ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 1: THE PROCESS OF EVOLUTION DRIVES THE DIVERSITY AND UNITY OF LIFE

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How do the processes of evolution drive the diversity and unity of life??	Options include, but are not limited to: • Unit tests • Lab assessments

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/ Activities
Substrand: Earth Structure and Processes Standard: Understand that by observing rock sequences and using fossils to correlate the sequences at various locations, geologic events can be inferred and geologic time can be estimated.	Cite evidence from the rock record for changes in the composition of the global atmosphere as life evolved on Earth. (For example: Banded iron formations as found in Minnesota's Iron Range.). *(Standard ESS: 9.3.1.3.2)*	None		• Campbell, *Biology,* 7th Edition, Chapters 22-26
Substrand: Interdependence Within the Earth System Standard: Understand that global climate is determined by distribution of energy from the sun at the Earth's surface.	Explain how evidence from the geologic record, including ice core samples, indicates that climate changes have occurred at varying rates over geologic time and continue to occur today. *(Standard ESS: 9.3.2.2.2)*	None		
Substrand: The Universe Standard: Understand that the solar system, sun, and Earth formed over billions of years.	Compare and contrast the environmental conditions that make life possible on Earth with conditions found on the other planets and moons of our solar system. *(Standard ESS: 9.3.3.2.3)*	None		
Substrand: Evolution Living Systems Standard: Understand that evolution by natural selection is a scientific explanation for the history and diversity of life on Earth.	Describe how evidence led Darwin to develop the theory of natural selection and common descent to explain evolution. *(Standard LS: 9.4.3.3.1)*	• Items may require students to connect evidence to the development of Darwin's ideas.		

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 1: THE PROCESS OF EVOLUTION DRIVES THE DIVERSITY AND UNITY OF LIFE (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Evolution Living Systems Standard: Understand that evolution by natural selection is a scientific explanation for the history and diversity of life on Earth.	Use scientific evidence, including the fossil record, homologous structures, and genetic and/or biochemical similarities, to show evolutionary relationships among species. *(Standard LS: 9.4.3.3.2)*	• Items may illustrate the concept of analogous structures but will NOT use the term. • Items may require understanding a graphical illustration of the relationships between organisms such as a cladogram or a phylogenetic tree but will NOT use these terms. • Items will NOT use specific terms involved in geological time scales. • Additional vocabulary may include terms such common ancestor, relatedness and anatomical evidence.		• Campbell, *Biology,* 7th Edition, Chapters 22-26
Substrand: Evolution Living Systems Standard: Understand that evolution by natural selection is a scientific explanation for the history and diversity of life on Earth.	Recognize that artificial selection has led to offspring through successive generations that can be very different in appearance and behavior from their distance ancestors. *(Standard LS: 9.4.3.3.3)*	None.		
Substrand: Evolution Living Systems Standard: Understand that evolution by natural selection is a scientific explanation for the history and diversity of life on Earth.	Explain why genetic variation within a population is essential for evolution to occur. *(Standard LS: 9.4.3.3.4)*	• Items assessing this benchmark may also assess benchmark 9.4.3.2.1.		• Campbell, *Biology,* 7th Edition, Chapters 22-26 • Hardy-Weinberg Population Genetics Lab
Substrand: Evolution Living Systems Standard: Understand that evolution by natural selection is a scientific explanation for the history and diversity of life on Earth.	Explain how competition for finite resources and the changing environment promotes natural selection on offspring survival, depending on whether the offspring have characteristics that are advantageous or disadvantageous in the new environment. *(Standard LS: 9.4.3.3.5)*	• Contexts for items will use examples of Minnesota ecosystems when appropriate.		

