Curriculum Map: Biology 2019

Course: BIOLOGY Sub-topic: Biology

Grade(s): 9 to 12

Course Description: Biology is a lab-based course that builds on biological concepts developed in Life Science. The program delves into the unity, diversity, and interdependence of all living things through the themes of energy, evolution, unity and diversity, structure and function, stability and systems, and their interactions. Laboratory investigations allow students to develop insights into problem solving and practical applications in the field of biology.

Vocabulary: See each individual unit for vocabulary lists.

Course Notes: Current curriculum is based upon the PA Keystone standards. The NGSS standards listed will tentatively begin 2022.

Unit: Unit A1 - Basic Biology Principles

Month: Content Anchor covers Chapters 1 and 7 (in current text - Miller & Levine Biology 2014)

Chapter 1 ~2 weeks

Chapter 7.1 - 7.2 ~2 weeks

Skills: List the characteristics of life. (E)

Compare and contrast prokaryotic and eukaryotic cells. (E)

Identify cells. (E)

Label and describe organelle function. (E)

Diagram the levels of organization. (E)

Essential Questions: What characteristics are common to all organisms?

What relationships exist between structure and function at biological levels?

Content: Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. (E)

Compare cellular structures and their functions in prokaryotic and eukaryotic cells. (E)

Describe and interpret relationships between structures and function at various levels (ie. orgaelles, cells, tissues, organs, organ systems, and multicellular organisms). (E)

Current curriculum is based upon the PA Keystone standards. The NGSS standards listed will tentatively begin 2022.

Assessments: Test

Quiz

Labs

Classwork

Homework

Vocabulary:

Animalia (E)

Archaea(E)

Archaebacteria(E)

Asexual reproduction(E)

Bacteria(E)

Biology(E)

Biosphere(E)

Cell(E)

Cell membrane(E)

Cell theory(E)

Cell wall(E)

Centriole(E)

Chemistry(E)

Chloroplast(E)

Cytoplasm(E)

Cytoskeleton(E)

DNA(E)

Endoplasmic reticulum(E)

Endosymbiosis(E)

Eubacteria(E)

Eukarya(E)

Eukaryote(E)

Extracellular(E)

Fungi(E)

Golgi apparatus(E)

Hierarchy of organization(E)

Homeostasis(E)

Homeostatic mechanism(E)

Intracellular(E)

Lipid bilayer(E)

Lysosome(E)

Metabolism(E)

Mitochondrion(E)

Multicellular(E)

Nucleus(E)

Organ(E)

Organ system(E)

Organelle(E)

Organism(E)

Plantae(E)

Plasma membrane(E)

Plastids(E)

Prokaryote(E)

Protista(E)

Ribosome(E)

Selectively permeable(E)

Sexual reproduction(E)

Stimulus(E)

Tissue(E)

Unicellular (E)

Vacuole (E)

Resources:

Textbook: Miller and Levine Biology / Published by Pearson Publishing copyright 2014 and ancillaries

PDE Keystone Biology Assessment Anchors and Eligible Content

PDE Keystone exams

PDE Keystone Biology Glossary to the Assessment Anchor and Eligible Content

STANDARDS:

STANDARDS

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

HS-LS1-1 (Advanced)	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.
HS-LS1-2 (Advanced)	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

STATE: Pennsylvania SAS Keystone Anchors (2010-2014)

BIO.A.1 (Advanced)	Basic Biological Principles
BIO.A.1.1 (Advanced)	Explain the characteristics common to all organisms.
BIO.A.1.1.1 (Advanced)	Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.
BIO.A.1.2 (Advanced)	Describe relationships between structure and function at biological levels of organization.
BIO.A.1.2.1 (Advanced)	Compare cellular structures and their functions in prokaryotic and eukaryotic cells.
BIO.A.1.2.2 (Advanced)	Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissues, organs, organ systems, and

multicellular organisms).

