CARLISLE AREA SCHOOL DISTRICT

Carlisle, PA 17013

BIOLOGY I – Option II

GRADES 9 and 10

Date of Board Approval: June 19, 2014

CARLISLE AREA SCHOOL DISTRICT

PLANNED INSTRUCTION COVER PAGE

TITLE OF COURSE: Biology I- Option II **SUBJECT:** Biology **GRADE LEVEL:** 9 and 10

COURSE LENGTH: Year **DURATION:** 50 minutes/day **FREQUENCY:** 5 days/week

PREREQUISITES: *Honors Biology placement must be approved by the 8th grade physical science teacher, have an A- in Algebra I or Algebra II, and have an A- average in Physical Science. **CREDIT:** 1 credit **LEVEL:** Secondary

Course Description/Objectives:

The Biology curriculum and its' corresponding standards in the following pages are all covered in the various levels within Biology I. Biology - Option I is a challenging curriculum that is designed to meet the needs of students who plan to enter into a career directly following high school, or enroll in a two-year post-secondary program. Biology- Option II provides a rigorous, in-depth science experience to meet the needs of students who are interested in attending a four-year college program. The Honors Biology is for the accelerated math/science student. The honors curriculum is designed for those students demonstrating exceptional interest and ability in the sciences. Although the curriculum and standards are the same within these levels, there are notable differences in the delivery of the content for Honors Biology.

*Honors Biology course objectives are taught in more depth and at a faster pace. Students within Honors Biology will have more in-depth text analysis using a variety of texts, as well as write more frequently within the course ascertaining information from a variety of research-based documents and scientific texts. Additionally, more inquiry-based student labs are found within this course. Additionally, students enrolled in Honors Biology are **required** to participate in the Carlisle Area Science and Advisory Committee science fair held in January. Grand champion placement in this local fair may lead to students competing in other science competitions through May. Additionally, summer work is **required** of all students selecting this course and will be due on the first day of school.

A Keystone Exam will be given at the end of the course regardless of the option. Supplemental instruction will be required for those who do not pass the Keystone Exam.

Text: *Biology* by Miller & Levine

Curriculum Writing Committee: Samantha Moyer, Emily Norcross, Leslie Tritt, Cheryl Holquist, James Wilkinson

COURSE TIME LINE

Unit 1a: The Nature of Science	10 days
1b: Safety and Laboratory Basics	5 days
Unit 2: Ecology	24 days
Unit 3: Biochemistry	17 days
Unit 4: Cells: Structure and Division	24 days
Review and Midterm:	4 days
Unit 5: Genetics	28 days
Unit 5a: Mendelian Genetics	10 days
Unit 5b: DNA, RNA, and Protein Synthesis	18 days
Unit 6: Population Genetics	8 days
Unit 7: Classification	5 days
Unit 8: Microbiology	12 days
Unit 9: Comparative Anatomy	21 days
Review and Final:	4 days
Keystones Given at "end" of Course in May	2 days

TOTAL: 164 days

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** Integrated within first unit

UNIT # 1: Safety and Laboratory Basics (Essential) **GRADE:** 9-10

STANDARDS:

PA Core Standards:

CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes
CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

PA Academic Standards:

3.2.C.A6	• Evaluate experimental information for relevance and adherence to science processes

College, Career Readiness Standards:

CCSS.ELA-Literacy.CCRA.W.4	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CCSS.ELA-Literacy.CCRA.W.10	• Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** Integrated within first unit

UNIT # 1: Safety and Laboratory Basics (Essential) **GRADE:** 9-10

UNDERSTANDINGS

Students will understand how to work and conduct laboratory experiments safely in the lab setting.

Common Misconceptions within the Unit:

Nothing bad can happen to them while they are in the lab; however, by not following specific safety measures and protocols, accidents can happen within the lab setting. Safety measures will be stressed.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Take and pass the safety quiz – Students must achieve a 100% on the quiz in order to work in the chemistry lab.
Students will also complete the POGIL Safety Unit
Draw a room map/layout of all safety equipment as well as how to properly use all safety equipment in the event of an emergency

KNOW	DO
• Identify proper laboratory behavior. • Identify lab equipment that will be used throughout the course of the year. • How to correctly use lab equipment that will be used throughout the course of the year.	• Correctly identify the location of safety equipment in the lab and know how to properly use in the event of an emergency. • Successfully read an MSDS sheet. • Successfully identify the parts and ratings of the NFPA diamond. • Create a poster and safety poem about the safety rules.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 10 days

UNIT # 1: The Nature of Science **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 10 days

UNIT # 1: The Nature of Science **GRADE:** 10

	what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
PA Academic Standards:	
3.1.10.A.1	• Explain the characteristics of life common to all organisms.
3.1.B.A1	• Describe the common characteristics of life.
Keystone Eligible Content/Assessment Anchors:	
BIO.A.1.1	• Explain the characteristics common to all organisms
BIO.A.1.1.1	• Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms
College and Career Readiness Standards:	
CCSS.ELA-Literacy. RST.9-10.4	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CCSS.ELA-Literacy. RST.9-10.7	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CCSS.ELA-Literacy. RST.9-10.3	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy. RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 10 days

UNIT # 1: The Nature of Science **GRADE:** 10

UNDERSTANDINGS

Scientific information is acquired through research and discovery and continues to evolve through new technology.

Living things are united by similar characteristics.

