. How are chemical properties affected by these functional groups?
9. How and where are proteins formed?

**Unit Goals:**

Amino acids and proteins play an important role in biological systems.

There are twenty different amino acids that join together with a peptide bond to form the proteins in the cell membrane important in cell transport and cell recognition.

**Recommended Duration: 3** weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How are the different types of amino acids and proteins named and drawn? | Describe the characteristics of amino acids and proteins, and their functions.<br><br>Distinguish between the 20 amino acids and classify them as polar, nonpolar, acidic or basic.<br><br>Name and draw peptides. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab- Models of Lipids, Amino Acids and Peptides<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |
| How does the structure of different types of amino acids and proteins relate to their physical properties?<br><br>What determines the charge on a zwitterion? | Analyze amino acids as acids and bases and their behavior at different pHs.<br><br>Explain the buffering capacity of amino acids and the process of electrophoresis. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs - Qualitative Analysis of proteins and Amino Acids<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| How do the different agents of protein disruption influence whether the protein is hydrolyzed or denatured? | Differentiate between protein hydrolysis and denaturation.<br><br>Describe the different agents of protein disruption such as acids, bases, organic solvents, heavy metals, and agitation. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab - Determine the Amino Acid Sequence of a Peptide<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |
| How does the primary structure of the protein relate to the resulting secondary, tertiary and quaternary forms?<br><br>How does the tertiary structure of myoglobin relate to the quaternary structure of hemoglobin and how does this affect function? | Analyze protein structure, both primary and secondary structures including the alpha helix and the beta-pleated sheet.<br><br>Describe the tertiary and quaternary structures of proteins describing hydrophobic and hydrophilic interactions, salt bridges, hydrogen bonds and disulfide bonds.<br><br>Analyze the structure of globular and fibrous proteins ex. myoglobin. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| Which of the twenty amino acids are essential amino acids?<br><br>How is the sequence of amino acids important to the health of living systems?<br><br>What is the importance of amino acids and proteins to the field of biochemistry and industry? | Describe cell membrane proteins and their role in biological activities.<br><br>Classify proteins as fibrous or globular and analyze their physical and chemical properties. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| SCI.9-12.5.1.12.A.c | Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. |
| SCI.9-12.5.1.12.B.a | Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations. |
| SCI.9-12.5.1.12.B.1 | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. |
| SCI.9-12.5.1.12.B.b | Mathematical tools and technology are used to gather, analyze, and communicate results. |
| SCI.9-12.5.1.12.B.d | Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. |
| SCI.9-12.5.1.12.C.1 | Reflect on and revise understandings as new evidence emerges. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
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| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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.2 | Describe oxidation and reduction reactions, and give examples of oxidation and reduction reactions that have an impact on the environment, such as corrosion and the burning of fuel. |
| SCI.9-12.5.3.12.A.1 | Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. |

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## Technology

Technology is used in multimedia presentations and for student project presentations throughout the course.

## College and Workplace Readiness

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# Unit 09 - Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds
4. Organic compounds react in different ways and play an important role in biological systems.
5. Reactions within living organisms are regulated by enzymes, neurotransmitters and other environmental and hereditary factors.
6. Regulation of cellular reactions, as well as the regulation and mutations of genes, play a major role in disease.

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals and handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are the different organic families named?
6. How are cellular reactions regulated?
7. How does the structure of regulating compound affect their function?
8. What are the different types of regulation found in the cell?
9. How is the transcription of a gene regulated?
10. Why are cofactors and vitamins needed for enzyme function?
11. What types of diseases result from deficiencies in the chemicals needed in cellular reactions?

**Unit Goals:**

Enzymes and vitamins play an important role in biological systems.
There are different models of enzyme activity.