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 1: THE PROCESS OF EVOLUTION DRIVES THE DIVERSITY AND UNITY OF LIFE (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Evolution Living Systems Standard: Understand that evolution by natural selection is a scientific explanation for the history and diversity of life on Earth.	Explain how genetic variation between two populations of a given species is due, in part, to different selective pressures acting independently on each population and how, over time, these differences can lead to the development of new species. *(Standard LS: 9.4.3.3.6)*	• Items may refer to the concept of directional, disruptive or stabilizing selection but will NOT use these terms. • Items may address the following processes and terms: divergence, convergence, adaptive radiation and co-evolution. • Items will NOT address the concept of bottlenecks, founder effects or genetic drift. • Contexts for items will use examples of Minnesota ecosystems when appropriate.		• Campbell, *Biology,* 7th Edition, Chapters 22-26
Substrand: Human Interactions with Living Systems Standard: Understand that human activity has consequences on living organisms and ecosystems.	Describe the social, economic and ecological risks and benefits of changing a natural ecosystem as a result of human activity. (For example: Changing the temperature or composition of water, air or soil; altering populations and communities; developing artificial ecosystems; or changing the use of land or water. *(Standard LS: 9.4.4.1.2)*	• Contexts for items will use examples of Minnesota ecosystems when appropriate. • Items assessing this benchmark may also assess benchmarks in standards 9.1.2.1 and 9.1.3.1.		• Campbell, *Biology,* 7th Edition, Chapters 22-26 • Peppered Moth Natural Selection Simulation
Substrand: The Practice of Science Standard: Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	Explain how scientific and technological innovations-as well as new evidence-can challenge portions of, or entire accepted theories and models including, but not limited to: cell theory, atomic theory, theory of evolution, plate tectonic theory, term theory of disease, and the big bang theory. *(Standard NSE: 9.1.1.1.7)*	• Items will address theories, models and the validity of scientific knowledge in the context of life science. • Technological innovations may include microscopy, global positioning system (GPS), genetic engineering and molecular engineering.		• Campbell, *Biology,* 7th Edition, Chapters 22-26
Substrand: The Practice of Science Standard: Understand that scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.	Evaluate the explanations proposed by others by examining and comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the scientifically acceptable evidence, and suggesting alternative scientific explanations. *(Standard NSE: 9.1.1.2.2)*	• Items may require students to evaluate a set of data to formulate possible conclusions.		

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 1: THE PROCESS OF EVOLUTION DRIVES THE DIVERSITY AND UNITY OF LIFE (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: The Practice of Science Standard: Understand that scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.	Identify the critical assumptions and logic used in a line of reasoning to judge the validity of a claim. *(Standard NSE: 9.1.1.2.3)*	• Items may include product claims, pseudoscience and unsupported conclusions.		• Campbell, *Biology,* 7th Edition, Chapters 22-26
Substrand: The Practice of Science Standard: Understand that scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.	Use primary sources or scientific writings to identify and explain how different types of questions and their associated methodologies are used by scientists for investigations in different disciplines. *(Standard NSE: 9.1.1.2.4)*	• Disciplines are limited to zoology, botany, microbiology, evolutionary biology, ecology, genetics, cell biology, anatomy and physiology. • Methodologies may include observation, gathering data, organizing information, analysis, experimentation and computer modeling.		
Substrand: The Universe Standard: Understand that the solar system, sun, and Earth formed over billions of years.	Explain how the Earth evolved into its present habitable form through interactions among the solid earth, the oceans, the atmosphere and organisms. *(Standard ESS: 9.3.3.2.2)*	None		

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 2: BIOLOGICAL SYSTEMS UTILIZE FREE ENERGY AND MOLECULAR BUILDING BLOCKS TO GROW, TO REPRODUCE, AND TO MAINTAIN DYNAMIC HOMEOSTASIS

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How do biological systems utilize free energy and molecular building blocks to grow, reproduce and maintain dynamic homeostasis?	Options include, but are not limited to: • Unit tests • Lab assessments