Common Misconceptions within the Unit:

1. Organisms "choose" adaptations or choose to adapt to new situations; however, adaptations usually occur because a gene mutates or changes.
2. Some mutations can help an animal or plant survive better than others in the species without the mutation. This is survival of the fittest.
3. Abiotic does not mean dead; instead it literally means non-living.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Successful completion of microscope lab

Microscope quiz

Chunk and tag essential vocabulary to gain literal meanings using the Latin/Greek roots

Scientific method/characteristics of life quiz

Completion of inquiry based labs (ice cube insulator, 'obsertainers', plant lab, and/or plant species richness project)

KNOW	DO
• Vocabulary: abiotic (nonliving), biotic (living), homeostasis (maintaining an internal chemical balance needed for survival). • Follow steps of the scientific method. • Differentiate between abiotic and biotic factors. • Identify major characteristics of life • Apply Latin/Greek roots to scientific terminology.	• Demonstrate proper use and care of the compound microscope. • Differentiate between biotic and abiotic factors based on the characteristics of life. (Thinking) • Apply and interpret scientific vocabulary using Greek and Latin roots. • Apply the steps of the scientific method by completing an inquiry based experiment, such as; plant project, ice cube insulators, and/or the species richness project. (Culminating) (Writing)

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 2: Ecology **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 2: Ecology **GRADE:** 10

CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.PA Academic Standards

PA Academic State Standards:

4.1.10.A	• Examine the effects of limiting factors on population dynamics. • Analyze possible causes of population fluctuations. • Explain the concept of carrying capacity in an ecosystem. • Describe how organisms become classified as threatened or endangered. • Describe how limiting factors cause organisms to become extinct.
4.1.12.A	• Analyze the significance of biological diversity in an ecosystem. • Explain how species adapt to limiting factors in an ecosystem. • Analyze the differences between natural causes and human causes of extinction. • Research wildlife management laws and their effects on biodiversity.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 2: Ecology **GRADE:** 10

4.1.10.B	• Explain the consequences of interrupting natural cycles.
4.1.10.C	• Evaluate the efficiency of energy flow within a food web.
	• Describe how energy is converted from one form to another as it moves through a food web (photosynthetic, geothermal).
4.1.12.B	• Research solutions to problems caused by interrupting natural cycles.
4.1.12.C	• Research how humans affect energy flow within an ecosystem.
	• Describe the impact of industrial, agricultural, and commercial enterprises on an ecosystem.
4.5.10.D	• Research practices that impact biodiversity in specific ecosystems.
	• Analyze the relationship between habitat changes to plant and animal population fluctuations.
4.5.12.D	• Analyze the effects of new and emerging technologies on biodiversity in specific ecosystems.
	• Evaluate the impact of laws and regulations on reducing the number of threatened and endangered species.
4.1.10.E	• Analyze how humans influence the pattern of natural changes (e.g. primary /secondary succession and desertification) in ecosystems over time.
4.1.12.E	• Research solutions addressing human impacts on ecosystems over time.
3.1.12.A2	• Evaluate how organisms must derive energy from their environment or their food in order to survive.
3.1.12.A8	• CHANGE AND CONSTANCY Describe and interpret dynamic changes in stable systems.
Keystone Eligible Content/Assessment Anchors:	
BIO.A.2.1	• Describe how the unique properties of water support life on Earth
BIO.A.2.1.1	• Describe the unique properties of water and how these properties support life on Earth (i.e.: freezing point, high specific heat, cohesion)
BIO.A.3.2	• Identify and describe how organisms obtain and transform energy for their life processes.
BIO.A.3.2.1	• Compare the basic transformation of energy during photosynthesis and cellular respiration
BIO.B.4.1	• Describe ecological levels of organization in the biosphere
BIO.B.4.1.1	• Describe the levels of ecological organization
BIO.B.4.1.2	• Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 2: Ecology **GRADE:** 10

BIO.B.4.2	• Describe interactions and relationships in an ecosystem
BIO.B.4.2.4	• Describe how ecosystems change in response to natural and human disturbances

College and Career Readiness Standards:

CCSS.ELA-Literacy. CCRA.W.4	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CCSS.ELA-Literacy. RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.
CCSS.ELA-Literacy. RST.9-10.9	• Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
CCSS.ELA-Literacy. RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

UNDERSTANDINGS

Living things are interdependent and are impacted by the flow of nutrients and energy in their environments.

Humans modify the world's ecosystems through population growth, technology, and consumption.

Common Misconceptions within the Unit:

1.) Students assume predators are harmful to an ecosystem instead of understanding the beneficial aspect of predator-prey relationships.
2.) Food webs show "who eats whom" with arrows pointing to the left. Actually, food chains show the transfer of energy and matter with arrows pointing to the right.
3.) Students assume that producers are only plants instead of realizing that numerous organisms undergo photosynthesis and chemosynthesis to produce their own food.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 2: Ecology **GRADE:** 10

COMMON ASSESSMENTS/CULMINATING ACTIVITY:

Develop a product that demonstrates an understanding of ecological concepts and the interaction among organisms and their environments.

Biome Project

Endangered Species Project

Concept Map

Species Richness Project

Ecology quizzes/ tests

KNOW	DO
Vocabulary: • Symbiosis- a close and permanent relationship between two different species • Succession- the orderly changes in an ecosystem over time following a disturbance • Niche- The role of an organism in its ecosystem. • Trophic levels- The hierarchical levels of organization in regards to energy and matter transfer in an ecosystem. • Carrying capacity- The number of organisms an ecosystem can sustain • S and J curves- Graphical representations of population growth (logistical and exponential) • Biogeochemical cycles- The cycling of nutrients and water through living things and their abiotic environment	Students will know how to: • Create a food web showing the exchange of matter and energy through the various trophic levels based upon an owl pellet dissection. • Investigate predator/prey relationships through data analysis and interpretation, which includes students creating a graphical representation, analyzing the results, and drawing conclusions based on the data. (Thinking)

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 17 days

UNIT # 3: Biochemistry **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 17 days

UNIT # 3: Biochemistry **GRADE:** 10

Writing:

CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

PA Academic Standards:

3.1.10.A2	• Explain cell processes in terms of chemical reactions and energy changes.
3.1.B.A2	• Identify the initial reactants, final products, and general purposes of photosynthesis and cellular respiration.
	• Explain the important role of ATP in cell metabolism.
	• Describe the relationship between photosynthesis and cellular respiration in photosynthetic organisms.
	• Explain why many biological macromolecules such as ATP and lipids contain high energy bonds.
	• Explain the importance of enzymes as catalysts in cell reactions.
	• Identify how factors such as pH and temperature may affect enzyme function.
3.1.10.A5	• Relate life processes to sub-cellular and cellular structures to their functions.
3.1.B.A5	• Relate the structure of cell organelles to their function (energy capture and release, transport, waste removal, protein synthesis, etc.)

