Southern York County School District Instructional Plan

Name:	Dates: August - October
Course/Subject: Biology	Unit 1: Ecology and Biomes

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

Biology Assessment Anchors

BIO B.4.1 Describe ecological levels of organization in the biosphere.
BIO B.4.1.1 Describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome and biosphere).
BIO B.4.1.2 Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.

BIO B.4.2 Describe interactions and relationships in an ecosystem.
BIO B.4.2.1 Describe how energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids).
BIO B.4.2.2 Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis).
BIO B.4.2.3 Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle and nitrogen cycle).
BIO B.4.2.4 Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires).
BIO B.4.2.5 Describe the effects of limiting factors on population dynamics and potential species extinction.

ANCHORS:
S11.B.3.1 Use evidence or examples to explain the characteristics of and interactions within an ecosystem.
S11.B.3.1.1 Explain the significance of diversity in ecosystems
S11.B.3.1.2 Explain the biotic and abiotic components of an ecosystem and their interaction.
S11.B.3.1.3 Describe how living organisms affect the survival of one another.
S11.B.3.1.4 Explain the similarities and differences in the major biomes and the communities that inhabit them.
S11.B.3.1.5 Predict how limiting factors can affect organisms.
S11. B.3.2 Analyze patterns of change in natural or human-made systems over time.
S11.B.3.2.1 Use evidence to explain how cyclical patterns in population dynamics affect natural systems.
S11.B.3.2.2 Explain biological diversity as an indicator of a healthy environment.

Understanding(s): ***Students will understand . . .***	**Essential Question(s):**
1. That organisms on Earth interact and depend in a variety of ways on other living and nonliving things in their environments.	▪ How do organisms interact and depend on each other and their environment for survival? ▪ To what extent do human activities change Earth's biodiversity? ▪ How does energy flow through an ecosystem?
Learning Objectives: ***Students will know: CONTENT*** ▪ That biomes are distributed according to broad zones of climate, altitude and latitude. ▪ Gradients in physical factors in an environment contribute to community diversity. ▪ Organisms occupy habitats best suited to their requirements. ▪ That organisms interact with their environment. ▪ That all forms of life on Earth are connected in a biosphere. ▪ The levels of ecological organization (organism, population, community, ecosystem, biome, and biosphere).	***Students will be able to: SCIENCE PROCESS*** ▪ Indicate the locations of different types of biomes on maps. ▪ Display an understanding of global air circulation and wind patterns on maps. ▪ Use models to determine population size and calculate population growth. ▪ Use ecological principles to analyze a community of organisms. ▪ Determine limits to carrying capacity ▪ Determine factors that affect the survival of a species. ▪ Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.

▪ That interactions limit the distribution of species. ▪ That biotic and abiotic factors characterize biomes and their component ecosystems. ▪ That the environment and organism's genetic makeup influence the development of behaviors. ▪ That populations are regulated by a complex interaction between biotic and abiotic factors. ▪ That human action and natural changes affect the balance within an ecosystem. ▪ That sunlight is the initial energy source for most life on Earth. ▪ That energy flows through an ecosystem; including food chains, food webs, and energy pyramids. ▪ That matter recycles through an ecosystem, including water, carbon, oxygen and nitrogen. ▪ That ecosystems change in response to natural and human disturbances, including climate changes, introduction of nonnative species, pollution and fires. ▪ The effects of limiting factors on population dynamics and potential species extinction. ▪ That structural and functional similarities and differences occur among living things.	▪ Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media. ▪ Identify and explain two ways models are used to explain, interpret and predict biological phenomena/systems. ARE ALL OF THESE REALLY SCIENCE PROCESS?

Name:	**Dates: October - November**
Course/Subject: Biology	**Unit 2: Cell Energetics and Biochemistry**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

3.3.12 B: Analyze the chemical and structural basis of living organisms.
- Identify and describe factors affecting metabolic function.
- Evaluate relationships between structure and functions of different anatomical parts given their structure.

3.1.12 B: Apply concepts of models as a method to predict and understand science and technology.
3.1.12 C: Assess and apply patterns in science and technology.
3.2.12 A: Evaluate the nature of scientific and technological knowledge.
3.2.12 B: Evaluate experimental information for appropriateness and adherence to relevant science processes.
- Evaluate experimental data correctly within experimental limits.
- Judge that conclusions are consistent and logical with experimental conditions.

