

CURRICULUM MAP

SUBJECT: Biology

GRADES: 9-10

Honors Biology will complete all of the topics except for Anatomy and Physiology in a one-semester course during the 9<sup>th</sup> grade. CP Biology will complete the beginning topics through Taxonomy during a one-quarter course in the 9<sup>th</sup> grade and complete the rest of the topics during a one-semester course in the 10<sup>th</sup> grade.

MONTH	ESSENTIAL QUESTION	CONTENT (CHAPTER/UNIT DESCRIPTION/ACTIVITIES)	SKILLS (STANDARDS/LEARNING OUTCOMES)	MATERIALS/RESOURCES	ASSESSMENT (Objective/Subjective)
1.5 weeks	<p><i>What characteristics do all living organisms share?</i></p> <p><i>What tools/strategies are needed to study biology?</i></p>	<p>Biology as the scientific study of life</p> <ul style="list-style-type: none"> <li>• Scientific method</li> <li>• Characteristics of life</li> <li>• Tools and equipment of the biologist</li> </ul>	<p>SIS1. Make observations, raise questions, and formulate hypotheses.</p> <p>SIS2. Design and conduct scientific investigations.</p> <p>SIS3. Analyze and interpret results of scientific investigations.</p> <p>SIS4. Communicate and apply the results of scientific investigations.</p>	Metric lab equipment, microscopes	<p>Scientific Method /Metric tools Activity</p> <p>Characteristics of life activity</p> <p>Test/Quiz on metric system and tools, scientific method, characteristics of life</p>
3.5 Weeks	<p><i>What are the structures and functions of the four major organic molecules and how are they metabolized by living</i></p>	<p>Biochemistry</p> <ul style="list-style-type: none"> <li>• Review of atomic structure and bonding</li> <li>• Identification of the 6 most abundant elements in living things</li> <li>• Structure and Function of the 4 major categories of organic molecules</li> </ul>	<p>1.1 Recognize that biological organisms are composed primarily of very few elements. The six most common are C, H, N, O, P, and S.</p> <p>1.2 Describe the basic molecular structures and primary functions of the</p>	pH paper, types of food and indicator solutions, lab equipment	<p>Labs: pH of Common liquids, Nutrition (test common foods for carbohydrates, lipids, proteins), Enzyme (levels of catalase in foods)</p> <p>Test/quiz on basic</p>

	<i>organisms?</i>	<ul style="list-style-type: none"> <li>• Role of enzymes <ul style="list-style-type: none"> <li>○ (factors that affect enzymes: pH, temperature)</li> </ul> </li> </ul>	<p>four major categories of organic molecules (carbohydrates, lipids, proteins, nucleic acids).</p> <p>1.3 Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, that have an effect on enzymes.</p>		chemistry and biochemistry
3.5 Weeks	<i>What are the structures and functions of both prokaryotic and eukaryotic cells and their organelles?</i>	<p>Cell biology</p> <ul style="list-style-type: none"> <li>• Use of the microscope</li> <li>• Relate Cell parts and organelles to their function</li> <li>• Compare prokaryotic and eukaryotic cells</li> <li>• Study the movement of molecules across the cell membrane</li> </ul>	<p>2.1 Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis,</p>	<p>Microscopes, prepared slides, slides &amp; cover slips, onion/potato and stains, petri dishes &amp; agar, eggs and vinegar, salt solutions</p>	<p>Labs: Microscope usage, plant vs. animal cells and/or bacterial growth, osmosis</p> <p>Cell structure project/activity: examples include cell models, cell organelles analogy posters, cell organelles shopping catalogues</p> <p>Test/quiz on cell structures and functions, prokaryotes vs. eukaryotes, plants vs. animals, cell</p>

			<p>facilitated diffusion, active transport).</p> <p>2.2 Compare and contrast, at the cellular level, the general structures and degrees of complexity of prokaryotes and eukaryotes.</p> <p>2.8 Compare and contrast a virus and a cell in terms of genetic material and reproduction.</p>		transport
0.5 Weeks	<i>How are living organisms classified?</i>	<p>Taxonomy</p> <ul style="list-style-type: none"> <li>Review of key cellular terms to describe the six kingdoms</li> <li>Hierarchical classification system</li> </ul>	<p>2.3 Use cellular evidence (e.g., cell structure, cell number, cell reproduction) and modes of nutrition to describe the six kingdoms (Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia).</p> <p>2.8 Compare and contrast a virus and a cell in terms of genetic material and reproduction.</p>	Preserved specimens, microscopes, prepared slides	<p>Lab: Kingdom classification</p> <p>Dichotomous key activity</p> <p>Test/quiz on the characteristics of the three domains and six kingdoms</p>