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 17 days

UNIT # 3: Biochemistry **GRADE:** 10

	• Explain the role of water in cell metabolism.
	• Explain how the cell membrane functions as a regulatory structure and protective barrier for the cell.
	• Describe transport mechanisms across the plasma membrane
3.1.10.A7	• Describe the relationship between the structure of organic molecules and the function they serve in living organisms.
	• Explain how cells store and use information to guide their functions.
3.1.B.A7	• Analyze the importance of carbon to the structure of biological macromolecules.
	• Compare and contrast the functions and structures of proteins, lipids, carbohydrates, and nucleic acids.
	• Explain the consequences of extreme changes in pH and temperature on cell proteins.
3.1.12.A5	• Analyze how structure is related to function at all levels of biological organization from molecules to organisms.
3.1.12.A7	• Evaluate metabolic activities using experimental knowledge of enzymes.
Keystone Eligible Content/Assessment Anchors:	
BIO.A.1.2	• Describe relationships between structure and functions in prokaryotic and eukaryotic cells.
BIO.A.1.2.1	• Compare cellular structures and their functions in prokaryotic and eukaryotic cells.
BIO.A.2.1	• Describe how the unique properties water support life on Earth.
BIO.A.2.1.1	• Describe the unique properties of water and how these properties support life on Earth.
BIO.A.2.2	• Describe and interpret relationships between structure and function at various levels of biochemical organizations.
BIO.A.2.2.1	• Explain how carbon is uniquely suited to form biological macromolecules.
BIO.A.2.2.2	• Describe how biological macromolecules form monomers.
BIO.A.2.3	• Explain how enzymes regulate biochemical reactions within a cell.
BIO.A.2.3.1	• Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction.
BIO.A.2.3.2	• Explain how factors such as pH, temperature, and concentration levels can affect enzyme function
BIO.A.3.1	• Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e.: atoms, molecules, and macromolecules.
BIO.A.3.2	• Analyze the sources of evidence for biological evolution
BIO.A.4.1	• Describe ecological levels of organization in the biosphere

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 17 days

UNIT # 3: Biochemistry **GRADE:** 10

BIO.B.4.1.1	• Describe the levels of ecological organization
BIO.B.4.1.2	• Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems
BIO.A.4.2	• Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments.
CCSS.ELA-Literacy.RST.9-10.4	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CCSS.ELA-Literacy.RST.9-10.5	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CCSS.ELA-Literacy.RST.9-10.7	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CCSS.ELA-Literacy.RST.9-10.3	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy.RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 17 days

UNIT # 3: Biochemistry **GRADE:** 10

UNDERSTANDINGS:

Form follows function in the molecular composition of molecules.

Enzymatic reactions regulate cell processes.

Movement of water and solid materials across living membranes is essential for life.

Organisms obtain and transform energy for their life processes.

Common Misconceptions within the Unit:

1. Stomach acids are solely responsible for digestion instead of realizing the holistic enzymatic process that occurs in order to ascertain all necessary nutrients/components for the body.
2. Compounds and mixtures both change the properties of their constituent elements.
3. Any enzyme will work on any substance. Instead, there are specific enzymes for specific substances (lock and key).
4. The structure of a molecule is irrelevant to its function.
5. Photosynthesis and respiration are not related. However, these processes are interrelated and interdependent upon one another.

COMMON ASSESSMENTS/CULMINATING ACTIVITY:

Biochemistry Test
Organic molecules in food project
Organic Molecule Research Project
Lactase enzyme lab
Cellular respiration lab

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 17 days

UNIT # 3: Biochemistry **GRADE:** 10

KNOW

Vocabulary:

- Organic compounds: compounds that are made of carbon and hydrogen; they existed after life or with the first incidence of life.
- Inorganic compounds: compounds that exist with or without life.
- Enzyme: Proteins that act as catalysts in digestion and biosynthesis through the joining of a substrate along the active site.
- Solutions: A mixture of solute and solvent, leading to isotonic, hypertonic, and hypotonic solutions.
- Plasma cell membrane: The combination of proteins, carbohydrates, and a phospholipid bilayer to act as a selectively permeable surface to allow the transport of molecules.
- ATP: Adenosine Tri-Phosphate is assembled to carry energy in photosynthesis and cellular respiration.
- Understand and interpret the various enzymatic processes.
- How to read a graph interpreting the effects of enzymes on chemical reactions based on time, temperature, pH levels, etc...
- Differentiate properties of bonds.
- Explain water's unique properties and its applications to living systems.

DO

- Hypothesize the effects of different solutions on egg cells (Egg lab).
- Observe, predict, and analyze the affect of exercise on CO2 and ATP production.
- Flipped video to acquire prior knowledge about the process of cellular respiration.
- Predict and measure the affects of an enzyme on its substrate (lactase in milk lab).
- Diagram the enzymatic process on a molecular level detailing the reactants, products, enzyme, and active site.
- Create a matrix differentiating between types of passive and active transport across the cell membrane.
- Compare/contrast passive and active transport.
- Build-A-Membrane activity (http://teach.genetics.utah.edu).
- Categorize food products based on their organic composition.
- Predict the outcome of various demonstrations used to enhance biochemistry concepts (i.e. Colloid creation, yeast/balloon, Ziploc/water cohesion, penny lab).
- Analyze graphs of endergonic and exergonic reactions.
- Read and respond to post-lab questions through writing.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 4: Cells: Structure and Division **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 4: Cells: Structure and Division **GRADE:** 10

CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
PA Academic Standards:	
3.1.B.A1	• Describe the common characteristics of life.
	• Compare and contrast the cellular structures and degrees of complexity of prokaryotic and eukaryotic organisms.
	• Explain that some structures in eukaryotic cells developed from early prokaryotic cells (e.g., mitochondria, chloroplasts)
3.1.10.A2	• Explain cell processes in terms of chemical reactions and energy changes.
3.1.10.A4	• Describe the cell cycle and the process and significance of mitosis.
3.1.B.A3	• Explain how all organisms begin their life cycles as a single cell and that in multicellular organisms, successive generations of embryonic cells form by cell division.
3.1.B.A4	• Summarize the stages of the cell cycle.
	• Examine how interactions among the different molecules in the cell cause the distinct stages of the cell cycle which can also be influenced by other signaling molecules.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 4: Cells: Structure and Division **GRADE:** 10

	• Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.
	• Explain the importance of enzymes as catalysts in cell reactions.
	• Identify how factors such as pH and temperature may affect enzyme function.
3.1.10.A5	• Relate life processes to sub-cellular and cellular structures to their functions.
3.1.10.A6	• Identify the advantages of multi-cellularity in organisms.
3.1.B.A5	• Relate the structure of cell organelles to their function (energy capture and release, transport, waste removal, protein synthesis, movement, etc.)
	• Explain the role of water in cell metabolism.
	• Explain how the cell membrane functions as a regulatory structure and protective barrier for the cell.
	• Describe transport mechanisms across the plasma membrane.
3.1.B.A6	• Explain how cells differentiate in multicellular organisms
3.1.10.A7	• Describe the relationship between the structure of organic molecules and the function they serve in living organisms.
	• Explain how cells store and use information to guide their functions.
3.1.10.A8	• Investigate the spatial relationships of organisms' anatomical features using specimens, models, or computer programs.
3.1.B.A8	• CHANGE AND CONSTANCY Recognize that systems within cells and multicellular organisms interact to maintain homeostasis.
	• Describe how the unique properties of water support life.
3.1.10.B2	• Explain the process of meiosis resulting in the formation of gametes
	• Compare and contrast the function of mitosis and meiosis.
3.1.12.A4	• Explain how the cell cycle is regulated.
3.1.12.A5	• Analyze how structure is related to function at all levels of biological organization from molecules to organisms.
3.1.12.A6	• Analyze how cells in different tissues/organs are specialized to perform specific functions.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 4: Cells: Structure and Division **GRADE:** 10

Keystone Eligible Content/Assessment Anchors:

BIO.A.1.2	• Describe relationships between structure and functions in prokaryotic and eukaryotic cells.
BIO.A.2.2	• Describe and interpret relationships between structure and function at various levels of biochemical organizations.
BIO.A.3.1	• Identify and describe the cell structures involved in processing energy.
BIO.A.4.2	• Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments.
BIO.B.1.1	• Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis.
BIO.B.1.2	• Explain how genetic information is inherited.
BIO.B.2.1	• Compare Mendelian and non-Mendelian patterns of inheritance.

College and Career Readiness Standards:

CCSS.ELA-Literacy.RST.9-10.4	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CCSS.ELA-Literacy.RST.9-10.5	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CCSS.ELA-Literacy.RST.9-10.7	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CCSS.ELA-Literacy.RST.9-10.3	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy.RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 24 days

UNIT # 4: Cells: Structure and Division **GRADE:** 10

UNDERSTANDINGS

A cell is the basic unit of life; the processes that occur at the cellular level provide the energy and basic structure organisms need to survive.
There are fundamental differences and similarities between eukaryotes and prokaryotes, as well as plant cells and animal cells.
Cellular structures are indicative of the cellular functions and are imperative for the nine cellular processes to occur for survival of the organism.

Common Misconceptions within the Unit:

1. Cellular respiration refers to when organisms "breathe"; however, cellular respiration is the process by which cells harvest the energy stored in food to make ATP (energy).

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Connect the relationship between structure and function and how that enables cell life processes (culminating) [i.e. – Edible Cell Project]
Mitosis Microviewer lab – students have to identify the various mitotic stages of the cells and understand the process that are occurring within each phase.
Meiosis Foldable – students must create and draw the various phases of meiosis I and meiosis II and compare how these processes differ to mitosis.
Quizzes (mitosis, cells, meiosis)
Various labs (virtual cell lab, onion root tips, etc.)
Mitosis Models

KNOW

- Describe the origin and ramifications of cell theory.
- Distinguish between various cell processes and the organelles responsible for them.
- Describe how cell and organelle structures relate to functions in order to maintain homeostasis.
- Compare/contrast between plant and animal cells.
- Compare/Contrast between eukaryotic and prokaryotic cells.
- Compare the processes and outcomes of mitotic and meiotic nuclear divisions.

DO

- Support and justify a case for which organelles or cell structures are responsible for carrying out specific cell processes (writing) (Form follows function).
- Connect the relationship between structure and function and how that enables cell life processes (culminating) [i.e. – Edible Cell Project]
- Describe the phases of mitosis and meiosis and their importance for the survival of an organism/species (mitosis models, microviewer, foldables, graphic organizer).
- Flipped activity using Amazing Cells to acquire background information for the various cellular organelles. (http://teach.genetics.utah.edu)
- Investigate and differentiate between plant cells and animal cells during the Cell Lab.
- Differentiate between the phases of mitosis by viewing onion root tip slides and/or the microviewer slide sets.
- Construct a cell city analogy and relate them to the organelles and the functions they perform within the cell.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 10 days

UNIT # 5a: Mendelian Genetics **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 10 days

UNIT # 5a: Mendelian Genetics **GRADE:** 10

CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
PA Academic Standards:	
3.1.10.B1	• Describe how genetic information is inherited and expressed.
3.1.B.B1	• Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in DNA molecules. • Explain the basic process of DNA replication. • Describe the basic processes of transcription and translation. • Explain how crossing over, jumping genes, and deletion and duplication of genes results in genetic variation. • Explain how mutations can alter genetic information and the possible consequences on resultant cells.
3.1.B.B2	• Describe how the process of meiosis results in the formation of haploid gametes and analyze the importance of meiosis in sexual reproduction. • Compare and contrast the function of mitosis and meiosis.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 10 days

UNIT # 5a: Mendelian Genetics **GRADE:** 10

	• Illustrate that the sorting and recombining of genes in sexual reproduction results in a great variety of possible gene combinations in offspring.
3.1.12.B2	• Evaluate the process of sexual reproduction in influencing genetic variability in a population.
3.1.10.B2	• Explain the process of meiosis resulting in the formation of gametes.
	• Compare and contrast the function of mitosis and meiosis.
3.1.10.B3	• Describe the basic structure of DNA and its function in genetic inheritance.
	• Describe the role of DNA in protein synthesis as it relates to gene expression.
3.1.10 B5	• PATTERNS Use models to demonstrate patterns in biomacromolecules.
	• Compare and contrast Mendelian and non- Mendalian patterns of inheritance.
3.1.B.B5	• PATTERNS Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance.
	• Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles).
	• CONSTANCY AND CHANGE: Explain how the processes of replication, transcription, and translation are similar in all organisms.
	• Explain how gene actions, patterns of heredity, and reproduction of cells and organisms account for the continuity of life.
	• SCALE: Demonstrate how inherited characteristics can be observed at the molecular, cellular, and organism levels.
3.1.12.A5	• Analyze how structure is related to function at all levels of biological organization from molecules to organisms.
3.1.12.B1	• Explain gene inheritance and expression at the molecular level.