Biology Assessment Anchors:

BIO.A.2.1 Describe how the unique properties of water support life on Earth.
Eligible Content: **BIO.A.2.1.1** Describe the unique properties of water and how these properties support life on Earth (e.g., freezing point, high specific heat, cohesion).

BIO.A.2.2 Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules).
Eligible Content: **BIO.A.2.2.1** Explain how carbon is uniquely suited to form biological macromolecules.
Eligible Content: **BIO.A.2.2.2** Describe how biological macromolecules form from monomers.
Eligible Content: **BIO.A.2.2.3** Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.

BIO.A.2.3 Explain how enzymes regulate biochemical reactions within a cell.
Eligible Content: **BIO.A.2.3.1** Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction.
Eligible Content: **BIO.A.2.3.2** Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.

BIO.A.3.1 Identify and describe the cell structures involved in processing energy.
Eligible Content **BIO.A.3.1.1** Describe the fundamental roles of plastids (e.g., chloroplasts) and mitochondria in energy transformations.

BIO.A.3.2 Identify and describe how organisms obtain and transform energy for their life processes.
Eligible Content: **BIO.A.3.2.1** Compare the basic transformation of energy during photosynthesis and cellular respiration.

BIO.A.3.2 Identify and describe how organisms obtain and transform energy for their life processes.
Eligible Content: **BIO.A.3.2.2** Describe the role of ATP in biochemical reactions.

Understanding(s): ***Students will understand . . .***	**Unit Essential Question(s):**
1. That organisms obtain and use energy to carry out their life processes.	▪ How do organisms obtain and use energy to carry out their life processes? ▪ What would happen to life on this planet if the sun burned out?
Learning Objectives: ***Students will know . . .***	***Students will be able to:***
▪ The flow of energy through living systems. ▪ Forms of energy are required to maintain life. ▪ The energy flow of biochemical reactions is governed by the physical laws of thermodynamics. ▪ Most biochemical reactions require an input of energy. ▪ Water is a reactant and product in biochemical processes that involved the transfer of energy. ▪ Photosynthesis is the process that transforms light energy into potential chemical energy. ▪ Photosynthesis occurs in a chloroplast. ▪ Carbohydrates are organic macromolecules that store carbon and energy. ▪ Polysaccharides are complex carbohydrates formed from monomers. ▪ Lipids store energy in animals. ▪ Cellular respiration is the process by which potential chemical energy in the bonds of glucose is transformed into potential chemical energy in the bonds of ATP. ▪ Cellular respiration occurs in mitochondria. ▪ ATP molecules store usable chemical energy to drive life processes through coupled reactions. ▪ Glycolysis is the foundation of both aerobic and anaerobic respiration. ▪ Glycolysis, through anaerobic respiration, is the main energy source in many prokaryotes. ▪ Enzymes regulate biochemical reactions within a cell. ▪ The role of enzymes as a catalyst in regulating a specific biochemical reaction.	▪ Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes in regards to enzyme activity. ▪ Select and use appropriate tools and techniques when designing and conducting experiments related to enzyme activity. ▪ Communicate an analysis of the findings of an investigation into enzyme activity

▪ Factors such as pH, temperature, and concentration levels can affect enzyme function. ▪ The fundamental roles of plastids and mitochondria in energy transformations.	

Name:	**Dates: November - December**
Course/Subject: Biology	**Unit 3: The Cell and Cell Environment**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

3.1.B.A1:
- 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.

3.1.B.A5:
- Describe the transport mechanisms across the plasma membrane.

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.

3.1.B.A9 (Science process)

Biology Assessment Anchors:

BIO. A.1.1 Explain the characteristics common to all organisms.
Eligible Content: **BIO.A.1.1.1** Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.

BIO.A.1.2 Describe the relationships between structure and function at biological levels of organization.
Eligible Content: **BIO.A.1.2.1** Compare cellular structures and their functions in prokaryotic and eukaryotic cells.
Eligible Content: **BIO.A.1.2.2** Describe and interpret relationships between structure and function at various levels of biological 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).
Eligible Content: **BIO.A.2.2.1** Explain how carbon is uniquely suited for form biological macromolecules.
Eligible Content: **BIO.A.2.2.2** Describe how biological macromolecules form from monomers.
Eligible Content: **BIO.A.2.2.3** Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.