Topic: Basic Biological Principles

Unit: Unit A2 - The Chemical Basis for Life

Month: Unit covers Chapter 2 from current text (Miller & Levine Biology 2014)

Chapter 2.1-2.2 - Chemistry - Taught together ~2 weeks

Chapter 2.3-2.4 - Biochemistry and Macromolecules ~2 weeks

Skills:

Demonstrate and explain the properties of water and solutions(adhesion, polarity, cohesion, pH) (E)

Draw and label carbon atom and molecules (E)

Identify and predict condensation and hydrolysis reactions (E)

Compare and contrast the properties and characteristics of the 4 classes of macromolecules (monomers and polymers). (E)

Identify the 4 categories of macromolecules based on the structural formulas (E)

Identify enzyme, substrate and activation energy as it relates to a chemical reaction. (E)

Identify the effects of denaturation on a protein catalyst. (E)

Essential Questions:

How do the unique properties of water support life on Earth?

What relationships exist between structure and function of atoms, molecules, and macromolecules?

How do enzymes regulate biochemical reactions within a cell?

Content:

Describe the unique properties of water and how these properties support life on earth (i.e. freezing point, high specific heat , cohesion, etc…). (E)

Explain how carbon is uniquely suited to form biological macromolecules. (E)

Describe how biological macromolecules form monomers. (E)

Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. (E)

Describe the role of an enzyme as a catalyst in regulating a specific biological reaction. (E)

Explain how factors such as pH, temperature and concentration levels can affect enzymes. (E)

Current curriculum is based upon the PA Keystone standards. The NGSS standards listed will tentatively begin 2022.

Assessments: Test

Quiz

Labs

Classwork

Homework

Vocabulary:

Acid (E)

Activation energy (E)

Adhesion (E)

Amino acid (E)

Atom (E)

Base (E)

Biological macromolecules (E)

Buffer (E)

Carbohydrate (E)

Catalyst (E)

Chemical reaction (E)

Cohesion (E)

Compound (E)

Concentration (E)

Concentration gradient (E)

Covalent bond (E)

Electron (E)

Element (E)

Enzyme (E)

Freezing point (E)

Hydrogen bond (E)

Ion (E)

Ionic bond (E)

Isotope (E)

Lipid (E)

Macromolecules (E)

Mixture (E)

Molecule (E)

Monomer (E)

Monosaccharide (E)

Nucleic acid (E)

Nucleotide (E)

Nucleus (E)

Organic molecule (E)

pH (E)

pH scale (E)

Polymer (E)

Product (E)

Protein (E)

Reactant (E)

Solute (E)

Solution (E)

Solvent (E)

Specific heat (E)

Substrate (E)

Suspension (E)

Temperature (E)

Van der Waals forces (I)

Resources:

Textbook: Miller and Levine Biology / Published by Pearson Publishing copyright 2014 and ancillaries

PDE Keystone Biology Assessment Anchors and Eligible Content

PDE Keystone exams

PDE Keystone Biology Glossary to the Assessment Anchor and Eligible Content

STANDARDS:

STANDARDS

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

HS-LS1-6 (Advanced)	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

STATE: Pennsylvania SAS Keystone Anchors (2010-2014)

BIO.A.2 (Advanced)	The Chemical Basis for Life
BIO.A.2.1 (Advanced)	Describe how the unique properties of water support life on Earth.
BIO.A.2.1.1 (Advanced)	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 (Advanced)	Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules).

BIO.A.2.2.1 (Advanced)	Explain how carbon is uniquely suited to form biological macromolecules.
BIO.A.2.2.2 (Advanced)	Describe how biological macromolecules form from monomers.
BIO.A.2.2.3 (Advanced)	Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.
BIO.A.2.3 (Advanced)	Explain how enzymes regulate biochemical reactions within a cell.
BIO.A.2.3.1 (Advanced)	Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction.
BIO.A.2.3.2 (Advanced)	Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.