Keystone Eligible Content/Assessment Anchors:

BIO.B.1.2	• Explain how genetic information is inherited.
BIO.B.2.1	• Compare Mendelian and non-Mendelian patterns of inheritance.
BIO.B.2.3	• Explain how genetic information is expressed.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 10 days

UNIT # 5a: Mendelian Genetics **GRADE:** 10

College and Career Readiness Standards:

CCSS.ELA-Literacy.RST.9-10.4	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CCSS.ELA-Literacy.RST.9-10.5	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CCSS.ELA-Literacy.RST.9-10.7	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CCSS.ELA-Literacy.RST.9-10.3	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy.CCRA.W.1	• Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
CCSS.ELA-Literacy.CCRA.W.2	• Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
CCSS.ELA-Literacy.RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 10 days

UNIT # 5a: Mendelian Genetics **GRADE:** 10

UNDERSTANDINGS

Every organism has a set of genetic instructions that determine their inherited traits.

Genetic variations are a result of sexual reproduction and/or mutations.

DNA is the universal code for life; it enables any organism to transmit hereditary information and, along with the environment, determines an organism's characteristics.

Scientific tools can allow scientists to discover human genetic differences/abnormalities.

Common Misconceptions within the Unit:

1. The environment cannot affect your genes. Instead there is an enormous amount of research surrounding the field of epigenetics where food, environment, and the choices you make now can affect your genes, and the transmission of your genes, to future generations.
2. Organisms can "choose" to adapt to their environment. Environments influence which organism will be able to successfully pass on their genes to future generations, thus dictating their genotypes and subsequent phenotypes. These genetic changes in an organism are typically the result of mutations.
3. People inherit one gene per trait. In fact, there are multiple allelic inheritance pathways for inheritance.

COMMON ASSESSMENTS/CULMINATING ACTIVITY:

Interpret genotypes for the expression of phenotypes when given a scenario of multiple methods of inheritance. (Culminating).

Karyotyping Lab

Epigenetics Research Paper

KNOW

- Genotype – refers to the genes or the genetic makeup of an organism.
- Phenotype – this describes the physical manifestation of your genes.
- Chromosomes – heritable nucleic acids that code for specific amino acids which ultimately determines the protein that is manufactured.
- Stem cell – undifferentiated cells.
- Laws of genetics – various rules of inheritance that includes the following:
    1. Law of complete dominance
    2. Law of incomplete dominance
    3. Law of segregation
    4. Law of codominance
- Students will be able to use various tools to study, interpret, and analyze human inheritance patterns.

DO

- Complete and interpret Punnett squares.
- Distinguish between inheritable and learned traits. (Nature vs. nurture)
- Track inherited traits using a pedigree.
- Compose a karyotype and analyze chromosomal pairs identifying abnormalities.
- Interpret genotypes for the expression of phenotypes when given a scenario of multiple methods of inheritance. (Culminating).

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 18 days

UNIT # 5b: DNA, RNA and Protein Synthesis **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 18 days

UNIT # 5b: DNA, RNA and Protein Synthesis **GRADE:** 10

CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
PA Academic Standards:	
3.1.B.B1	• Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in DNA molecules. • Explain the basic process of DNA replication. Describe the basic processes of transcription and translation. Explain how crossing over, jumping genes, and deletion and duplication of genes results in genetic variation. Explain how mutations can alter genetic information and the possible consequences on resultant cells.
3.1.10.B1	• Describe how genetic information is inherited and expressed.
3.1.10.B3	• Describe the basic structure of DNA and its function in genetic inheritance. Describe the role of DNA in protein synthesis as it relates to gene expression.
3.1.B.B3	• Describe the basic structure of DNA, including the role of hydrogen bonding. Explain how the process of DNA replication results in the transmission and conservation of the genetic code. Describe how transcription and translation result in gene expression. Differentiate among the end products of replication, transcription, and translation. Cite evidence to support that the genetic code is universal.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 18 days

UNIT # 5b: DNA, RNA and Protein Synthesis **GRADE:** 10

3.1.10.B4	• Explain how genetic technologies have impacted the fields of medicine, forensics, and agriculture.
3.1.B.B4	• Explain how genetic technologies have impacted the fields of medicine, forensics, and agriculture.
3.1.10.C2	• Explain the role of mutations and gene recombination in changing a population of organisms.
3.1.12.A7	• Describe the potential impact of stem cell research on the biochemistry and physiology of life.
3.1.12.B1	• Explain gene inheritance and expression at the molecular level. Explain the impact of environmental factors on gene expression.
3.1.12.B4	• Evaluate the societal impact of genetic engineering techniques and applications.
Keystone Eligible Content/Assessment Anchors:	
BIO.A.2.2	• Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules).
BIO.B.1.2	• Explain how genetic information is inherited.
BIO.B.2.1	• Compare Mendelian and non-Mendelian patterns of inheritance.
BIO.B.2.2	• Explain the process of protein synthesis (i.e., transcription, translation, and protein modification).
BIO.B.2.3	• Explain how genetic information is expressed.
BIO.B.2.4	• Apply scientific thinking, processes, tools, and technologies in the study of genetics.
College and Career Readiness Standards:	
CCSS.ELA-Literacy.RST.9-10.4	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CCSS.ELA-Literacy.RST.9-10.5	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CCSS.ELA-Literacy.RST.9-10.7	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 18 days

UNIT # 5b: DNA, RNA and Protein Synthesis **GRADE:** 10

CCSS.ELA-Literacy.RST.9-10.3	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy.CCRA.W.1	• Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
CCSS.ELA-Literacy.CCRA.W.2	• Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
CCSS.ELA-Literacy.CCRA.W.7	• Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
CCSS.ELA-Literacy.CCRA.W.8	• Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
CCSS.ELA-Literacy.CCRA.W.9	• Draw evidence from literary or informational texts to support analysis, reflection, and research.
CCSS.ELA-Literacy.RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 18 days

UNIT # 5b: DNA, RNA and Protein Synthesis **GRADE:** 10

UNDERSTANDINGS

Decoding of DNA holds the key to the understanding of the genetic code which determines the biochemistry of each organism.