BIO.A.4.1 Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell.
Eligible Content: BIO.A.4.1.1 Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell.
Eligible Content: **BIO.A.4.1.2** Compare the mechanisms that transport materials across the plasma membrane.
Eligible Content: **BIO.A.4.1.3** Describe how membrane-bound cellular organelles facilitate the transport of materials within a cell.

Understanding(s): ***Students will understand . . .*** 1. That the cell is the basic unit of life; all organisms are made of cells; and the structure of cells determines the function of the cell, tissues, organs and organisms.	**Essential Question(s):** ▪ To what extent does the structure of a cell determine the function of the cell, tissues, organs or an organism? ▪ How does life result from chemical structure and function? ▪ How is a biological balance maintained between internal and external environments in a living system?
Learning Objectives:	

Students will know . . .	***Students will be able to:***
▪ That the cell is the basic unit of life. ▪ Structure is related to function at the cellular and organelle levels of biological organization. ▪ That there are similarities and difference between structure and function among living things. ▪ Molecules, ions and water move in and out of the cell through a variety of mechanisms. ▪ The mechanisms that transport materials across the plasma membrane. ▪ Passive transport depends on the diffusion of substances with a concentration gradient moving across a membrane from an area of higher concentration to an area of lesser concentration without energy. ▪ Both passive and facilitated diffusion move materials along a concentration gradient without energy. ▪ Osmosis is the diffusion of water from an area of lower solute concentration across a membrane to an area of higher solute concentration. ▪ Active transport moves atoms, ions and small molecules mostly against a concentration gradient and requires an expenditure of energy. ▪ Active transport of larger substances and subcellular structures occurs through endocytosis and exocytosis. ▪ Biological molecules produced by a cell can be used by the cell or transported outside for use by other cells. ▪ Cells are composed mostly of C, H, N, O, P and S. ▪ Carbon rings and chains form the backbone of all biological molecules. ▪ Many biological molecules are polymers made from monomers that contain carbon chemically bound with other elements. ▪ Carbohydrates, lipids, proteins, and nucleic acids are the chemical foundations for life. ▪ Molecular structure is related to function. ▪ Cellular structures and their functions in prokaryotic and eukaryotic cells are both similar and different. ▪ That the cytoplasm contains a collection of connected, internal membranous sacs that divide the cytoplasm into functional and structural compartments or organelles. ▪ The fundamental roles of plastids and mitochondria in energy transformations. ▪ How endoplasmic reticulum, Golgi apparatus, and other membrane-bound cellular organelles facilitate transport of materials within cells.	▪ Investigate the processes of diffusion and osmosis in a model of a membrane system. ▪ Demonstrate how membrane-bound cellular organelles facilitate the transport of materials within a cell. ▪ Demonstrate how a microscope can be used to study cells.

▪ The differences between prokaryotic and eukaryotic cells. ▪ The characteristics of life shared by all prokaryotic and eukaryotic organisms.	
Name:	**Dates January - February**
Course/Subject: Biology	**Unit 4: DNA and Protein Synthesis**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

Biology Assessment Anchors

BIO.A.2.2.3 Compare the structure and function of carbohydrates, lipids, proteins and nucleic acids in organisms.
BIO.B.2.2 Explain the process of protein synthesis (i.e., transcription, translation, and protein modification).
BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms.
BIO.B.2.2.2 Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.
BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms.
BIO.B.2.3 Explain how genetic information is expressed.
BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).
BIO.B.2.4 Apply scientific thinking, processes, tools, and technologies in the study of genetics.
BIO.B.2.4.1 Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy).

Understanding(s): ***Students will understand . . .*** 1. That the great diversity of life forms continues to change even today as genetic instructions within cells are passed from generation to generation, yet the amazing integrity of most species remain.	**Essential Question(s):** ▪ How is genetic information expressed?
Learning Objectives: ***Students will know . . .*** ▪ The DNA molecule contains instructions for the development and function of all living organisms. ▪ DNA segments called genes contain information for the production of proteins necessary for growth and function of cells. ▪ Not all DNA contains instructions for making proteins. ▪ Through gene expression, information in the DNA directs the production of the molecules that make up an organism. ▪ In transcription, the information coded in DNA is copies into mRNA. ▪ RNA is necessary for protein synthesis from DNA. ▪ In translation, information from DNA is used to build functional molecules. ▪ The structure of ribosomes allows for the translation of mRNA and directs the production of a protein. ▪ Rough ER, Smooth ER and the Golgi	***Students will be able to:*** ▪ Use a model to simulate protein synthesis.