Topic: The chemical basis for life

Unit: Unit A3 - Bioenergetics

Month: Content Anchor covers Chapters 8 and 9 (in current text - Miller & Levine Biology 2014)

Chapter 8 ~ 2.5 weeks

Chapter 9 ~ 2.5 weeks

Skills: Draw/diagram with labels the structure of chloroplast and mitochondrion and show the flow of electrons/energy within these structures. (E)

Identify the reactants, products and energy conversions in the chemical equations for photosynthesis and cellular respiration. (E)

Diagram and label the ADP/ATP cycle (E)

Essential Questions: What cell structures are involved in processing energy?

How do cell structures process energy?

How do organisms obtain energy for life processes?

Content: Describe the fundamental role of plastids(i.e. chloroplasts) and mitochondria in energy transformations. (E)

Compare the basic transformation of energy during photosynthesis and cellular respiration. (E)

Describe the role of ATP in biochemical reactions. (E)

Current curriculum is based upon the PA Keystone standards. The NGSS standards listed will tentatively begin 2022.

Assessments: Test

Quiz

Labs

Classwork

Homework

Vocabulary:

Adenosine triphosphate (ATP) (E)

Aerobic (E)

Anaerobic (E)

ATP synthase (E)

Autotroph (E)

Calorie (E)

Calvin cycle (E)

Cellular respiration (E)

Chlorophyll (E)

Electron transport chain (E)

Energy transformation (E)

Fermentation (E)

Glycolysis (E)

Heterotroph (E)

Krebs cycle (E)

Light dependent reactions (E)

Light independent reactions (E)

Matrix (E)

NAD +(H) (E)

NADP+(H) (E)

Photosynthesis (E)

Photosystem (E)

Pigment (E)

Stroma (E)

Thylakoid (E)

Resources:

Textbook: Miller and Levine Biology / Published by Pearson Publishing copyright 2014 and ancillaries

PDE Keystone Biology Assessment Anchors and Eligible Content

PDE Keystone exams

PDE Keystone Biology Glossary to the Assessment Anchor and Eligible Content

STANDARDS:

STANDARDS

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

HS-LS2-3 (Advanced) Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and

	anaerobic conditions.
HS-LS2-5 (Advanced)	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
HS-LS1-5 (Advanced)	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-7 (Advanced)	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.
STATE: Pennsylvania SAS Keystone Anchors (2010-2014)	
BIO.A.3 (Advanced)	Bioenergetics
BIO.A.3.1 (Advanced)	Identify and describe the cell structures involved in processing energy.
BIO.A.3.1.1 (Advanced)	Describe the fundamental roles of plastids (e.g., chloroplasts) and mitochondria in energy transformations.
BIO.A.3.2 (Advanced)	Identify and describe how organisms obtain and transform energy for their life processes.
BIO.A.3.2.1 (Advanced)	Compare the basic transformation of energy during photosynthesis and cellular respiration.
BIO.A.3.2.2 (Advanced)	Describe the role of ATP in biochemical reactions.

Topic: Bioenergetics

Unit: Unit A4 - Homeostasis and Transport

Month: Content Anchor covers Chapters 7.3 - 7.4 (in current text - Miller & Levine Biology 2014)

Chapter 7.3-7.4 ~ 2 weeks

Skills:

Draw and label a plasma membrane. (E)

List, identify and describe the methods of transport across the plasma membrane (E)

Identify the energy sources for cell membrane transport. (E)

Compare and contrast the various methods of cellular membrane transport. (E)

Relate cellular transport to the roles of the endoplasmic reticulum and Golgi apparatus with vesicles. (E)

Describe how the cell maintains balance through homeostatic mechanisms. (E)

Essential Questions:

How does transport of materials into, out of, and within, a cell occur using cell structures?

What mechanisms exist that permit organisms to maintain biological balance between their internal and external environments?

Content:

Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or a protective barrier for a cell. (E)

Compare the mechanisms that transport materials across the plasma membrane (i.e. passive transport – diffusion, osmosis, facilitated diffusion; and active transport – pumps, endocytosis, exocytosis) (E)

Describe how membrane bound cellular organelles (i.e. endoplasmic reticulum, Golgi apparatus) facilitate transport of materials within a cell. (E)

Explain how organism maintain homeostasis (i.e. thermoregulation, water regulation, oxygen regulation). (E)

Current curriculum is based upon the PA Keystone standards. The NGSS standards listed will tentatively begin 2022.