Common Misconceptions within the Unit:

1. Environment cannot affect your genes. In fact, the environment does affect genes through epigenetics. The environment cannot affect your genes. Instead there is an enormous amount of research surrounding the field of epigenetics where food, environment, and the choices you make now can affect your genes, and the transmission of your genes, to future generations.
2. Organisms can "choose" to adapt to their environment. Environments influence which organism will be able to successfully pass on their genes to future generations, thus dictating their genotypes and subsequent phenotypes. These genetic changes in an organism are typically the result of mutations.
3. Mutations are always bad. Actually, mutations can be detrimental to an organism, beneficial for the organism, or neutral in its effect.

COMMON ASSESSMENTS/CULMINATING ACTIVITY:

Construct an accurate DNA and mRNA model and understand how the information found within the DNA is decoded, transmitted, and transcribed to synthesize proteins.

Research epigenetics and support a stance on the nature vs. nurture argument using research based documents.

KNOW	DO
• Mutation - Errors in DNA replication or protein synthesis can result in favorable or unfavorable changes in the organism. • Protein synthesis - DNA is transcribed into mRNA which then is translated into proteins at the ribosome. • Genetic Engineering- Any modification of a genome or future generations (i.e. Selective breeding, recombinant DNA, GMO's, etc.)	• Construct a DNA model and follow the steps to protein synthesis. • Identify several of the major human genetic disorders, their key characteristics, and their impact on the quality of life. (Writing) • Interpret DNA separated on an agarose gel to determine paternity ("Who's Your Father" gel electrophoresis) • Complete the virtual labs depicting PCR Amplification, DNA extraction and gel electrophoresis (learn.genetics.utah.edu) Analyze results. • Research epigenetics and support a stance on the nature vs. nurture argument after reading and interpreting information from research based documents. • Differentiate between the various forms of genetic engineering and analyze how it affects society.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 8 days

UNIT # 6: Population Genetics **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 8 days

UNIT # 6: Population Genetics **GRADE:** 10

CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

PA Academic Standards:

3.1.10.C1	• Explain the mechanisms of biological evolution
3.1.B.C1	• Describe species as reproductively distinct groups of organisms. • Analyze the role that geographic isolation can play in speciation. • Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity within a population. • Describe how the degree of kinship between species can be inferred from the similarity in their DNA sequences.
3.1.10.C2	• Explain the role of mutations and gene recombination in changing a population of organisms.
3.1.B.C2	• Describe the theory suggesting that life on Earth arose as a single, primitive prokaryote about 4 billion years ago and that for the next 2 billion years, a huge diversity of single celled organisms evolved.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 8 days

UNIT # 6: Population Genetics **GRADE:** 10

	• Analyze how increasingly complex, multicellular organisms evolved once cells with nuclei developed.
	• Describe how mutations in sex cells may be passed on to successive generations and that the resulting phenotype may help, harm, or have little or no effect on the offspring's success in its environment.
	• Describe the relationship between environmental changes and changes in the gene pool of a population.
3.1.10.C3	• CONSTANCY AND CHANGE Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution.
3.1.B.C3	• CONSTANCY AND CHANGE Compare and contrast various theories of evolution. Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. PATTERNS Discuss the implications of a universal genetic code for evolution.
3.1.12.A8	• CHANGE AND CONSTANCY Describe and interpret dynamic changes in stable systems.
3.1.12.B2	• Evaluate the process of sexual reproduction in influencing genetic variability in a population
3.1.12.C1	• Analyze how natural selection leads to speciation.
3.1.12.C2	• Analyze how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment.
3.1.12.C3	• CONSTANCY AND CHANGE Analyze the evidence to support various theories of evolution (gradualism, punctuated equilibrium). Evaluate survival of the fittest in terms of species that have remained unchanged over long periods of time.
Keystone Eligible Content/Assessment Anchors:	
BIO.B.3.1	• Explain the mechanisms of evolution.
BIO.B.3.2	• Analyze the sources of evidence for biological evolution.
BIO.B.3.3	• Apply scientific thinking, processes, tools, and technologies in the study of the theory of evolution.
College and Career Readiness Standards:	
CCSS.ELA-Literacy. RST.9-10.4	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CCSS.ELA-Literacy.RST.9-10.5	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CCSS.ELA-Literacy.RST.9-10.7	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 8 days

UNIT # 6: Population Genetics **GRADE:** 10

CCSS.ELA-Literacy.RST.9-10.3	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy.CCRA.W.1	• Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
CCSS.ELA-Literacy.CCRA.W.2	• Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
CCSS.ELA-Literacy.CCRA.W.7	• Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
CCSS.ELA-Literacy.CCRA.W.8	• Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
CCSS.ELA-Literacy.CCRA.W.9	• Draw evidence from literary or informational texts to support analysis, reflection, and research.
CCSS.ELA-Literacy.RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 8 days

UNIT # 6: Population Genetics **GRADE:** 10

UNDERSTANDINGS

Genetic variation is the driving force for natural selection and influences survival of organisms and/ or their species, as well as population growth rates.

