SUBJECT: Principles of Biology	GRADE: 10
Unit Title: Intro to Biological Concepts	**Time Frame: 6 Weeks**

UNIT OVERVIEW
This unit will introduce the basic characteristics of all living things. It will also introduce some basic information that will serve as a foundation for material taught throughout the course.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
Continual Learning and Growth Mindset: short description (	**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.2.2.1 Explain how carbon is uniquely suited to form biological macromolecules** **BIO.A.1.1.1 Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.** **BIO.A.1.2.1 Compare cellular structures and their functions in prokaryotic and eukaryotic cells.** **BIO.A.4.2.1 Explain how organisms maintain homeostasis (e.g., thermoregulation, water regulation, oxygen regulation).**

COMPETENCIES	LEARNING TARGETS
I understand the characteristics that all living things share	• **I can describe the characteristics of life all organisms, both prokaryotic and eukaryotic** • **I can explain the differences between a prokaryotic and eukaryotic organism**

	• **I can explain how organisms maintain homeostasis (an internal balance)** • **I can differentiate between atoms, elements and compounds.** • **I can describe how the properties of water support life.** • **I can explain how carbon is able to form large molecules**

SUBJECT: Principles of Biology	**GRADE: 10**
Unit Title: Biochemistry and Enzymes	**Time Frame: 4 Weeks**
UNIT OVERVIEW	
This unit explores the structure and function of the carbon-based molecules that build living things. It will also introduce enzymes and how they influence the function of chemical reactions within cells.	
LRG SKILLS AND DISPOSITIONS	**PA STANDARDS**
	BIO.A.2.2.2 Describe how biological macromolecules form from monomers. **BIO.A.2.2.3 Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.** **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 can affect enzyme function.**
COMPETENCIES	**LEARNING TARGETS**
I understand the structure and function of molecules that build up and enable life	• I can describe how monomers form large molecules • I can compare the structure and function of the four different macromolecules • I can explain and identify the structure of carbohydrates

	• I can explain and identify the structure of lipids • I can explain and identify the structure of proteins • I can describe the importance of carbohydrates to living things • I can describe the importance of lipids to living things • I can describe the importance of proteins to living things
I understand how enzymes speed up the reactions that happen in living things	• I can describe the role of an enzymes • I can describe how an enzyme acts on a substrate to produce a product

SUBJECT: Principles of Biology	**GRADE: 10**
Unit Title: Cells and Cell Transport and Division	**Time Frame: 9 Weeks**
UNIT OVERVIEW	
This unit will explore various topics regarding cells. The first section will explore the structure and function of plant vs. animal cells. Next, the methods for molecules to get into and out of cells will be explained. Finally, students will learn the different processes and outcomes of mitotic and meiotic cell divisions.	
LRG SKILLS AND DISPOSITIONS	**PA STANDARDS**
Creativity and Innovation	**BIO.B.1.2.2 Describe and interpret relationships between structure and function at various levels of biological structure (i.e., organelles, cells, tissues, organs, organ systems, and multicellular organisms).** **BIO.A.4.1.3 Describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell.** **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.** **BIO.A.4.1.2 Compare the mechanisms that transport materials across the plasma membrane (i.e., passive transport- diffusion, osmosis, facilitated diffusion; and active transport- pumps, endocytosis, exocytosis).**

	BIO.B.1.1.1 Describe the events that occur during the cell cycle: interphase, nuclear division (i.e. mitosis or meiosis), cytokinesis. **BIO.B.1.1.2 Compare the processes and outcomes of mitotic and meiotic nuclear divisions.**
COMPETENCIES	**LEARNING TARGETS**
I understand how cells are classified based on their components	● I can describe the structure and function of cellular organelles ● I can compare plant and animal cells ● I can describe the relationship between different structure levels (organelles, cells, tissues, organs, organ systems and organisms)
I understand how and why substances move across the cell membrane	● I can describe how the structure of the cell membrane allows it to act as a protective barrier ● I can describe and compare ways materials move across the cell membrane by passive transport and active transport.
I understand how cells and organisms grow and reproduce	● I can describe events that occur during the cell cycle (interphase, nuclear division [mitosis], and cytokinesis) and errors which may occur (cancer) ● I can describe the events that occur during meiosis, including crossing over, and errors which may occur (non-disjunction) ● I can compare the process and outcome of mitosis and meiosis

SUBJECT: Principles of Biology	**GRADE: 10**
Unit Title: DNA	**Time Frame: 4 Weeks**
UNIT OVERVIEW	
This unit includes an overview of DNA structure and function. It will connect to the cell division chapter by explaining how and why DNA replicates. The coding of DNA and how it relates to the traits of organisms (proteins and gene expression) will be explored. Finally, the effect of	

errors in the DNA and how they affect expression of genes will be explained.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
	BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect the phenotype (e.g. silent, nonsense, frameshift). **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 function of relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance.** **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.**
COMPETENCIES	**LEARNING TARGETS**
I understand the structure and function of DNA and how proteins are made	● I can describe and identify the parts of DNA ● I can describe the process of DNA replication ● I can explain the relationship between DNA, genes, alleles, and chromosomes ● I can describe the process of transcription ● I can describe the process of translation ● I can describe the role of ribosomes, ER, Golgi, and nucleus in the production of proteins ● I can describe how genetic mutations alter the DNA sequence (silent, nonsense, frameshift) ● I can explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture

SUBJECT: Principles of Biology	GRADE: 10
Unit Title: Genetics	**Time Frame: 5 Weeks**

UNIT OVERVIEW
This unit uses Punnett Square practice to predict genetic outcomes from parents to offspring. Genetic diseases resulting from gene mutations are introduced through the topics. Genetic disorders resulting from abnormal chromosomal inheritance are briefly explored. Current and emerging DNA and genetic technologies are introduced with an emphasis on the applications in the fields of medicine, genetics and agriculture.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
Collaboration	**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, translocation, deletion, insertion, and inversion).** **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).**

COMPETENCIES	LEARNING TARGETS
I understand the ways different traits can be passed down from parent to offspring	• I can use correct genetics vocabulary and notation (dominant/recessive, genotypic/phenotypic, homozygous/heterozygous) to complete a genetics cross • I can interpret the results of a genetics cross to predict genetic outcomes • I can describe and/or predict different patterns of inheritance (dominant/recessive)

	• I can describe and/or predict different patterns of inheritance (codominance and incomplete dominance) • I can describe and/or predict different patterns of inheritance (sex-linked) • I can describe and/or predict different patterns of inheritance (blood typing) • I can describe the different types of DNA chromosome mutations (translocation, deletion, insertion, and inversion) and their outcomes • I can explain how genetic engineering has impacted the fields of medicine, forensics and agriculture

SUBJECT: Principles of Biology	**GRADE: 10**
Unit Title: Evolution	**Time Frame: 4 Weeks**
UNIT OVERVIEW	
This unit focuses on how organisms change over time through mutations, the process of natural selection, and genetic drift. Gene pools and allele frequencies are discussed as a method to track change. An overview of Hardy-Weinberg is presented, as well as several pieces of evidence which support the theory of evolution	
LRG SKILLS AND DISPOSITIONS	**PA STANDARDS**
Adaptability and Flexibility	**BIO.B.3.1.1 Explain how natural selection can impact allele frequencies in 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.3.2.1 Interpret evidence supporting the theory of evolution (i.e. fossil, anatomical, physiological, embryological, biochemical, and universal genetic code).** **BIO.B.3.3.1 Distinguish between scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.**
COMPETENCIES	**LEARNING TARGETS**
I understand how populations change over time.	● I can explain how natural selection can impact gene frequencies in a population ● I can describe how the factors the contribute to the formation of a new species ● I can explain how genetic mutations can result in genetic and physical variations within a population ● I can interpret evidence that supports the theory of evolution ● I can distinguish between the terms hypothesis, theory, inference, law, principle, fact, and observation

SUBJECT: Principles of Biology	**GRADE: 10**
Unit Title: Energetics	**Time Frame: 3 Weeks**
UNIT OVERVIEW	
This unit introduces ATP to students, then models the flow and transformation of energy from sunlight, into the chloroplast and the process of photosynthesis, and finally into the mitochondria and the process of cellular respiration.	
LRG SKILLS AND DISPOSITIONS	**PA STANDARDS**

	BIO.A.3.2.2 Describe the role of ATP in biochemical reactions. **BIO.A.3.1.1 Describe the fundamental roles of plastids (i.e. chloroplasts) and mitochondria in energy transformations.** **BIO.A.3.2.1 Compare the basic transformation of energy during photosynthesis and cellular respiration.**
COMPETENCIES	**LEARNING TARGETS**
I understand how living things obtain and use energy at the cellular level	● I can describe the role of chloroplast/mitochondria in the change of energy all living organisms perform. ● I can compare what happens to energy in photosynthesis and respiration ● I can describe the role of ATP in the process of a chemical reaction

SUBJECT: Principles of Biology	**GRADE: 10**
Unit Title: Ecology	**Time Frame: 1 Week**
UNIT OVERVIEW	
This unit serves as a quick review of Ecology concepts introduced in elementary school and reinforced in middle school.	
LRG SKILLS AND DISPOSITIONS	**PA STANDARDS**
	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.4.2.1 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, 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.**
COMPETENCIES	LEARNING TARGETS
I understand how organisms interact with each other and the physical environment in a balanced ecosystem.	● I can differentiate between biotic and abiotic components in various ecosystems ● I can differentiate between biosphere, biome, ecosystem, community, populations, and species ● I can describe how energy flows through an ecosystem using food chains, food webs, and energy pyramids ● I can describe how matter is recycled through the ecosystem (water, carbon, oxygen and nitrogen cycles) ● I can describe the effect of limiting factors on populations and population growth. ● I can differentiate between competition, predation, commensalism, mutualism, and parasitism. ● I can describe the impact of human natural disturbances to ecosystems.