Assessments: Test

Quiz

Labs

Classwork

Homework

Vocabulary:

Active transport (E)

Aquaporin(I)

Carrier (transport) protein (E)

Cell membrane (E)

Cell wall (E)

Cytoplasm (E)

Diffusion (E)

Endocytosis (E)

Endoplasmic reticulum (E)

Exocytosis (E)

Extracellular (E)

Facilitated diffusion (E)

Golgi apparatus (E)

Homeostasis (E)

Homeostatic mechanism (E)

Hypertonic (E)

Hypotonic (E)

Impermeable (E)

Intracellular (E)

Isotonic (E)

Lipid bilayer (E)

Osmosis (E)

Osmotic pressure (E)

Passive transport (E)

Plasma membrane (E)

Pumps (ion or molecular) (E)

Receptor (I)

Selectively permeable (E)

Resources:

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PDE Keystone Biology Assessment Anchors and Eligible Content

PDE Keystone exams

PDE Keystone Biology Glossary to the Assessment Anchor and Eligible Content

STANDARDS:

STANDARDS

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

HS-LS1-3 (Advanced)	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

STATE: Pennsylvania SAS Keystone Anchors (2010-2014)

BIO.A.4 (Advanced)	Homeostasis and Transport
BIO.A.4.1 (Advanced)	Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell.
BIO.A.4.1.1 (Advanced)	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 (Advanced)	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.A.4.1.3 (Advanced)	Describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell.
BIO.A.4.2 (Advanced)	Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments.
BIO.A.4.2.1 (Advanced)	Explain how organisms maintain homeostasis (e.g., thermoregulation, water regulation, oxygen regulation).

Topic: Homeostasis and transport

Unit: Unit B1 - Cell Growth and Reproduction

Month:

Content Anchor covers Chapter 10 (in current text - Miller & Levine Biology 2014)

Chapter 10 ~ 2 weeks

Skills:

Diagram and label the cell cycle. (E)

Identify the stages of mitotic division. (E)

Diagram and label a DNA molecule. (E)

Explain how various enzymes are utilized in the process of DNA replication. (E)

Identify the result of DNA replication. (E)

Identify diagrams showing the relationship in size and function of molecules of DNA in chromosome formation. (E)

Explain how cells control growth and development (I)

Essential Questions:

What occurs during interphase, nuclear division, and cytokinesis?

How is genetic information inherited?

Content:

Describe the events that occur during the cell cycle: interphase, nuclear division (mitosis, meiosis), and cytokinesis (E)

Compare the processes and outcomes of mitotic and meiotic nuclear division. (E)

Describe how the process of DNA replication results in the transmission and/or conservation of genetic information (E)

Explain the functional relationships between DNA, genes, alleles and chromosomes and their roles in inheritance (E)

Describe how the cell cycle is regulated (I)

Describe the process of cell differentiation (C)

Current curriculum is based upon the PA Keystone standards. The NGSS standards listed will tentatively begin 2022.

Assessments:

Test

Quiz

Labs

Classwork

Homework

Vocabulary:

Allele (E)

Anaphase (E)

Apoptosis (C)

Asexual reproduction (E)

Blastocyte (C)

Cancer (I)

Cell cycle (E)

Cell division (E)

Centriole (E)

Centromere (E)

Chromatid (E)

Chromatin (E)

Chromosome (E)

Cyclin (C)

Cytokinesis (E)

Deoxyribonucleic acid (DNA) (E)

Differentiation (C)

DNA polymerase (E)

Embryo (C)

Gamete (E)

Gene (E)

Growth factor (C)

Helicase (E)

Interphase (E)

Ligase (E)

Metaphase (E)

Mitosis (E)

Multipotent (C)