Common Misconceptions within the Unit:

1. Organisms can "choose" their adaptations; however, adaptations are the result of genetic mutations that are favored over time. (Survival of the Fittest).
2. The physically strongest always survives. They believe that fitness = physical strength. However, fitness actually equates to the ability for an organisms to survive and reproduce, thus passing on their traits to future generations.
3. Mutations are always bad. In fact, mutations can be beneficial, detrimental, or neutral in effect. Beneficial mutations lead to adaptations.
4. That it is impossible for a person think evolution is real while also believing in a religion. Evolution explains natural phenomena, not phenomena outside the realm of empirical observation.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Population genetics quizzes/tests

Identify and research specific adaptations found in animals/ organisms caused by human interference and/or human population growth (ex: tuskless elephants)

KNOW	DO
• Natural Selection: There is a natural variation in genetic code of species and can enable adaptations that would increase the fitness and ultimately affect allele frequencies of a population. • Population Growth Rates: Changes in allele frequencies result in changes in population makeup.	• Analyze population growth rate graphs. • Summarize and critique a video series on evolutionary processes (Howard Hughes Medical Institute). • Identify beneficial, detrimental, and/or neutral adaptations by participating in the bird-beak lab. • Compare bird beak and feet to correlate how their physical adaptations help to dictate their structure, function, habitat, diets, etc.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 5 days

UNIT #7: Classification **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 5 days

UNIT #7: Classification **GRADE:** 10

CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
PA Academic Standards:	
3.1.B.A1	• Describe the common characteristics of life. • Compare and contrast the cellular structures and degrees of complexity of prokaryotic and eukaryotic organisms. • Explain that some structures in eukaryotic cells developed from early prokaryotic cells (e.g., mitochondria, chloroplasts).
Keystone Eligible Content/Assessment Anchors:	
BIO.A.1.1	• Explain the characteristics common to all organisms
BIO.A.1.2	• Describe relationships between structure and function at biological levels of organization.
College and Career Readiness Standards:	
CCSS.ELA-Literacy. RST.9-10.4	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 5 days

UNIT #7: Classification **GRADE:** 10

CCSS.ELA-Literacy.RST.9-10.5	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CCSS.ELA-Literacy.RST.9-10.7	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CCSS.ELA-Literacy.RST.9-10.3	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy.CCRA.W.1	• Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
CCSS.ELA-Literacy.CCRA.W.7	• Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
CCSS.ELA-Literacy.CCRA.W.9	• Draw evidence from literary or informational texts to support analysis, reflection, and research.
CCSS.ELA-Literacy.RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 5 days

UNIT #7: Classification **GRADE:** 10

UNDERSTANDINGS

Organisms are classified and given scientific names according to their genetic and morphological characteristics which reflect phylogenic relationships.

Common Misconceptions within the Unit:

1. Students build their cladograms based on preconceived ideas of what makes an organism "complex" versus "simple." However, many of their characteristics are based on physical appearances instead of understanding the entire morphology of the various phyla representatives.

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COMMON ASSESSMENTS/CULMINATING ACTIVITY

Construction of the dichotomous key project

Test

KNOW	DO
• Phylogeny – The evolutionary history of a lineage • Know how to classify organisms based on modern classification and characteristics	• Classify organisms based upon their various attributes. (writing) • Apply the rules of binomial nomenclature to identify organisms. (thinking) • Construct and use a dichotomous key. (culminating)

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 12 days

UNIT #8: Microbiology **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 12 days

UNIT #8: Microbiology **GRADE:** 10

CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
PA Academic Standards:	
3.1.10.A3	• Compare and contrast the life cycles of different organisms.
3.1.10.A5	• Relate life processes to sub-cellular and cellular structures to their functions.
3.1.B.A1	• Describe the common characteristics of life.
	• Compare and contrast the cellular structures and degrees of complexity of prokaryotic and eukaryotic organisms.
	• Explain that some structures in eukaryotic cells developed from early prokaryotic cells (e.g., mitochondria, chloroplasts).
3.1.12.A5	• Analyze how structure is related to function at all levels of biological organization from molecules to organisms.
3.1.B.A6	• Explain how cells differentiate in multicellular organisms.
3.1.B.A8	• CHANGE AND CONSTANCY Recognize that systems within cells and multicellular organisms interact to maintain homeostasis.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 12 days

UNIT #8: Microbiology **GRADE:** 10

3.1.12.A1	• Relate changes in the environment to various organisms' ability to compensate using homeostatic mechanisms.

Keystone Eligible Content/Assessment Anchors:

BIO.A.1.1	• Explain the characteristics common to all organisms
BIO.A.1.2	• Describe relationships between structure and function at biological levels of organization.
BIO.A.2.2	• Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules).
BIO.A.3.1	• Identify and describe the cell structures involved in processing energy.
BIO.A.4.2	• Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments.
BIO.B.1.2	• Explain how genetic information is inherited.
BIO.B.3.1	• Explain the mechanisms of evolution.
BIO.B.3.2	• Analyze the sources of evidence for biological evolution.

College and Career Readiness Standards:

CCSS.ELA-Literacy.RST.9-10.4	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CCSS.ELA-Literacy.RST.9-10.5	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CCSS.ELA-Literacy.RST.9-10.7	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CCSS.ELA-Literacy.RST.9-10.3	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy.CCRA.W.1	• Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
CCSS.ELA-Literacy.CCRA.W.7	• Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
CCSS.ELA-Literacy.CCRA.W.9	• Draw evidence from literary or informational texts to support analysis, reflection, and research.
CCSS.ELA-Literacy RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 12 days

UNIT #8: Microbiology **GRADE:** 10

UNDERSTANDINGS

Microbe growth habits and modes of transmission affect populations in negative, positive, or neutral ways.

Common Misconceptions within the Unit:

1. Viruses are living, when they are in fact non-living but exhibit living characteristics.
2. All bacteria are bad when in fact bacteria are essential for life on Earth.
3. Students should live their lives in fear of microbes, when in fact most bacteria they encounter are vital for their survival and for Earth's natural processes.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

HIV life cycle assignment as well as analysis and interpretation of HIV statistics for Cumberland County
Transmission Lab
Tests

KNOW	DO
• Microorganisms and viruses are classified according to their identifying characteristics. • Microbe growth habits and modes of transmission affect populations.	• Label major structures and functions of microbes. • Understand and identify the various common household bacteria and construct a graphic organizer displaying the symptoms, modes of transmission, and interesting facts after participating in a jig-saw activity. • Classify microorganisms based on fundamental characteristics. (thinking) • Describe methods of microbial growth and understand different preventative measures. • Simulate the transmission of a pathogenic disease and analyze the data. (thinking)