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/ Activities
Substrand: Structure and Function of Living Systems Standard: Understand that cells and cell structures have specific functions that allow an organism to grow, survive and reproduce.	Recognize that cells are composed primarily of a few elements (carbon, hydrogen, oxygen, nitrogen, phosphorus, and sulfur), and describe the basic molecular structures and the primary functions of carbohydrates, lipids, proteins, and nucleic acids. *(Standard LS: 9.4.1.2.1)*	• Items may require students to know the elemental symbols for carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur.		• Campbell, *Biology,* 7th Edition, Chapters 2-12
Substrand: Structure and Function of Living Systems Standard: Understand that cells and cell structures have specific functions that allow an organism to grow, survive and reproduce.	Explain the function and importance of cell organelles for prokaryotic and/or eukaryotic cells as related to the basic cell processes of respiration, photosynthesis, protein synthesis and cell reproduction. *(Standard LS: 9.4.1.2.4)*	• Cell organelles will be referred to in test items as cell parts. • The cell part related to respiration in eukaryotes is limited to the mitochondria (transforms energy to a usable form for the cell). • The cell part related to photosynthesis is limited to the chloroplast (converts light energy to chemical energy). • Cell parts related to protein synthesis in eukaryotes are limited to nucleus (site of transcription) and ribosomes (site of Translation). • Structures related to protein synthesis in prokaryotes are limited to genetic material (site of transcription) and ribosomes (site of translation). • Cell parts related to cell reproduction in eukaryotes are limited to the nucleus (site of replication), genetic material (DNA), nuclear membrane (nuclear barrier), cell membrane (cytoplasmic barrier) and cell wall (cytoplasmic division). • Cell parts related to cell reproduction in prokaryotes are limited to genetic material (DNA) and cell membrane (cytoplasmic barrier). • Items will NOT address prokaryotic respiration or photosynthesis. • Cell division in prokaryotes is limited to binary fission. • Items may use other cell parts not listed here as distractors.		• Campbell, *Biology,* 7th Edition, Chapters 2-12, 19

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UNIT 2: BIOLOGICAL SYSTEMS UTILIZE FREE ENERGY AND MOLECULAR BUILDING BLOCKS TO GROW, TO REPRODUCE, AND TO MAINTAIN DYNAMIC HOMEOSTASIS (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Structure and Function of Living Systems Standard: Understand that organisms use the interaction of cellular processes as well as tissues and organ systems to maintain homeostasis.	Explain how cell processes are influenced by internal and external factors, such as pH and temperature, and how cells and organisms respond to changes in their environment to maintain homeostasis. *(Standard LS: 9.4.1.1.1)*	• Internal and external factors or stimuli include pH, temperature, light, gravity and concentration. • A cell's response to maintain homeostasis may include single-celled organisms or individual cells of organisms. • An organism's response to maintain homeostasis may include responses such as gravitropism and phototropism in plants and shivering or sweating in animals. • Items may address both voluntary and involuntary responses. • Items will NOT address the mechanisms of specific organ systems. • Items will NOT require students to distinguish between innate and learned behaviors.		• Campbell, *Biology,* 7th Edition, Chapters 2-12
Substrand: Structure and Function of Living Systems Standard: Understand that cells and cell structures have specific functions that allow an organism to grow, survive and reproduce.	Compare and contrast passive transport (including osmosis and facilitated transport) with active transport such as endocytosis and exocytosis. *(Standard LS: 9.4.1.2.5)*	• Active transport is limited to endocytosis and exocytosis. • Passive transport is limited to diffusion, osmosis and facilitated transport. • Additional vocabulary may include terms such as concentration gradient and selective barrier.		• Campbell, *Biology,* 7th Edition, Chapters 2-12 • Diffusion and Osmosis Labs
Substrand: Interdependence Among Living Systems Standard: Understand that matter cycles and energy flows through different levels of organization of living systems and the physical environment, as chemical elements are combined in different ways.	Use words and equations to differentiate between the processes of photosynthesis and respiration in terms of energy flow, beginning reactants and end products. *(Standard LS: 9.4.2.2.1)*	• Items will refer to reactants and products of cellular respiration as oxygen, glucose, carbon dioxide, water, ATP. • Items will refer to reactants and products of photosynthesis as carbon dioxide, water, oxygen, glucose. • Molecular formulas will include labels, for example water (H_20). • Items will NOT require students to understand absorption spectra. • Items will NOT require students to recognize light reactions or the Calvin cycle. • Items will NOT include glycolysis, Krebs cycle, electron transport system or fermentation.		• Campbell, *Biology,* 7th Edition, Chapters 2-12 • Photosynthesis lab • Cell Respiration Lab

