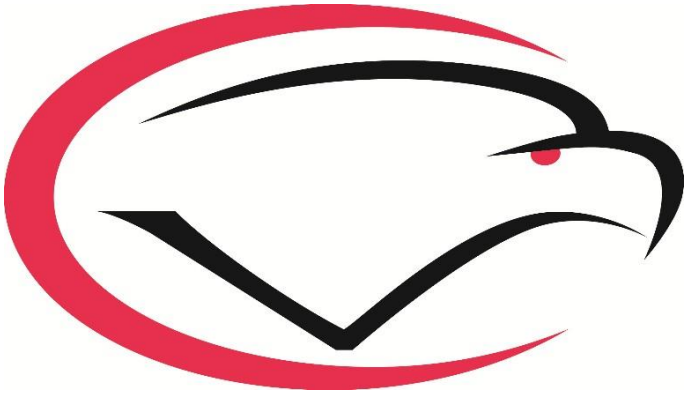
Secondary Curriculum Maps



Cumberland Valley School District

Soaring to Greatness, Committed to Excellence

Biology

CVHS Biology Scope and Sequence

Units	Approximate # of Periods (40 min.)	Keystone Biology Assessment Anchor	PA Academic Priority Standards
Bio 1st days	2		
1. **Basic Biological Principles**	12-13	Bio.A.1.1 Bio.A.1.2	3.1.B.A1
2. **The Chemistry of Life**	25 **21**	Bio.A.2.1 Bio.A.2.2 Bio.A.2.3	3.1.B.A2
3. **Cells: Homeostasis & Transport**	24	Bio.A.4.1 Bio.A.4.2	3.1.B.A2
4. **Bioenergetics**	17	Bio.A.3.1	3.1.B.A2
Common Assessment (midterm) and differentiated study	3		
5. **Cell Growth and Reproduction**	20	Bio.B.1.1	3.1.B.A4
6. Genetics (molecular and human; biotechnology)	30	Bio.B.1.2 Bio.B.2.1 Bio.B.2.2 Bio.B.2.3 Bio.B.2.4.	3.1.B.B5
7. Theory of Evolution	13	Bio.B.3.1 Bio.B.3.2 Bio.B.3.3	3.1.C
8. Ecology	14	Bio.B.4.1 Bio.B.4.2.	4.1.12.A
Keystone Review/remediation	5		
Teacher Choice topics Post Keystone	10		

CVSD Biology Curriculum Map#6
Grade 9

CV Priority Standard/PA Core Standard
4.1.12.A - Analyze the significance of biological diversity in an ecosystem. - Explain how species adapt to limiting factors in an ecosystem. - Analyze the differences between natural causes and human causes of extinction.
Taught in Unit(s)
Units: 7, 8
Explanation/Example of Standard
- All biotic and abiotic factors are interrelated and have an impact upon each other as well as the biosphere.
Common Misconceptions
- Water is living. - When a living organism dies it becomes abiotic. - The arrows in a food web point to the things being consumed. - Global climate change, caused by humans, is not occurring.

Big Idea(s)	Essential Question(s)
- Ecology is the study of the interdependence between organisms and their environment.	- How do living things interact with each other and the nonliving world?

Assessments
See attached common assessments Labs: See L1, L2, L3 Unit Maps Projects: See L1, L2, L3 Unit Maps

Assessment Anchor		Eligible Content	
Bio. B.4.1	Describe the ecological levels of organization in the biosphere.	**Bio.B.4.1.1**	Describe the levels of ecological organization (i.e. organisms, population, community, ecosystem, biome, 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 the 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, 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.

Concepts (what students need to know)	**Skills** (what students must be able to do)
1. All living things are organized into a hierarchy that include organism, population, community, ecosystem, biomes and biosphere. 2. Ecosystems can be composed of aquatic and terrestrial biomes and contain biotic and abiotic components. 3. All energy for life comes from the sun, and flows in different forms through the trophic levels of a food web. 4. Essential nutrients that cycle through ecosystems include water, carbon, oxygen and nitrogen. 5. Community interactions within an ecosystem include competition, and symbiotic relationships. 6. Human or natural factors such as agriculture, nonnative species and succession can affect ecosystems. 7. Populations growth of organisms can be limited by extinction, limiting factors and population	1. Describe the levels of ecological organization. 2. Describe the characteristic biotic and abiotic components of aquatic terrestrial ecosystems. 3. Describe how energy flows through and ecosystem. 4. Describe how matter recycles through an ecosystem. 5. Describe the biotic interactions in an ecosystem. 6. Describe how ecosystems change in response to natural and human disturbances. 7. Describe the effect of limiting factors on population dynamics and potential species extinction.