KNOW, UNDERSTAND, DO

COURSE: Biology I- Option II **TIME FRAME:** 21 days

UNIT #9: Comparative Anatomy **GRADE:** 10

STANDARDS:

PA Core Standards:

Reading:

CC.3.5.9-10.A	• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B	• Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CC.3.5.9-10.D	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.9-10.E	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CC.3.5.9-10.F	• Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
CC.3.5.9-10.G	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H	• Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I	• Compare and contrast findings presented in a text to those from other sources (including their own experiments) noting when the findings support or contradict previous explanations or accounts.
CC.3.5.9-10.J	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing:

CC.3.6.9-10.A	• Write arguments focused on discipline-specific content.
CC.3.6.9-10.B	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

KNOW, UNDERSTAND, DO

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CC.3.6.9-10.C	• Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D	• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E	• Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CC.3.6.9-10.F	• Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.3.6.9-10.G	• Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CC.3.6.9-10.H	• Draw evidence from informational texts to support analysis, reflection, and research.
CC.3.6.9-10.I	• Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
PA Academic Standards:	
3.1.10.A3	• Compare and contrast the life cycles of different organisms.
3.1.10.A5	• Relate life processes to sub-cellular and cellular structures to their functions
3.1.B.A1	• Describe the common characteristics of life.
	• Compare and contrast the cellular structures and degrees of complexity of prokaryotic and eukaryotic organisms.
	• Explain that some structures in eukaryotic cells developed from early prokaryotic cells (e.g., mitochondria, chloroplasts).
3.1.12.A5	• Analyze how structure is related to function at all levels of biological organization from molecules to organisms.
3.1.B.A6	• Explain how cells differentiate in multicellular organisms.
3.1.B.A8	• CHANGE AND CONSTANCY Recognize that systems within cells and multicellular organisms interact to maintain homeostasis.
3.1.12.A1	• Relate changes in the environment to various organisms' ability to compensate using homeostatic mechanisms.

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3.1.12.A6	• Analyze how cells in different tissues/organs are specialized to perform specific functions.

Keystone Eligible Content/Assessment Anchors:

BIO.A.1.1	• Explain the characteristics common to all organisms
BIO.A.1.1.1	• Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.
BIO.A.1.2	• Describe relationships between structure and function at biological levels of organization.
BIO.A.1.2.1	• Compare cellular structures and their functions in prokaryotic and eukaryotic cells.
BIO.A.2.2	• Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules).
BIO.A.3.1	• Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e.: atoms, molecules, and macromolecules.
BIO.A.4.2	• Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments.
BIO.B.4.2.5	• Describe the effects of limiting factors on population dynamics and potential dynamics and potential species extinction.
BIO.B.1.2	• Explain how genetic information is inherited
BIO.B.1.2.1	• Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.
BIO.B.1.2.2	• Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance
BIO.B.3.1	• Explain the mechanisms of evolution
BIO.B.3.1.1	• Explain how the natural selection can impact allele frequencies of a population.
BIO.B.3.1.2	• Describe the factors that can contribute to the development of new species
BIO.B.3.1.3	• Explain how the genetic mutations may result in genotypic and phenotypic variations within a population.
BIO.B.3.2	• Analyze the sources of evidence for biological evolution
BIO.B.3.2.1	• Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code).

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College and Career Readiness Standards:

CCSS.ELA-Literacy.RST.9-10.4	• Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CCSS.ELA-Literacy.RST.9-10.5	• Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
CCSS.ELA-Literacy.RST.9-10.7	• Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CCSS.ELA-Literacy.RST.9-10.3	• Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCSS.ELA-Literacy.CCRA.W.1	• Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
CCSS.ELA-Literacy.CCRA.W.7	• Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
CCSS.ELA-Literacy.CCRA.W.9	• Draw evidence from literary or informational texts to support analysis, reflection, and research.
CCSS.ELA-Literacy RST.9-10.10	• By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

KNOW, UNDERSTAND, DO

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UNDERSTANDINGS:

There are similarities and differences in the internal and external anatomy of different types of animals.

Animals' survival depends on their intra-relationships in regard to their structure, function, and behavior.

Common Misconceptions within the Unit:

1. Coral and sponges are plants instead of realizing that they are a part of the animal Kingdom.
2. Fishes is not a word. Fishes actually means multiple species of fish
3. Echinoderms should be found early on the cladogram instead of understanding that they exhibit complex characteristics, such as radial symmetry, that allows them to be found underneath chordates.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Comparative Anatomy dissections

Tests

KNOW	DO
• Tissue layers – Formed during the embryologic stage of organisms. • Embryonic stages- The developmental phases of a zygote and embryo. • Anatomy- The morphological features of an organism. • Students will be able to differentiate the various tissue layers found within the developing embryo. • Students will be able to anatomically compare and contrast organ systems as animals become more complex.	• Compare and contrast animal body plans and their adaptations. (writing) • Distinguish various structural components in animals through direct observation and/or dissection. (culminating) • Design a spreadsheet or graphic organizer on comparative anatomy of representative species from each phylum of kingdom Animalia. (thinking/culminating) • Construct Phyla & Structural Milestone Matching. (Culminating) • Create cladogram differentiating the various milestones. (Culminating)

Adaptations/Modifications for Students with I.E.P.s

Adaptations or modifications to this planned course will allow exceptional students to earn credits toward graduation or develop skills necessary to make a transition from the school environment to community life and employment. The I.E.P. team has determined that modifications to this planned course will meet the student's I.E.P. needs.

Adaptations/Modifications may include but are not limited to:

INSTRUCTION CONTENT

- Modification of instructional content and/or instructional approaches
- Modification or deletion of some of the essential elements

SETTING

- Preferential seating

METHODS

- Additional clarification of content
- Occasional need for one to one instruction
- Minor adjustments or pacing according to the student's rate of mastery
- Written work is difficult, use verbal/oral approaches
- Modifications of assignments/testing
- Reasonable extensions of time for task/project completion
- Assignment sheet/notebook
- Modified/adjusted mastery rates
- Modified/adjusted grading criteria
- Retesting opportunities

MATERIALS

- Supplemental texts and materials
- Large print materials for visually impaired students
- Outlines and/or study sheets
- Carbonless notebook paper
- Manipulative learning materials
- Alternatives to writing (tape recorder/calculator)