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UNIT 2: BIOLOGICAL SYSTEMS UTILIZE FREE ENERGY AND MOLECULAR BUILDING BLOCKS TO GROW, TO REPRODUCE, AND TO MAINTAIN DYNAMIC HOMEOSTASIS (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Structure and Function of Living Systems Standard: Understand that cells and cell structures have specific functions that allow an organism to grow, survive and reproduce.	Describe how viruses, prokaryotic cells, and eukaryotic cells differ in relative size, complexity and general structure. *(Standard LS: 9.4.1.2.3)*	• Viral structures are limited to genetic material and protein coat. • Examples of differences between viruses, eukaryotic cells and prokaryotic cells are limited to relative sizes, the presence of nuclei, the presence of other organelles, and that multi-cellular organisms are composed of eukaryotic cells. • Items will use the terms cell parts for general structures.		• Campbell, *Biology,* 7th Edition, Chapters 2-12
Substrand: Interdependence Within the Earth System Standard: Understand that global climate is determined by distribution of energy from the sun at the Earth's surface.	Explain how Earth's rotation, ocean currents, configuration of mountain ranges, and composition of the atmosphere influence the absorption and distribution of energy, which contributes to global climatic patterns. *(Standard ESS: 9.3.2.2.1)*	None		• Campbell, *Biology,* 7th Edition, Chapters 50-55
Substrand: Interdependence Within the Earth System Standard: Understand that global climate is determined by distribution of energy from the sun at the Earth's surface.	Explain how evidence from the geologic record, including ice core samples, indicates that climate changes have occurred at varying rates over geologic time and continue to occur today. *(Standard ESS: 9.3.2.2.2)*	None		
Substrand: Interdependence Within the Earth System Standard: Understand that the cycling of materials through different reservoirs of the earth's system is powered by the Earth's sources of energy.	Trace the cyclical movement of carbon, oxygen and nitrogen through the lithosphere, hydrosphere, atmosphere and biosphere. (For example: The burning of fossil fuels contributes to the greenhouse effect.) *(Standard ESS: 9.3.2.3.1)*	None		
Substrand: Human Interactions with the Earth System Standard: Understand that people consider potential benefits, costs and risks to make decisions on how they interact with natural systems.	Analyze the benefits, costs, risks and tradeoffs associated with natural hazards, including the selection of land use and engineering mitigation. (For example: Determining land use in floodplains and areas prone to landslides.) *(Standard ESS: 9.3.4.1.1)*	None		

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UNIT 2: BIOLOGICAL SYSTEMS UTILIZE FREE ENERGY AND MOLECULAR BUILDING BLOCKS TO GROW, TO REPRODUCE, AND TO MAINTAIN DYNAMIC HOMEOSTASIS (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Human Interactions with the Earth System Standard: Understand that people consider potential benefits, costs and risks to make decisions on how they interact with natural systems.	Explain how human activity and natural processes are altering the hydrosphere, biosphere, lithosphere and atmosphere, including pollution, topography and climate. (For example: Active volcanoes and the burning of fossil fuels contribute to the greenhouse effect.) *(Standard ESS: 9.3.4.1.2)*	None		• Campbell, *Biology,* 7th Edition, Chapters 50-55
Substrand: Interdependence Among Living Systems Standard: Understand that the interrelationship and interdependence of organisms generate dynamic biological communities in ecosystems.	Explain how ecosystems can change as a result of the introduction of one or more new species. (For example: The effect of migration, localized evolution or disease organism.) *(Standard LS: 9.4.2.1.2)*	• Contexts for items will use examples of Minnesota ecosystems when appropriate. • Items may require students to predict, analyze and reflect on global issues. • Items may include invasive species.		
Substrand: Human Interactions with Living Systems Standard: Understand that personal and community health can be affected by the environment, body functions and human behavior.	Explain how environmental factors and personal decisions, such as water quality, air quality and smoking affect personal and community health. *(Standard LS: 9.4.4.2.4)*	• Items will NOT require students to make ethical decisions. • Items may include point and nonpoint sources of pollution. • Items assessing this benchmark may also assess benchmarks in standards 9.1.2.1, 9.1.2.2 and 9.1.3.3 and benchmark 9.4.3.2.3.		
Substrand: Interdependence Among Living Systems Standard: Understand that the interrelationship and interdependence of organisms generate dynamic biological communities in ecosystems.	Describe factors that affect the carrying capacity of an ecosystem and relate these to population growth. *(Standard LS: 9.4.2.1.1)*	• Examples of factors include resources such as food or nutrient availability, shelter, water and light. • Items may address how competition for the same resources decreases carrying capacity such as predators competing for the same resources. • Contexts will use examples of Minnesota ecosystems when appropriate.		