Okazaki fragments (I)

Pluripotent (C)

Primase (E)

Prophase (E)

Sexual reproduction (E)

Stem cell (C)

Telophase (E)

Totipotent (C)

Tumor (I)

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PDE Keystone Biology Assessment Anchors and Eligible Content

PDE Keystone exams

PDE Keystone Biology Glossary to the Assessment Anchor and Eligible Content

STANDARDS:

STANDARDS

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

HS-LS1-4 (Advanced) Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

STATE: Pennsylvania SAS Keystone Anchors (2010-2014)

BIO.B.1 (Advanced)	Cell Growth and Reproduction
BIO.B.1.1 (Advanced)	Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis.
BIO.B.1.1.1 (Advanced)	Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis.
BIO.B.1.1.2 (Advanced)	Compare the processes and outcomes of mitotic and meiotic nuclear divisions.
BIO.B.1.2 (Advanced)	Explain how genetic information is inherited.
BIO.B.1.2.1 (Advanced)	Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.
BIO.B.1.2.2 (Advanced)	Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance.

Topic: Cell growth and reproduction

Unit: Unit B2 - Genetics

Month: Content Anchor covers Chapters 11-15 (in current text - Miller & Levine Biology 2014)

Chapter 11 - Introduction to Genetics ~2.5 weeks

Chapter 12 - DNA ~ 1.5 weeks

Chapter 13 - RNA and Protein synthesis ~ 2 weeks

Chapter 14 - Human heredity ~ 1 week

Chapter 15 - Genetic engineering ~ 1 week

Skills: Predict the results of genetic crosses displayed through multiple forms of inheritance. (E)

Contrast causes of gene mutations and the effects on genotype and phenotype for a particular trait. (E)

Diagram within a cell the process of protein synthesis including all involved cell organelles. (E)

Compare and contrast the structure and roles in protein synthesis of the 3 types of ribonucleic acid. (E)

Contrast causes of chromosomal mutations and the effects on genotype and phenotype for a particular trait. (E)

Compare and contrast protein synthesis in various types of organisms. (E)

Relate protein production to cell need. (I)

Research current genetic trends as related to genetic engineering. (C)

Essential Questions: How are traits inherited through both Mendelian and non-Mendelian patterns?

How does protein synthesis occur through transcription, translation, and protein modification?

How is genetic information expressed?

How is genetics studied through scientific thinking, processes, tools, and technologies?

Content: Describe and/or predict observed patterns of inheritance (i.e. dominant, recessive, co-

dominance, incomplete dominance, sex-linked, polygenic and multiple alleles) (E)

Describe processes that can alter composition or number of chromosomes (i.e. crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion) (E)

Describe how the processes of transcription and translation are similar in all organisms. (E)

Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins. (E)

Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (i.e. silent, nonsense, frame-shift) (E)

Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (i.e. selective breeding (E), gene splicing (C) , cloning (E), genetically modified organism (C), gene therapy (C)

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Assessments: Test

Quiz

Labs

Classwork

Homework

Vocabulary:

Allele (E)

Allele frequency (E)

Anticodon (E)

Autosome (E)

Bacteriophage (C)

Base pairing (E)

Bioinformatics (C)

Biotechnology (C)

Chromosomal mutation (E)

Chromosomes (E)

Cloning (E)

Codominance (E)

Codon (E)

Crossing over (E)

Deoxyribonucleic acid (DNA) (E)

Differentiation (I)

Diploid (E)

Dominant inheritance (E)

Exon (C)

Fertilization (E)

Forensics (C)

Frame-shift mutation (E)

Gamete (E)

Gel electrophoresis (I)

Gene (E)

Gene expression (E)

Gene recombination (C)

Gene splicing (C)

Gene therapy (C)

Genetic code (E)

Genetic engineering (E)

Genetic marker (C)

Genetically modified organism (I)

Genetics (E)

Genome (E)

Genomics (C)

Genotype (E)

Haploid (E)

Heterozygous (E)

Homeobox gene (C)