CVSD Biology Curriculum Map#5
Grade 9

CV Priority Standard/PA Core Standard
3.1.C - Explain the mechanisms of biological evolution. - Explain the role of mutations and gene recombination in changing a population of organisms.
Taught in Unit(s)
Units: 6, 7
Explanation/Example of Standard
- Evolution is a rigorously tested theory that continues to incrementally change populations of organisms over time.
Common Misconceptions
- Humans came from monkeys. - Natural selection involves organisms trying to adapt. - Natural selection gives organisms what they need. - Humans can not negatively impact ecosystems, because species will just evolve what they need to survive. - Natural selection acts for the good of the species. - The fittest organisms in a population are those that are strongest, healthiest, fastest, and/or largest. - All traits of organisms are adaptations. - Organisms "decide" which adaptations are "good" or "bad". - Individual organisms evolve.

Big Idea(s)	Essential Question(s)
- Through natural selection small changes in organisms can lead to large changes in populations.	- How is evolutionary theory a unifying theme for the study of life?

Assessments
See attached common assessments Labs: See L1, L2, L3 Unit Maps Projects: See L1, L2, L3 Unit Maps

Assessment Anchor		Eligible Content	
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 the evidence supporting the theory of evolution (i.e. fossil,

			anatomical, physiological, embryological, biochemical, and universal genetic code)
Bio.B.3.3	Apply scientific thinking, processes, tools, and technologies in the study of evolution.	**Bio.B.3.3.1**	Distinguish among the scientific terms: hypothesis, inference, law, theory, principle, fact and observation.
Concepts (what students need to know)		**Skills** (what students must be able to do)	
1. The Evidence supporting the theory of evolution includes biochemical (universal genetic code); embryological; anatomical (analogous structures, homologous structures, vestigial structures); and fossils. 2. The mechanisms that lead to changes in allele frequencies include natural selection(variation, fitness, adaptations); gene flow; mutations; random mating; and genetic drift(founder effect and bottleneck effect). 3. Factors that contribute to the formation of new species (speciation) include isolating mechanisms. 4. Theories of rate of evolution are gradualism and punctuated equilibrium.		1. Interpret evidence supporting the theory of evolution. 2. Explain how natural selection can impact allele frequencies of a population. 3. Describe the factors that can contribute to the development of new species. 4. Explain how genetic mutations may result in genotypic and phenotypic variations within a population.	

CVSD Biology Curriculum Map#4
Grade 9

CV Priority Standard/PA Core Standard
3.1.B.B5 - PATTERNS: Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance. - Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles). - CONSTANCY AND CHANGE: Explain how the processes of replication, transcription, and translation are similar in all organisms. - Explain how gene actions, patterns of heredity, and reproduction of cells and organisms account for the continuity of life. - SCALE: Demonstrate how inherited characteristics can be observed at the molecular, cellular, and organism levels.
Taught in Unit(s)
Units: 5, 6, 7
Explanation/Example of Standard
- The genetic code provides a template for transcription and translation and allows for the expression of traits.
Common Misconceptions
- One set of alleles is responsible for determining each trait, and there are only 2 different alleles (dominant and recessive) for each gene. - All mutations are harmful - A dominant trait is the most likely to be found in the population - Your genes determine all of your characteristics, and cloned organisms are exact copies of the original. - DNA, genes and chromosomes are interchangeable concepts. - DNA is the only genetic material in the genome. - Simple organisms such as bacteria do not have DNA.

Big Idea(s)	Essential Question(s)
- The central dogma of biology states that DNA codes for RNA which drives the synthesis of proteins. - The unique structure of DNA allows genetic traits to be passed down from generation to generation resulting in a pattern of inheritance that can be analyzed and from which, predictions can be made. - Changes to the sequence of DNA in any organism can potentially disrupt the production of proteins and fundamentally change an organism and future generations of that organism.	- How is the structure of DNA related to its ability to pass on genetic information? - How do the mechanisms of inheritance dictate the expression of genes?

Assessments
See attached common assessments Labs: See L1, L2, L3 Unit Maps Projects: See L1, L2, L3 Unit Maps

Assessment Anchor		Eligible Content	
Bio.B.1.2	Explain how genetic information is inherited.	**Bio.B.1.2.1**	Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.
Bio.B.2.1	Compare and contrast Mendelian and non-Mendelian patterns of inheritance.	**Bio.B.1.2.2**	Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance.
Bio.B.2.2	Explain the process of protein synthesis (i.e., transcription, translation, and protein modification).	**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.2.3	Explain how genetic information is expressed.	**Bio.B.2.1.2**	Describe the processes that can alter composition or number of chromosomes (i.e., crossing over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).
Bio.B.2.4	Apply scientific thinking, processes, tools, and technologies in the study of genetics.	**Bio.B.2.2.1**	Describe how the process 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.2.3.1	Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).
		Bio.B.2.4.1	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).
Concepts (what students need to know)		**Skills** (what students must be able to do)	

