PAP Biology-Integrated Year-at-a-Glance

ARKANSAS STATE SCIENCE STANDARDS

FIRST SEMESTER		SECOND SEMESTER			
Unit 1 **Intro, Inquiry, CER**	**Unit 2** **Structure & Function**	**Unit 3** **Cycling of Matter & Energy**	**Unit 4** **Genetic Variations in Organisms**	**Unit 5** **Biodiversity, Populations, and Evolution**	**Unit 6** **Life and Earth's Systems and Human Impact on Earth's Systems**
4 weeks	13 weeks	4 weeks	6 weeks	4 weeks	4 weeks
• **RST.9-10.2** • **RST.9-10.5** • **RST.9-10.9** • **WHST.9-10.1**	• **BI-LS1-2** • **BI-LS1-3** • **BI-LS1-6**	• **BI-LS1-5** • **BI-LS1-7** • **BI-LS2-3** • **BI-LS2-4** • **BI-LS2-5** • **BI-ESS2-6**	• **BI-LS1-1** • **BI-LS1-2** • **BI-LS1-4** • **BI-LS3-1** • **BI-LS3-2**	• **BI-LS2-1** • **BI-LS2-2** • **BI-LS2-6** • **BI-LS2-8** • **BI-LS3-3** • **BI-LS4-1** • **BI-LS4-2** • **BI-LS4-3** • **BI-LS4-4** • **BI-LS4-5** • **BI-ESS2-7** • **BI-ESS3-3**	• **BI-LS2-7** • **BI-LS4-6** • **BI-ESS2-2** • **BI-ESS2-5** • **BI-ESS3-1** • **BI-ESS3-2** • **BI-ESS3-4** • **BI-ESS3-5** • **BI-ESS3-6**

Recurring

- **RST.9-10.2** 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.
- **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).
- **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.
- **WHST.9-10.1** Write arguments focused on discipline-specific content.

Unit 1	Introduction to Inquiry in Biology	Grade Level	10	Approx length	4 weeks

CPSD Power Standards with Student Learning Objectives

RST.9-10.2 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.

Student-Friendly Objectives:

- I can summarize complex concepts or a piece of a text.
- I can identify the main idea of a text.

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).

Student-Friendly Objectives:

- I can group key terms together to show relationships.
- I can use concept maps to explain relationships between concepts and key terms.

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.

Student-Friendly Objectives:

- I can read scientific data to determine similarities and differences.
- I can use scientific information to support a claim.

WHST.9-10.1 Write arguments focused on discipline-specific content

Student-Friendly Objectives:

- I can write a strong argument.
    - I can develop a claim.
    - I can use sufficient evidence to support my claim.
    - I can thoroughly explain how or why my evidence supports my claim using scientific vocabulary.
    - I can anticipate and refute a counterclaim to strengthen my argument.
- I can revise and edit my writing based on feedback.

Learning Indicators of Power Standards	
Students will know… ● Analytical strategies for interpreting text ○ Annotating, summarizing, etc. ○ Purpose, importance, procedure, data analysis, conclusion ● Scientific symbols ● Scientific notation ● Specific vocabulary ○ Greek and Latin roots ● Analytical strategies for comparing and contrasting data interpretation ○ Text features (headings, subheadings, axis titles, diagrams, etc.) ● The different components of an argument ○ Claim, evidence, reasoning ○ Counterclaim ○ Refutation of counterclaim ● What constitutes relevant and sufficient evidence ● Formal tone of academic writing ● Editing/revision strategies	And be able to… ● Summarize complex concepts using claims, evidence, and reasoning. ● Identify the main concept or conclusion of a text. ● Categorize relationships among key terms. ● Use concept maps to explain relationships among concepts and key terms. ● Evaluate scientific findings to determine similarities and differences. ● Differentiate between supporting and contrasting information. ● Compose a scientific argument using evidence. ● Create a draft including the components of an argument: ○ Support argument with relevant and sufficient evidence (qualitative and/or quantitative) ○ Thoroughly explain how or why the evidence supports the claim using specific scientific vocabulary ○ Develop and refute a counterclaim to strengthen an argument ● Maintain an appropriate style and tone for academic writing. ● Revise writing based on feedback.

Unit 2	Structure and Function	**Grade Level**	10	**Approx Length**	13 weeks

Arkansas State Standards

- **BI-LS1-2** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- **BI-LS1-3** Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
- **BI-LS1-6** 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.