Homeotic gene (C)

Homologous (E)

Homozygous (E)

Hox gene (C)

Hybrid (E)

Hybridization (E)

Inbreeding (I)

Incomplete dominance (E)

Independent assortment (E)

Inheritance (E)

Insertion (E)

Intron (C)

Inversion (E)

Karyotype (E)

Meiosis (E)

Messenger RNA (E)

Migration (genetics) (I)

Multiple alleles (E)

Mutagen (E)

Mutation (E)

Nondisjunction (E)

Operator (C)

Operon (C)

Pedigree (E)

Phenotype (E)

Plasmid (C)

Point mutation (E)

Polygenic trait (E)

Polypeptide (E)

Polyploidy (E)

Primase (E)

Principle of dominance (E)

Probability (E)

Promoter (I)

Protein synthesis (E)

Punnett square (E)

Recessive inheritance (E)

Recombinant DNA (I)

Restriction enzyme (C)

Ribosomal RNA (E)

RNA (E)

RNA interference (C)

RNA polymerase (E)

Segregation (E)

Selective breeding (E)

Semi-conservative replication (E)

Sex chromosome (E)

Sex-linked trait (E)

Telomere (C)

Tetrad (E)

Trait (E)

Transcription (E)

Transfer RNA (E)

Transformation (C)

Transgenic (C)

Translation (E)

Translocation (E)

Zygote (E)

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PDE Keystone Biology Assessment Anchors and Eligible Content

PDE Keystone exams

PDE Keystone Biology Glossary to the Assessment Anchor and Eligible Content

STANDARDS:

STANDARDS

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

HS-LS3-1 (Advanced)	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2 (Advanced)	Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
HS-LS3-3 (Advanced)	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

STATE: Pennsylvania SAS Keystone Anchors (2010-2014)

BIO.B.2 (Advanced)	Genetics
BIO.B.2.1 (Advanced)	Compare Mendelian and non-Mendelian patterns of \inheritance.
BIO.B.2.1.1 (Advanced)	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 (Advanced)	Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).
BIO.B.2.2 (Advanced)	Explain the process of protein synthesis (i.e., transcription, translation, and protein modification).
BIO.B.2.2.1 (Advanced)	Describe how the processes of transcription and translation are similar in all organisms.
BIO.B.2.2.2 (Advanced)	Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.
BIO.B.2.3 (Advanced)	Explain how genetic information is expressed.
BIO.B.2.3.1 (Advanced)	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 (Advanced)	Apply scientific thinking, processes, tools, and technologies in the study of genetics.
BIO.B.2.4.1 (Advanced)	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).

Topic: Genetics

Unit: Unit B3 - Theory of Evolution

Month: Content Anchor covers Chapters 16 - 19 (in current text - Miller & Levine Biology 2014)

Chapter 17 - Evolution of populations

Chapter 18 - Classification

Chapter 19 - History of life

~2-3 weeks spent in Evolution - combine the materials from each chapter into a single unit

Skills: Identify the genetic variations within a population. (E)

Explain how genetic variations within populations contribute to speciation. (I)

Identify new phenotypes as a result of genetic mutations within a population. (E)

List and describe the scientific evidence supporting the theory of evolution. (E)

Identify the parts of a controlled experiment. (E)

Create and/or perform a controlled experiment. (E)

Essential Questions: What are the mechanisms of evolution?

What are the sources for evidence for biological evolution?

How is the theory of evolution studies through scientific thinking, processes, tools, and technologies?

Content: Explain how natural selection can impact allele frequencies of a population (E)

Describe the factors that can contribute to the development of new species (i.e. isolating mechanisms, genetic drift, founder effect, migration) (I)

Explain how genetic mutations may result in genotypic and phenotypic variations within a population (E)

Interpret evidence supporting the theory of evolution (i.e. fossils, anatomical, physiological, embryological, biochemical and universal genetic code). (E)

Distinguish between the scientific terms, hypothesis, inference, law, theory, principle, fact, and observation. (E)

Current curriculum is based upon the PA Keystone standards. The NGSS standards listed will tentatively begin 2022.