apparatus have roles in the production of specific types of proteins. ▪ Damage to the genetic code has a variety of causes and effects. ▪ Mutations: Cause and effect ▪ Faulty genes/recipes can code for faulty proteins and lead to disorders. ▪ Biotechnology has the potential for improving human health. ▪ The basic molecular and the associated genetic code structure of DNA are universal, revolutionizing our understanding of disease, heredity and evolution.	

Name:	**Dates: February - March**
Course/Subject: Biology	**Unit 5: Continuity of Life**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

Biology Assessment Anchors

BIO.B.1.1 Describe the three stages of the cell cycle: interphase, nuclear division, and cytokinesis.
BIO.B.1.1.1Describe the events that occur during the cell cycle: interphase, nuclear division, cytokinesis.
BIO.B.1.1.2 Compare the processes and outcomes of mitotic and meiotic nuclear divisions.

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 transmilssion and/or conservation of genetic information.

BIO B.2.1.2 Describe processes that can alter composition or number of chromosomes (i.e. crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).
BIO B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g. silent, nonsense, frameshift).

Understanding(s): ***Students will understand . . .*** 1. That the great diversity of life forms continues to change even today as genetic instructions within cells are passed from generation to generation, yet the amazing integrity of most species remain.	**Essential Question(s):** ▪ How do cells grow and reproduce to assure the continuity of life?
Learning Objectives: ***Students will know . . .*** ▪ Cells may divide when their metabolism exceeds nutrient absorption. ▪ All cells go through a cell cycle. ▪ Prokaryotic cells divide via binary fission. ▪ Eukaryotic cells first divide their nucleus and then divide their cytoplasm to make new cells. ▪ Cell differentiation occurs many times during development of multicellular organisms giving rise to a diversity of cell types. ▪ The three states of the cell cycle are interphase, nuclear division and cytokinesis. ▪ Sexually reproducing organisms produce gametes which transport hereditary information from one generation of organisms	***Students will be able to:*** ▪ Describe models illustrating how DNA replication results in transmission and/or conservation of genetic information. ▪ Describe models illustrating the overall control of the cell cycle.

into another generation.
- Meiosis involves a two-step nuclear division reducing the number of chromosomes in half, producing gametes.
- Deviations from the normal chromosome number lead to problems.

Name:	**Dates: March - April**
Course/Subject: Biology	**Unit 6: Genetics and Heredity**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

3.1.12.B1 Explain gene inheritance and expression at the molecular level.
3.1.12.B2: Evaluate the process of sexual reproduction in influencing genetic variability in a population.
3.1.12.B3: Analyze gene expression at the molecular level.
3.1.12.B3: Explain the impact of environmental factors on gene expression.
3.1.12.B4: Evaluate the societal impact of genetic engineering techniques and applications.
3.1.12.C2: Analyze how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment.
3.1.10.B5 Compare and contrast Mendelian and non-Mendelian patterns of inheritance.
3.1.10.B6: Know that both direct and indirect observations are used by scientists to study the natural world and universe.
4.4.10:A: Apply scientific thinking, processes, tools, and technologies in the study of genetics.

Biology Assessment Anchors:
BIO B.1.2 Explain how genetic information is inherited.
BIO B.1.2.2 Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance.
BIO B.2.1 Compare and contrast Mendelian and non-Mendelian patterns of inheritance.
BIO B.2.1.1 Describe and/or predict observed patterns of inheritance (i.e. dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic and multiple alleles).
BIO B.2.1.2 Describe processes that can alter composition or number of chromosomes (i.e. crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).
BIO B.2.3 Explain how genetic information is expressed.
BIO B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g. silent, nonsense, frameshift).
BIO B.2.4 Apply scientific thinking, processes, tools and technologies in the study of biology.
BIO B.2.4.1 Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g. selective breeding, gene splicing, cloning, generically modified organisms, gene therapy).

Understanding(s):
Students will understand . . .

1. That the great diversity of life forms continues to change even today as genetic instructions within cells are passed from generation to generation, yet the amazing integrity of most species remain.