Beginning of 10<sup>th</sup> Grade Course

<p>0.5 Weeks</p>	<p>What are the structures and functions of both prokaryotic and eukaryotic cells and their organelles?</p>	<p>Introduction/Cell Review</p> <ul style="list-style-type: none"> <li>Cell Structure and function</li> </ul>	<p>2.1 Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, facilitated diffusion, active transport).</p> <p>2.2 Compare and contrast, at the cellular level, the general structures and degrees of complexity of prokaryotes and eukaryotes.</p>	<p>Microscopes, slides, cover slips</p>	<p>Microscope usage &amp; cells lab/activity</p> <p>Test/quiz on cell structure &amp; function</p>
------------------	---	---	---	---	--

1.5 Week	<i>How do the processes of cellular respiration and photosynthesis compare and contrast?</i>	Cellular Respiration and Photosynthesis <ul style="list-style-type: none"> <li>• Biochemical pathway of Photosynthesis</li> <li>• Biochemical pathways of Cellular Respiration</li> </ul>	2.4 Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration. Explain the interrelated nature of photosynthesis and cellular respiration in the cells of photosynthetic organisms. 2.5 Explain the important role that ATP serves in metabolism.	pH indicators, straws, NaOH, glassware, Microscopes, slides, aquatic plants	CO <sub>2</sub> production lab  Plant structure lab/activity  Test/quiz on the stages of photosynthesis and cellular respiration
1.5 Weeks	<i>How do the processes of mitosis and meiosis compare and contrast?</i>	Cell Division <ul style="list-style-type: none"> <li>• Compare processes of Mitosis and Meiosis</li> </ul>	2.6 Describe the cell cycle and the process of mitosis. Explain the role of mitosis in the formation of new cells, and its importance in maintaining chromosome number during asexual reproduction. 2.7 Describe how the process of meiosis results in the formation of haploid cells. Explain the importance of this process in sexual reproduction, and how gametes form diploid zygotes in the	Microscope, prepared slides, poster paper, yarn, markers, internet access	Mitosis and meiosis visual activities (worksheets, poster, flipbook, powerpoint, prepared slides and/or computer animations)  Test/quiz on comparing and contrasting the stages of mitosis and meiosis

			<p>process of fertilization.</p> <p>4.6 Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father, and that sexually produced offspring resemble, but are not identical to, either of their parents.</p>		
3 Weeks	<p><i>How does the structure of DNA translate into gene expression?</i></p> <p><i>What is the importance of complementary base pairing in the replication of DNA and protein synthesis?</i></p>	<p>Molecular biology</p> <ul style="list-style-type: none"> <li>• DNA structure and function</li> <li>• Replication of DNA</li> <li>• Protein synthesis <ul style="list-style-type: none"> <li>○ Transcription</li> <li>○ Translation</li> </ul> </li> <li>• Mutations</li> </ul>	<p>3.1 Describe the basic structure (double helix, sugar/phosphate backbone, linked by complementary nucleotide pairs) of DNA, and describe its function in genetic inheritance.</p> <p>3.2 Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic processes of transcription and translation, and how they</p>	<p>Scissors, tape, markers, colored paper</p>	<p>Protein synthesis worksheets/activity; examples include cutting out nucleotides to simulate transcription &amp; translation, using charts to determine the order of amino acids</p> <p>DNA worksheets/activity; examples include identifying parts of double helix, building models</p> <p>Test/quiz on the structure, function and replication of DNA and protein synthesis</p>