Unit 3	Cycling of Energy and Matter	Grade Level	10	Approx Length	4 weeks

CPSD Power Standards with Student Learning Objectives

BI-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy

Student-Friendly Objectives:

- I can identify the products and reactants of a chemical reaction.
- I can create a model to explain photosynthesis.
- I can interpret graphs and diagrams of photosynthesis.

BI-LS1-7 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.

Student-Friendly Objectives:

- I can identify the products and reactants of a cellular respiration.
- I can create a model to explain cellular respiration.
- I can interpret graphs and diagrams of cellular respiration.

Learning Indicators of Power Standards

Students will know…	And be able to…
● Photosynthesis converts light energy to stored chemical energy ● The reactants of photosynthesis are carbon dioxide and water ● The products of photosynthesis are sugars and oxygen ● The role of pigments and solar energy in photosynthesis ● The energy molecules (ATP and NADPH) for photosynthesis ● Structure of the leaf and chloroplast ● Locations of the reactions of photosynthesis ● The role of transpiration in photosynthesis ● The role of cell transport (diffusion of O_2 and CO_2) ● Food can be converted to energy when it combines with oxygen in a cell ● The reactants of cellular respiration are food molecules (sugars) and oxygen ● The products of cellular respiration are energy (ATP), CO_2, and water	● Create a model that explains photosynthesis. ● Interpret graphs of rates of photosynthesis based on different environmental factors. ● Create a model that explains cellular respiration.

• The energy molecules (ATP, $FADH_2$, NADH) for cellular respiration • The structure of the cell and mitochondria • The location of the reactions of cellular respiration • Cell transport: facilitated diffusion of glucose diffusion of O_2 and CO_2	

Additional Arkansas State Standards

- **BI-LS2-3** Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
- **BI-LS2-4** Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
- **BI-LS2-5** Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
- **BI-ESS2-6** Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

Unit 4	Genetic Variations in Organisms	Grade Level	10	Approx Length	6 weeks

CPSD Power Standards with Student Learning Objectives

BI-LS1-1 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.

Student-Friendly Objectives:

- I can develop a model of DNA.
- I can use base-pair rules to model DNA replication.
- I can connect a specific type of RNA to its role in protein synthesis.
- I can interpret a codon chart to determine the accurate sequence of amino acids.
- I can describe the structure of proteins and how their structure determines their function.
- I can explain how a mutation in DNA or proteins alters the function of the protein.

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

Student-Friendly Objectives:

- I can develop a model showing the steps of mitosis.
- I can describe how a single cell can lead to many cells via mitosis.
- I can explain how specialized cells develop from the same beginning cell.

BI-LS3-2 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.

Student-Friendly Objectives:

- I can compare and contrast sexual and asexual reproduction.
- I can identify the general stages of meiosis.
- I can explain how meiosis leads to genetic variation.
- I can describe how errors during DNA replication contribute to genetic variation.
- I can write and support a claim that inheritable genetic variation may result from meiosis, DNA replication errors, and/or environmental factors.

Learning Indicators of Power Standards

Students will know…	And be able to…

• Structure of DNA • Structure of RNA • DNA contains regions called genes • Genes can code for proteins • Not all DNA codes for a protein • Types of RNA and their roles in protein synthesis • The process of transcription and its role in protein synthesis • The process of translation and its role in protein synthesis • Structure of proteins (types of chemical bonds) • Functions of proteins as enzymes, signal molecules, and transport molecules • Types of DNA mutations • Cell differentiation • Individual cells grow and divide via a process called mitosis • A multicellular organism begins as a single cell (fertilized egg) that undergoes division • Daughter cells produced as a result of mitosis are genetically identical • Cellular reproduction is the means by which organisms grow and repair damage • The steps involved in cell differentiation • The steps of meiosis • Alleles sort independently of one another during meiosis • Sexual reproduction gives rise to new genetic combinations and variation between parent and offspring • During sexual reproduction, chromosomes may swap sections (crossing over) during meiosis, resulting in genetic variation • Errors that occur during DNA replication lead to mutations, which are another source of genetic variation • Environmental factors can cause genetic mutations; viable mutations are inherited	• Develop a model of DNA. • Illustrate DNA replication. • Transcribe a segment of DNA into mRNA. • Translate a segment of mRNA into an amino acid sequence using a codon chart. • Describe protein synthesis. • Research and communicate an explanation of a human disorder(s) due to mutations in DNA and/or protein. • Develop a model showing the steps of mitosis/cell division. • Explain how a single cell can divide to make two exact duplicate cells. • Outline the steps of cell differentiation. • Compare and contrast sexual and asexual reproduction. • Model the steps of meiosis. • Evaluate genetic diagrams to determine chromosome changes (good or bad). • Construct a scientific argument, using supporting evidence, that genetic variation is a result of genetic recombination, replication errors, and environmental factors.
Additional Arkansas State Standards	
• **BI-LS1-2** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. • **BI-LS3-1** Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.	