1. Structure of DNA is a double helix and involves the pairing of nitrogen bases (Adenine with Thymine and Cytosine with Guanine) 2. DNA replication is a semiconservative. 3. Protein synthesis involves transcription of mRNA in the nucleus and translation of proteins by a ribosome. 4. Proteins may be modified in the endoplasmic reticulum and golgi apparatus before being exported by the cell. 5. Genetic Mutations:include chromosomal mutations and gene mutations. frame-shift mutations, 6. Failure of chromosomes to separate properly during meiosis is called nondisjunction. 7. Meiosis results in the production of gametes. 8. Mitosis and Meiosis are two types of nuclear divisions that result in two different outcomes. 9. A chromosome is composed of DNA which contains specific units of heredity called genes. Variations in genes are called alleles. 9. Patterns of inheritance can be observed and described. - co-dominance - dominant inheritance - gene expression - genotype - incomplete dominance - multiple alleles - pedigree - phenotype - polygenic trait - punnett square - recessive inheritance - sex-linked trait	1. Describe how the process of DNA replication results in the conservation of genetic information. 2. Describe the processes of transcription and translation. 3. Describe the role of the ribosome, ER, Golgi Apparatus and Nucleus in the production of proteins. 4. Explain processes that can alter composition or number of chromosomes. 5. Describe how genetic mutations alter the DNA sequence and may or may not affect the phenotype of an organism. 6. Identify frame-shift mutations, point mutations, and translocations. 7. Describe how non-disjunction can lead to abnormal numbers of chromosomes in the cells that result. 8. Compare the processes and outcomes of mitotic and meiotic nuclear divisions. 9. Explain the functional relationships between: DNA, genes, alleles and chromosomes; and explain their roles in inheritance. 10. Describe and predict patterns of inheritance.

CVSD Biology Curriculum Map #3
Grade 9

CV Priority Standard/PA Core Standard
3.1.B.A4 - Summarize the stages of the cell cycle. - Examine how interactions among different molecules in the cell cause the distinct stages of the cell cycle which can also be influenced by other signaling molecules. - Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction. - Compare and Contrast a virus and a cell. Relate the stages of viral cycles to the cell cycle.
Taught in Unit(s)
Units: 5, 6
Explanation/Example of Standard
- All cells go through a life cycle that includes specific stages.
Common Misconceptions
- Interphase is a "resting phase" where the cell isn't doing anything. - Cell division vs. nuclear division

Big Idea(s)	Essential Question(s)
- DNA and in some cases RNA is the primary source of heritable information. In Eukaryotes, heritable information is passed to the next generation via processes that include the cell cycle and mitosis, or asexual reproduction in prokaryotes. The cell cycle is the series of events that take place in a cell leading to its division and replication of its DNA resulting in two daughter cells with conserved chromosome numbers.	- What are the events that occur in a typical cellular life cycle?

Assessments
See attached common assessments Labs: See L1, L2, L3 Unit Maps Projects: See L1, L2, L3 Unit Maps

Assessment Anchor		Eligible Content	
Bio.B.1.1	Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis.	**Bio.B.1.1.1** **Bio B.1.1.2**	Describe the events that occur during the cell cycle: interphase, nuclear division, cytokinesis. Compare and contrast the processes and outcomes of mitotic and meiotic nuclear divisions.

Concepts (what students need to know)	Skills (what students must be able to do)
1. A typical cellular life cycle involves 3 distinct phases including: *interphase, mitosis and cytokinesis.*	1. Identify and describe the processes and outcomes of mitotic nuclear divisions.

CVSD Biology Curriculum Map #2
Grade 9

CV Priority Standard/PA Core Standard
3.1.B.A2 - Identify the initial reactants, final products, and general purposes of photosynthesis and cellular respiration. - Explain the important role of ATP in cell metabolism. - Describe the relationship between photosynthesis and cellular respiration in photosynthetic organisms. - Explain why many biological macromolecules such as ATP and lipids contain high energy bonds. - Explain the importance of enzymes as catalysts in cell reactions. - Identify how factors such as pH and temperature may affect enzyme function.
Taught in Unit(s)
Units: 2, 3, 4, 8
Explanation/Example of Standard
- Cells contain complex molecules and require complex metabolic reactions to maintain homeostasis.
Common Misconceptions
- Energy can be created (Ex. Plants create energy through photosynthesis) - Plants photosynthesize and animals use cellular respiration. - Plants don't have mitochondria. - Enzymes get used up in a reaction.

Big Idea(s)	Essential Question(s)
- Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.	- How do organisms obtain and transform energy to power their life processes? - How do the interactions of molecules create macromolecules that function to be essential to life?