Assessments: Test

Quiz

Labs

Classwork

Homework

Vocabulary:

Adaptation (E)

Adaptive radiation (E)

Allele frequency (E)

Analogous structure (E)

Artificial selection (E)

Behavioral isolation (C)

Binomial nomenclature (C)

Biogeography (E)

Bottleneck effect (C)

Clade (C)

Cladogram (C)

Coevolution (E)

Control group (E)

Controlled experiment (E)

Convergent evolution (E)

Data (E)

Dependent variable (E)

Directional selection (C)

Disruptive selection (C)

Embryology (E)

Endemic species (C)

Endosymbiotic theory (E)

Era (E)

Evolution (E)

Extinction (E)

Fitness (E)

Fossils (E)

Founder effect (I)

Gene pool (I)

Genetic drift (I)

Genetic equilibrium (C)

Geographic isolation (C)

Geologic time scale (E)

Gradualism (C)

Half life (E)

Hardy-Weinberg Principle (C)

Homologous structure (E)

Hypothesis (E)

Independent variable (E)

Inference (E)

Isolating mechanism (C)

Law (scientific) (E)

Macroevolution (C)

Mass extinction (C)

Mechanism (scientific) (E)

Microevolution (C)

Natural selection (E)

Observation (E)

Period (I)

Phylogeny (C)

Polygenic (C)

Principle (scientific) (E)

Punctuated equilibrium (C)

Radiometric dating (E)

Relative dating (E)

Reproductive isolation (C)

Science (E)

Selective breeding (I)

Sexual selection (C)

Speciation (C)

Species (E)

Stabilizing selection (C)

Taxon (C)

Temporal isolation (C)

Theory (E)

Vestigial structures (E)

Resources: Textbook: Miller and Levine Biology / Published by Pearson Publishing copyright 2014 and

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PDE Keystone Biology Assessment Anchors and Eligible Content

PDE Keystone exams

PDE Keystone Biology Glossary to the Assessment Anchor and Eligible Content

STANDARDS:

STANDARDS

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

HS-LS4-1 (Advanced)	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
HS-LS4-2 (Advanced)	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-3 (Advanced)	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-LS4-4 (Advanced)	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS4-5 (Advanced)	Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

STATE: Pennsylvania SAS Keystone Anchors (2010-2014)

BIO.B.3 (Advanced)	Theory of Evolution
BIO.B.3.1 (Advanced)	Explain the mechanisms of evolution.
BIO.B.3.1.1 (Advanced)	Explain how natural selection can impact allele frequencies of a population.
BIO.B.3.1.2 (Advanced)	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 (Advanced)	Explain how genetic mutations may result in genotypic and phenotypic variations within a population.
BIO.B.3.2 (Advanced)	Analyze the sources of evidence for biological evolution.
BIO.B.3.2.1 (Advanced)	Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code).
BIO.B.3.3 (Advanced)	Apply scientific thinking, processes, tools, and technologies in the study of the theory of evolution.
BIO.B.3.3.1 (Advanced)	Distinguish between the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.

Topic: Theory of evolution

Unit: Unit B4 - Ecology

Month: Content Anchor covers Chapters 3 - 6 (in current text - Miller & Levine Biology 2014)

Chapter 3 - The Biosphere

Chapter 4 - Ecosystems and Communities

Chapter 5 - Populations

Chapter 6 - Humans in the biosphere

Skills:

Create a diagram of the levels of ecological organization with descriptions. (E)

Identify the abiotic and biotic factors within every ecosystem and/or biome. (E)

Create and/or interpret a food chain and food web. (E)

Identify the relationships between different species within an ecosystem and the effects on each other. (E)

Diagram or interpret the biogeochemical cycles within the biosphere. (E)

Illustrate and identify the effects of natural and human disturbances on the biosphere. (E)

Essential Questions:

What are the ecological levels of organization in the biosphere?

What interactions and relationships exist in an ecosystem?