**Recommended Duration: 3** weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How are the different types of enzymes and vitamins named and classified? | Describe and define types of enzymes and catalysts and their biological role.<br><br>Name enzymes and how they apply to function.<br><br>Identify the six classes of enzymes. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab- Lactase Enzyme<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |
| How do enzymes regulate reactions in a feedback control?<br><br>What factors affect enzyme activity and how? | Describe the structure and function of coenzymes and apoenzymes in models of enzyme catalyzed reactions.<br><br>Describe factors affecting enzyme activity, i.e., temperature, pH, and concentration. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab- Introduction to Nucleic Acids<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| How do allosteric enzymes, reversible competitive and noncompetitive inhibition, and irreversible inhibition regulate enzyme activity?<br><br>How do positive and negative regulators affect allosteric enzymes? | Describe enzyme inhibition: reversible competitive and noncompetitive inhibition, and irreversible inhibition.<br><br>Discuss regulation of enzyme activity through inactive zymogens and allosteric enzymes in feedback control. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab or projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |
| How do coenzymes, cofactors, and vitamins affect enzymes and human biological function?<br><br>How and which diseases are caused by deficiencies in specific vitamins? | Differentiate between types of cofactors, i.e. metal ions and vitamins.<br><br>Describe and recognize the nine different water-soluble vitamins and the four different fat-soluble vitamins important for biological function. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs or projects and group work on Deficiencies of Vitamins and Enzymes related to diseases<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| How do chemical messages enter the cell?<br><br>How are neurotransmitters and hormones similar and different? | Analyze the function of hormones and neurotransmitters in regulating function and information transfer. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| SCI.9-12.5.2.12.B | Substances can undergo physical or chemical changes to form new substances. Each change involves energy. |
| SCI.9-12.5.1.12.A.c | Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. |
| SCI.9-12.5.1.12.B.1 | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. |
| SCI.9-12.5.1.12.B.d | Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. |
| SCI.9-12.5.1.12.C.1 | Reflect on and revise understandings as new evidence emerges. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| SCI.9-12.5.3.12.A.1 | Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. |
| 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. |
| SCI.9-12.5.3.12.A.2 | Demonstrate the properties and functions of enzymes by designing and carrying out an experiment. |
| SCI.9-12.5.3.12.A.6 | Describe how a disease is the result of a malfunctioning system, organ, and cell, and relate this to possible treatment interventions (e.g., diabetes, cystic fibrosis, lactose intolerance). |

## Differentiation

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## Technology

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## College and Workplace Readiness

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# Unit 10 - Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The safe and appropriate use of instruments will result in a clearer understanding of experimental results.
2. The structure of each organic family determines its name and function.
3. There are different ways to represent the structures of organic compounds
4. Organic compounds react in different ways and play an important role in biological systems.
5. Reactions within living organisms are regulated by enzymes, neurotransmitters and other environmental and hereditary factors.
6. Regulation of cellular reactions, as well as the regulation and mutations of genes, play a major role in disease.

**Essential Questions:**

1. Why is safety essential for successful laboratory investigation?
2. How are chemicals handled safely?
3. To what extent do valuable test results depend on accurate and precise laboratory skills?
4. How are the results analyzed and written in a lab report?
5. How are cellular reactions regulated?
6. What are the different types of regulation found in the cell?
7. How is the transcription of a gene regulated?
8. How are different types of mutations responsible for disease?

**Unit Goals:**

Nucleic acids and proteins play an important role in biological systems.
There are five basic nucleic acids found in living systems that are formed in a specific sequence giving information for cell development and growth.