Unit 5	Biodiversity, Populations, and Evolution	Grade Level	10	Approx Length	3 weeks

CPSD Power Standards with Student Learning Objectives

BI-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Student-Friendly Objectives:

- I can create and interpret a cladogram based on molecular, morphologic and embryonic homologies.
- I can interpret structural homologies to determine if they are due to convergent of divergent evolution.
- I can explain how common ancestry is demonstrated by homologies.

BI-LS4-2 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.

Student-Friendly Objectives:

- I can predict an individual's ability to compete for resources based on genetic variation.
- I can discuss how a population will change as a result of natural selection.
- I can describe how genetic mutations leads to genetic variation and contributes to the process of evolution.
- I can explain the role of natural selection in the process of evolution.
- I can contrast acclimation, adaptation, and evolution.
- I can interpret a graph relating to changes in population size.
- I can identify adaptations and evidence for evolution.

Learning Indicators of Power Standards

Students will know…	And be able to…
● Morphological homologies demonstrate common ancestry by showing similarities in structure not function ● Morphological homologies based on shared environments are caused by environmental selection pressure and not common ancestry ● Molecular homologies demonstrate common ancestry by showing the differences in genomes, DNA or RNA nucleotide sequences, or Protein amino acid sequences - the more differences indicate more distant relationships ● Embryonic homologies demonstrate that embryos often have shared	● Compare and contrast molecular, morphologic, and embryonic homologies to explain evolutionary history. ● Compare molecular sequences, identify differences, and quantify differences to determine order of speciation/evolution. ● Interpret cladograms. ● Create cladograms based on homologies. ● Explain homologies, geographic distribution, the fossil record, provide evidence of common ancestry. ● Differentiate between convergent and divergent evolution.

structures between distantly related organisms, even though the adult form of the organism has very little structural homologies ● Cladograms/phylogenetic trees are models of evolutionary history that depict order of speciation and relatedness between species ● Evolution is genetic change within a population over long periods of time; individual organisms do not evolve ● DNA mutations and sexual reproduction lead to genetic variation ● Natural selection only happens when there is genetic variation between organisms in a population and variation in the expression of that genetic variation ● Variation among expressed traits allows some individuals to reproduce more successfully than others ● Organisms best suited for their environment are more likely to survive and reproduce, making their traits more common in the population ● Populations change over time due to competition for resources ● Natural selection leads to adaptation and is on-going ● Adaptation is when the majority of a population is anatomically, behaviorally, and physiologically is best suited for its environment ● Examples of biotic and abiotic factors that contribute to a change in gene frequency over time, leading to adaptation of populations: seasonal temperature ranges, acidity, light, geographic barriers, evolution of other organisms, long-term climate change ● Changes in environment may result in expansion, decline, or extinction of a species or the emergence of a new species	● Evaluate survival strategies based on limited resources. ● Describe how variation in traits help or inhibit individuals' ability to compete for resources. ● Predict effects of natural selection on a population when its environment changes. ● Relate an increase in species, genetic variation, competition among organisms, and natural selection to the process of evolution. ● Distinguish between acclimation, adaptation, and evolution. ● Identify supported evidences for evolution. ● Use graphical data to account for changes within a population.

Arkansas State Standards

- **BI-LS2-1** Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- **BI-LS2-2** Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- **BI-LS2-6** Evaluate the 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.
- **BI-LS2-8** Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
- **BI-LS3-3** Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- **BI-LS4-3** 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.
- **BI-LS4-4** Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

- **BI-LS4-5** 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.
- **BI-ESS2-7** Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
- **BI-ESS3-3** Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

Unit 6	Life and Earth's Systems and Human Impact on Earth's Systems	**Grade Level**	10	**Approx Length**	4 weeks

Additional Arkansas State Standards

- **BI-LS2-7** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **BI-LS4-6** Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
- **BI-ESS2-2** Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
- **BI-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- **BI-ESS3-1** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- **BI-ESS3-2** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- **BI-ESS3-4** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- **BI-ESS3-5** Analyze geoscience data and the results from global climate models to make an evidence based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
- **BI-ESS3-6** Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.