Content:

Describe the levels of ecological organization (i.e. organism, population, community, ecosystem, biome, and biosphere) (E)

Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. (E)

Describe how energy flows through an ecosystem (i.e. food chains, food webs, energy pyramids). (E)

Describe biotic interactions in an ecosystem (i.e. competition, predation symbiosis). (E)

Describe how matter recycles through an ecosystem (i.e. water cycle, carbon cycle, oxygen cycle, and nitrogen cycle). (E)

Describe how ecosystems change in response to natural and human disturbances (i.e. climate changes, introduction of nonnative species, pollution, fires). (E)

Describe the effects of limiting factors on populations dynamics and potential species extinction (E)

Current curriculum is based upon the PA Keystone standards. The NGSS standards listed will tentatively begin 2022.

Assessments:

Test

Quiz

Labs

Classwork

Homework

Vocabulary:

Abiotic (E)

Acid rain (E)

Agriculture (I)

Aphotic zone (E)

Aquatic (E)

Autotroph (E)

Biochemical conversion (I)

Biodiversity (E)

Bioenergetics (E)

Biogeochemical cycles (E)

Biological magnification (C)

Biome (E)

Biosphere (E)

Biotic (E)

Carbon cycle (E)

Carnivore (E)

Carrying capacity (E)

Chemosynthesis (E)

Commensalism (E)

Community (ecological) (E)

Competition (E)

Consumer (ecological) (E)

Decomposer (E)

Denitrification (C)

Ecological succession (E)

Ecology (E)

Ecosystem (E)

Emmigration (C)

Energy pyramid (E)

Environment (E)

Estuary (I)

Exponential growth (E)

Food chain (E)

Food web (E)

Habitat (E)

Herbivore (E)

Heterotroph (E)

Immigration (I)

Keystone species (I)

Limiting factor (E)

Logistic growth (C)

Mutualism (E)

Niche (I)

Nitrogen cycle (E)

Nitrogen fixation (C)

Non-native species (I)

Non-renewable resource (C)

Omnivore (E)

Parasitism (E)

Phosphorous cycle (E)

Photic zone (E)

Pioneer species (E)

Population (E)

Population density (I)

Population dynamics (I)

Predation (E)

Primary producer (E)

Primary succession (E)

Producer (ecological) (E)

Renewable resource (I)

Resource (I)

Scavenger (E)

Secondary succession (E)

Species (E)

Succession (E)

Symbiosis (E)

Symbiotic relationship (E)

System (I)

Terrestrial (E)

Tropic level (E)

Water cycle (E)

Resources: Textbook: Miller and Levine Biology / Published by Pearson Publishing copyright 2014 and ancillaries

PDE Keystone Biology Assessment Anchors and Eligible Content

PDE Keystone exams

PDE Keystone Biology Glossary to the Assessment Anchor and Eligible Content

STANDARDS:

STANDARDS

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

HS-LS4-6 (Advanced)	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
HS-LS2-1 (Advanced)	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2 (Advanced)	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-4 (Advanced)	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-LS2-6 (Advanced)	Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
HS-LS2-7 (Advanced)	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-LS2-8 (Advanced)	Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.

STATE: Pennsylvania SAS Keystone Anchors (2010-2014)

BIO.B.4 (Advanced)	Ecology
BIO.B.4.1 (Advanced)	Describe ecological levels of organization in the biosphere.
BIO.B.4.1.1 (Advanced)	Describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome, and biosphere).
BIO.B.4.1.2 (Advanced)	Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.
BIO.B.4.2 (Advanced)	Describe interactions and relationships in an ecosystem.
BIO.B.4.2.1 (Advanced)	Describe how energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids).
BIO.B.4.2.2 (Advanced)	Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis).
BIO.B.4.2.3 (Advanced)	Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle, and nitrogen cycle).
BIO.B.4.2.4 (Advanced)	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 (Advanced)	Describe the effects of limiting factors on population dynamics and potential species extinction.

Topic: Ecology