**Recommended Duration: 3** weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How are the different types of nucleic acids and proteins named and classified?<br><br>What are the differences between purines and pyrimidines? | Describe and define nucleic acids and differentiate between DNA and RNA.<br><br>Analyze nitrogen bases, differentiating between nucleotides and nucleosides.<br><br>Describe the primary structure of nucleic acids and the significance of the order of bases.<br><br>Discuss the secondary structure of the DNA double helix and base pairing. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab Models of Nucleic Acids<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |
| How and where does replication take place in prokaryotes and eukaryote? Why are Okazaki fragments formed during replication? | Describe where the genetic material is located in the cell.<br><br>Detail the process of replication, indicating the direction of replication.<br><br>Differentiate between leading and lagging strands, and the formation of Okazaki fragments. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab - Introduction to Nucleic Acids<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| How are the three types of RNA utilized in the cell? | Describe the three types of RNA. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Lab or projects and group work to prepare for Metabolic Pathways<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |
| How is transcription regulated in the cell? Which codons are responsible for initiating and terminating a protein during translation? | Describe in detail the process of transcription.<br><br>Analyze regulation of transcription by the operon and control site of the gene.<br><br>Be familiar with the sequence of codons in the genetic code.<br><br>Discuss and describe protein synthesis, translation, initiation and termination. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| What are the different types of genetic mutations that occur and which are more severe? | Explain different types of genetic mutations.<br><br>Describe examples of genetic mutations, including albinism, hemophilia, and Tay – Sachs. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |
| How are different genes inserted into the genome during recombinant DNA and cloning procedures? How are vaccines and retroviruses used to treat diseases? | Describe recombinant DNA, how it is formed and its uses.<br><br>Explain the human genome project and cloning procedures.<br><br>Analyze viral infection, vaccines, and the retrovirus HIV – 1, its causes and treatments for aids. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Labs<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Lab reports<br><br>Quizzes and exams |

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| SCI.9-12.5.1.12.A.c | Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. |
| SCI.9-12.5.1.12.B.a | Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations. |
| SCI.9-12.5.1.12.B.1 | Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. |
| SCI.9-12.5.1.12.B.b | Mathematical tools and technology are used to gather, analyze, and communicate results. |
| SCI.9-12.5.1.12.B.d | Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. |
| SCI.9-12.5.1.12.C.1 | Reflect on and revise understandings as new evidence emerges. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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.9-12.5.3.12.A.1 | Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. |
| 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. |
| SCI.9-12.5.3.12.A.6 | Describe how a disease is the result of a malfunctioning system, organ, and cell, and relate this to possible treatment interventions (e.g., diabetes, cystic fibrosis, lactose intolerance). |
| SCI.9-12.5.3.12.D.a | Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins. |
| SCI.9-12.5.3.12.D.1 | Explain the value and potential applications of genome projects. |
| SCI.9-12.5.3.12.D.b | Inserting, deleting, or substituting DNA segments can alter the genetic code. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment. |
| SCI.9-12.5.3.12.D.2 | Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations. |

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## Technology

Technology is used in multimedia presentations and for student project presentations throughout the course.

## College and Workplace Readiness

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# Unit 11 - Honors Biochemistry/Cell Physiology

## Unit Plan

**Enduring Understandings:**

1. The structure of each organic family determines its name and function.
2. There are different ways to represent the structures of organic compounds.
3. Organic compounds react in different ways and play an important role in biological systems.
4. Carbohydrates, lipids and proteins are built from organic compounds and in turn comprise the cellular structure of living organisms.
5. Metabolism of carbohydrates, lipids and proteins takes place within the structure of cell organelles to produce the energy and new materials essential for life.

**Essential Questions:**

1. How are the different organic families named?
2. How are cellular reactions regulated?
3. What role do carbohydrates play in metabolism?
4. What role do lipids play in metabolism?
5. What role do proteins play in metabolism?

**Unit Goals:**

Metabolism of carbohydrates, lipids and amino acids takes place within the structure of cell organelles.
Metabolism takes place in different stages which require various coenzymes and ATP to store the released energy.

**Recommended Duration:** 4 weeks

| Guiding/Topical Questions | Content/Themes/Skills | Resources and Materials | Suggested Strategies | Suggested Assessments |
|---|---|---|---|---|
| How the structures of ATP and coenzymes are used to store and transfer energy and energy related compounds during metabolism and respiration? How are the various reactions in the different phases of metabolism related to the structure of cell organelles? | Define terms used to describe the metabolic pathways of carbohydrates.<br><br>Understand the structure of ATP and its use in energy storage.<br><br>Analyze the structure and function of cell organelles and their relationship to biochemistry.<br><br>Write the overall equations of aerobic and anaerobic respiration. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Projects and group work on Metabolic Pathways<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Quizzes and exams |
| What are the general phases of metabolism and the more specific reactions of glycolysis, the oxidation of pyruvate, glycogenolysis, and glyconeogenesis? How are the steps in glycogen metabolism and the pyruvate pathway, glycogenolysis, glyconeogenesis, and the Cori cycle regulated? | Describe the structure and functions of coenzymes.<br><br>Describe the steps in glycogen metabolism.<br><br>Explain the pathway for pyruvate regulation.<br><br>Analyze the process of glucogenolysis.<br><br>Explain and differentiate between the process of gluconeogenesis and the Cori cycle. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Projects and group work on Metabolic Pathways<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Quizzes and exams |