Essential Question(s):

- How is genetic information inherited?

Learning Objectives:
Students will know . . .

- DNA contains the complete set of instructions, the genetic code for building and running an organism.
- Genes are expressed at a given time, which is determined by internal and environmental signals received by a cell.
- Hereditary information in genes is inherited and expressed.

Students will be able to:

- Predict genetic outcomes.
- Interpret pedigree charts.
- Calculate the probability of genetic occurrences.

▪ Sexually reproducing organisms produce gametes which transport hereditary information from one generation of organisms into another generation. ▪ Meiosis involves a two-step nuclear division reducing the number of chromosomes in half, producing gametes. ▪ Deviations from the normal chromosome number lead to problems. ▪ One or more pairs of genes on one or more chromosomes code for the expression of inherited traits. ▪ Two or more versions of a gene (alleles) contribute to the expression of inherited traits. ▪ During the process of meiosis genetic recombinations may occur contributing to genetic variability within a population. ▪ Patterns of inheritance reflecting how genes interact and express themselves (including dominant, recessive, codominance, incomplete dominance, sex-linked, sex-influenced, multiple alleles) can be predicted, observed and described. ▪ According to Mendel's Law of Segregation, only one of two alleles for a gene is put into a gamete. ▪ Observing an organism's phenotype does not always confirm genotype. ▪ The Punnet square is a tool that can be used to predict the probability of an offspring's genotype and phenotype. ▪ Damage to the genetic code has a variety of causes and effects. ▪ Faulty genes, coding for faulty enzymes, can lead to sickness. ▪ Pedigrees can predict inheritance patterns of genes. ▪ Blood type is controlled by multiple alleles, codominance and Mendelian dominance. ▪ One gene can influence multiple traits. ▪ Sex-linked traits differ in their pattern of inheritance. ▪ Mendel's Law of Independent Assortment states that one trait does not influence the inheritance of another trail. ▪ Some traits are linked together. ▪ Biotechnology has the potential for improving life on this planet.	
Name:	**Dates: April - May**
Course/Subject: Biology	**Unit 7: Evolution**

Stage 1 – Desired Results

PA Core Standard(s)/Assessment Anchors Addressed:

Biology Assessment Anchors:

BIO.B.3.1 Explain the mechanisms of evolution
BIO.B.3.1.1 Explain how 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 (e.g. isolating mechanisms, genetic drift, founder effect, migration.)
BIO.B.3.1.3 Explain how 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 (ie. Fossil, anatomical, physiological, embryological, biochemical, and universal genetic code.)

BIO.B.3.3 Apply scientific thinking, processes, tools and technologies in the study of the theory of evolution.
BIO.B.3.3.1 Distinguish between the scientific terms: hypothesis, inference, law, theory, principle, fact and observation.

Understanding(s):
Students will understand . . .

1. That the great diversity of life forms is the result of many random processes selecting for the survival and reproduction of a population.

Essential Question(s):

- How do species change over time?

Learning Objectives:
Students will know . . .

- Mutations alter a gene's genetic information, resulting in a change in the protein that is made, or how or when a cell makes that protein.
- Evolution occurs when the gene grequency of alleles in a population shifts to confer survival and reproductive success.
- The differential reproductive success of populations of organisms with advantageous traits is known as natural selection.
- Speciation occurs when one population is isolated from another population.
- Isolation can be geological, reproductive, or filling different ecological niches to reduce competition.
- With isolation comes changing environmental factors exerting selective pressure on mutations and adaptation.
- Common anatomical and or genetic structures and behaviors demonstrate that species have evolved from common ancestors.
- The fossil record documents patterns of mass and background extinctions and the appearance of new species.
- There are similarities and differences between fossils and living organisms.
- Selective breeding and biotechnology contribute to the deliberate changing of the genetic makeup of a population.

Students will be able to:

- Pose scientific questions about a group of organisms whose relatedness is described by a phylogenetic tree or cladogram in order to identify shared characteristics, make inferences about the evolutionary history of the group and identify character data that could extend or improve the phylogenetic tree.
- The student is able to evaluate scientific evidence provided by a data set in conjunction with a phylogenetic tree or simple cladogram to determine evolutionary history and speciation.
- The student is able to create a phylogenetic tree or simple cladogram that correctly represents evolutionary history and speciation from a provided data set.