Assessments
See attached common assessments Labs: See L1, L2, L3 Unit Maps Projects: See L1, L2, L3 Unit Maps

Assessment Anchor		Eligible Content	
Bio.A.2.1	Describe how the unique properties of water support life on Earth.	**Bio.A.2.1.1**	Describe the unique properties of water and how these properties support life on Earth (eg. Freezing point, high specific heat, cohesion).
Bio.A.2.2	Describe and interpret the relationships between structure and function at various levels of biochemical organization (ie., atoms, molecules, and macromolecules).	**Bio.A.2.2.1** **Bio.A.2.2.2** **Bio.A.2.2.3**	Explain how Carbon is uniquely suited to form biological macromolecules. Describe how biological macromolecules from from monomers. Compare and contrast 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.	**Bio.A.2.3.1** **Bio.A.2.3.2**	Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction. 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.	**Bio.A.3.1.1**	Describe the fundamental roles of plastids (eg. chloroplasts) and mitochondria in energy transformations.
Bio.A.4.1	Identify and describe the cell structures involved in transport of materials into, out of and throughout a cell.	**Bio.A.3.2.1** **Bio.A.3.2.2**	Compare and contrast the basic transformation of energy during photosynthesis and cellular respiration. Describe the role of ATP in biochemical reactions.
Bio.A.4.2	Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments.	**Bio.A.4.2.1**	Explain how organisms maintain homeostasis (e.g., thermoregulation, water regulation, oxygen regulation).

Concepts (what students need to know)	**Skills** (what students must be able to do)
1. Water is a unique molecule with distinct characteristics. 2. Carbon atoms have a structure that allows them to form organic molecules. 3. The structure of molecules determines their functions. 4. Enzymes are specialized proteins used in biochemical reactions. 5. All cells are surrounded by a selectively permeable plasma membrane. 6. Transport of materials across the plasma membrane. 7. Organelles and their transport roles within a eukaryotic cell. 8. All organisms must be able to maintain homeostasis. 9. Plant cells use photosynthesis to convert solar energy into chemical energy and both animal and plant cells convert glucose into ATP. 10. The high energy bonds in ATP can be used to do cellular work.	1. Describe the unique properties of water and explain how these properties support life on earth. 2. Explain how a carbon atom has the ability to form macromolecules. 3. Describe how biological macromolecules form from monomers. 4. Explain how the structure of carbohydrates, lipids, proteins and nucleic acids determines their function. 5. Describe the role enzymes play in biochemical reactions and explain how pH, temperature and concentration affect these reactions. 6. Describe how the structure of the plasma membrane allows it to function as a regulatory and protective structure for a cell. 7. Compare the mechanisms that transport materials across the plasma membrane. 8. Describe how the membrane bound organelles facilitate the transport of materials within a cell. 9. Explain how organisms maintain homeostasis. 10. Describe the events that occur in a typical cellular life cycle.

	11. Describe the fundamental role of plastids (mitochondria and chloroplasts) in energy transformation within plant and animal cells. 12. Compare the basic energy transformations during photosynthesis and cellular respiration. 13. Describe how ATP stores and releases energy, fueling biochemical reactions.

CVSD Biology Curriculum Map #1
Grade 9

CV Priority Standard/PA Core Standard
3.1.B.A1 - Describe the common characteristics of life. - Compare and contrast the cellular structures and degrees of complexity of prokaryotic and eukaryotic organisms. - Explain that some structures in eukaryotic cells developed from early prokaryotic cells (eg. mitochondria, chloroplasts)
Taught in Unit(s)
Units: 1, 3
Explanation/Example of Standard
- All living things share common characteristics.
Common Misconceptions
- Plants are not living things. - Abiotic = dead. - All cells have a nucleus. - Responding to a stimulus means movement. - The scientific method are always performed in the same order.

Big Idea(s)	Essential Question(s)
- All living things share common characteristics no matter their level of organization.	- What characteristics do all living things share? - How does structure impact function?

Assessments
See attached common assessments Labs: See L1, L2, L3 Unit Maps Projects: See L1, L2, L3 Unit Maps

Assessment Anchor		Eligible Content	
Bio.A.1.1	Explain the characteristics common to all organisms.	**Bio.A.1.1.1**	Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.
Bio.A.1.2	Describe relationships between structure and function at biological levels of organization.	**Bio.A.1.2.1** **Bio.A.1.2.2**	Compare cellular structures and function at biological levels of organization. Describe and interpret relationships between structure and function at various levels of biological organization (eg. Organelles, cells, tissues, organs, organ system and multicellular organisms)

Concepts (what students need to know)	Skills (what students must be able to do)
To be considered living matter on the planet earth an organism must meet a specific set of criteria.	1. Apply a scientific thought process to determine if an object is living or non-living.

	2. Apply the same scientific thought process to interpret the relationship between structure and function within a living organism.