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| How is the citric acid cycle of respiration broken down into eight separate reactions? | Describe the two pathways in respiration, the citric acid cycle and the electron transport chain.<br><br>Analyze the eight reactions in the citric acid cycle.<br><br>Discuss the regulatory effects of ATP on the citric acid cycle. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Projects and group work on Metabolic Pathways<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Quizzes and exams |
| How are oxidation and reduction reactions of electron carriers used to produce energy in the electron transport chain? How do the four protein complexes in the electron transport chain facilitate energy production in the chemiosmotic and ATP synthetase models? | Analyze the four distinct protein complexes in the electron transport chain.<br><br>Describe the chemiosmotic model and the ATP synthetase model for energy production. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Quizzes and exams |

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| How many ATP's are produced in glycolysis, during the oxidation of pyruvate to acetyl CoA, and during the citric acid cycle? | Analyze the overall ATP production in glycolysis, pyruvate oxidation to acetyl CoA, and in the citric acid cycle. | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Quizzes and exams |
| How does the digestion of triacylglycerols and amino acids differ from that of glucose? How many ATP are formed during the oxidation of fatty acids?<br><br>How are amino acids degraded in the urea cycle? How and in what pathways are ketone bodies, fatty acids and amino acids formed? | Describe the digestion of triacylglycerols and analyze the oxidation of fatty acids describing the four associated reactions.<br><br>Describe how ATP is formed during the oxidation of fatty acids.<br><br>Analyze ketogenesis and ketone body formation and describe fatty acid synthesis.<br><br>Describe the digestion of proteins and explain how amino acids are degraded<br><br>Analyze the four reactions of the urea cycle.<br><br>Delineate the transamination of amino acids and describe the synthesis of amino acids | Multimedia presentation<br><br>Text<br><br>Overhead projector for structures and reactions<br><br>Study guides<br><br>Models/manipulatives to create and recognize distinguishing characteristics of organic molecules<br><br>Experiments | Higher order critical thinking questions<br><br>Guided and practice example problems illustrated on the board<br><br>Board illustration of diagrams of structures and reactions<br><br>Projects and group work<br><br>Pair shares | Student oral and written responses to academic prompts and critical thinking questions<br><br>Homework practice problems<br><br>Graded study guides<br><br>Visual products and Graphic Organizers<br><br>Quizzes and exams |

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| SCI.9-12.5.2.12.B | Substances can undergo physical or chemical changes to form new substances. Each change involves energy. |
| SCI.9-12.5.1.12.C.1 | Reflect on and revise understandings as new evidence emerges. |
| SCI.9-12.5.1.12.C.2 | Use data representations and new models to revise predictions and explanations. |
| SCI.9-12.5.1.12.D.a | Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. |
| SCI.9-12.5.1.12.D.1 | Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. |
| SCI.9-12.5.1.12.D.b | Science involves using language, both oral and written, as a tool for making thinking public. |
| SCI.9-12.5.1.12.D.2 | Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. |
| 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.2 | Describe oxidation and reduction reactions, and give examples of oxidation and reduction reactions that have an impact on the environment, such as corrosion and the burning of fuel. |
| SCI.9-12.5.3.12.A.1 | Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. |
| 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. |
| SCI.9-12.5.3.12.B.e | In both plant and animal cells, sugar is a source of energy and can be used to make other carbon-containing (organic) molecules. |
| SCI.9-12.5.3.12.B.f | All organisms must break the high-energy chemical bonds in food molecules during cellular respiration to obtain the energy needed for life processes. |

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