			result in the expression of genes. Distinguish among the end products of replication, transcription, and translation.		
3 Weeks	<p><i>How do the Mendelian laws relate to the principles of inheritance?</i></p> <p><i>How are inheritance patterns based upon complex gene interactions?</i></p> <p><i>How are human genetic disorders inherited?</i></p>	<p>Genetics</p> <ul style="list-style-type: none"> <li>• Mendelian genetics</li> <li>• Punnett squares for determining probabilities of genotypes and phenotypes</li> <li>• Advanced modes of inheritance</li> <li>• Human heredity and genetic disorders</li> </ul>	<p>3.3 Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in an organism. Explain how mutations in gametes may result in phenotypic changes in offspring.</p> <p>3.4 Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles).</p> <p>3.5 Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance (e.g., dihybrid crosses).</p> <p>3.6 Use a Punnett Square to determine the</p>	<p>Scissors, tape, internet access, genetics video</p>	<p>Karyotype, Punnett square and probability problem solving activities</p> <p>Genetics project (Powerpoint/brochure/virtual activity)</p> <p>Test/quiz on Mendelian genetics and principles of inheritance, genetic disorders</p>

			probabilities for genotype and phenotype combinations in monohybrid crosses.		
2 Weeks	<p><i>What evidence supports the theory of evolution?</i></p> <p><i>How does natural selection lead to biodiversity?</i></p> <p><i>How does variation in a genome lead to evolution?</i></p>	<p>Evolutionary Process</p> <ul style="list-style-type: none"> <li>• Evidence for evolution</li> <li>• Natural Selection and biodiversity</li> <li>• Genetic basis for evolution</li> </ul>	<p>5.1 Explain how evolution is demonstrated by evidence from the fossil record, comparative anatomy, genetics, molecular biology, and examples of natural selection.</p> <p>5.2 Describe species as reproductively distinct groups of organisms. Recognize that species are further classified into a hierarchical taxonomic system (kingdom, phylum, class, order, family, genus, species) based on morphological, behavioral, and molecular similarities. Describe the role that geographic isolation can play in speciation.</p> <p>5.3 Explain how evolution through natural selection can result in changes in biodiversity through the</p>	<p>Evolution videos, masking tape, internet access</p>	<p>Natural selection and evidence of evolution activities; examples include peppered moth activity, opposable thumbs activity</p> <p>Test/quiz on natural selection, biodiversity, evidence of evolution and the genetic basis for evolution</p>

			increase or decrease of genetic diversity within a population.		
2 Weeks	<p><i>What is an ecosystem?</i></p> <p><i>How does energy and matter flow through an ecosystem?</i></p> <p><i>How do nutrients cycle through the ecosystem?</i></p>	<p>Ecology</p> <ul style="list-style-type: none"> <li>• Populations</li> <li>• Biodiversity</li> <li>• Food Webs and Chains and Energy Flow</li> <li>• Nutrient Cycles (water, carbon, nitrogen, phosphorus)</li> </ul>	<p>6.1 Explain how birth, death, immigration, and emigration influence population size.</p> <p>6.2 Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.</p> <p>6.3 Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalism, mutualism) add to the</p>	<p>Ecosystem videos, posters, markers, internet access</p>	<p>Food Chain posters, ecosystem project</p> <p>Test/quiz on food chains/webs, energy flow through ecosystems, nutrient cycles and changes in an ecosystems</p>

			<p>complexity of biological communities.</p> <p>6.4 Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an ecosystem, and how oxygen cycles through photosynthesis and respiration</p>		
5 Weeks	<i>How does the structure and function of the organ systems allow for the maintenance of homeostasis?</i>	<p>Anatomy and Physiology</p> <ul style="list-style-type: none"> <li>• Nervous System</li> <li>• Skeletal and Muscular Systems</li> <li>• Digestive System</li> <li>• Blood and Circulatory System</li> <li>• Respiratory System</li> </ul>	<p>4.1 Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth.</p> <p>4.2 Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the</p>	<p>Microscopes, prepared slides, internet access, yarn, posters, markers, specimen models, body system videos</p>	<p>Body system specific activity/lab/project</p> <p>Tests/quizzes on structures and functions of the different body systems and how together they maintain homeostasis</p>

excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds from blood.

4.3 Explain how the respiratory system (nose, pharynx, larynx, trachea, lungs, alveoli) provides exchange of oxygen and carbon dioxide.

4.4 Explain how the nervous system (brain, spinal cord, sensory neurons, motor neurons) mediates communication among different parts of the body and mediates the body's interactions with the environment. Identify the basic unit of the nervous system, the neuron, and explain generally how it works.

4.5 Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscles, bones,

			<p>cartilage, ligaments, tendons) works with other systems to support the body and allow for movement. Recognize that bones produce blood cells.</p> <p>4.7 Recognize that communication among cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells.</p> <p>4.8 Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.</p>	
--	--	--	--	--