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UNIT 2: BIOLOGICAL SYSTEMS UTILIZE FREE ENERGY AND MOLECULAR BUILDING BLOCKS TO GROW, TO REPRODUCE, AND TO MAINTAIN DYNAMIC HOMEOSTASIS (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that natural and designed systems are made up of components that act within a system and interact with other systems.	Identify properties of a system that are different from those of its parts but appear because of the interaction of those parts. *(Standard NSE: 9.1.3.1.2)*	• Items may use either natural or designed systems. • Examples of systems include ecosystems, organ systems, power plants and water treatment systems.		• Campbell, *Biology,* 7th Edition, Chapters 2-12
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that natural and designed systems are made up of components that act within a system and interact with other systems.	Describe how positive and/or negative feedback occur in systems. (For example: The greenhouse effect) *(Standard NSE: 9.1.3.1.3)*	• Items may use either natural or designed systems. • Items may require students to analyze positive and negative feedback from a set of data or information. • Items will NOT require students to know specific feedback mechanisms within an organism. • Additional examples may include ecosystem and population dynamics, greenhouses and aquaculture. • Items will NOT address organ systems. • Positive feedback is the response of the system to a change of a variable that results in an amplified change in the system; negative feedback reduces changes in a system and tends to keep a system in stable equilibriums.		• Campbell, *Biology,* 7th Edition, Chapters 40-49
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that natural and designed systems are made up of components that act within a system and interact with other systems.	Describe a system, including specifications of boundaries and subsystems, relationships to other systems, and identification of inputs and expected outputs. (For example: A power plant or ecosystem) *(Standard NSE: 9.1.3.1.1)*	• Items may use either natural or designed systems. • Items will be placed in contexts that give sufficient background information.		
Substrand: Human Interactions with Living Systems Standard: Understand that human activity has consequences on living organisms and ecosystems.	Describe contributions from diverse cultures, including Minnesota American Indian tribes and communities, to the understanding of interactions among humans and living systems. (For example: American Indian understanding of sustainable land use practices.) *(Standard LS: 9.4.4.1.3)*	• Items will be placed in contexts that give sufficient background information. • Items will NOT require standards to match an individual to a specific contribution. • Items assessing this benchmark may also assess benchmarks 9.1.3.2.1 and 9.1.1.1.6.		• Campbell, *Biology,* 7th Edition, Chapters 50-55

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UNIT 2: BIOLOGICAL SYSTEMS UTILIZE FREE ENERGY AND MOLECULAR BUILDING BLOCKS TO GROW, TO REPRODUCE, AND TO MAINTAIN DYNAMIC HOMEOSTASIS (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Interdependence Among Living Systems Standard: Understand that matter cycles and energy flows through different levels of organization of living systems and the physical environment, as chemical elements are combined in different ways.	Explain how matter and energy is transformed and transferred among organisms in an ecosystem, and how energy is dissipated as heat into the environment. *(Standard LS: 9.4.2.2.2)*	• Items may address the processes of photosynthesis, respiration and decomposition in recycling matter. • Items may include energy and matter cycling in food chains and food webs. • Items may address the conceptual cycling of matter in the carbon, nitrogen and oxygen cycles but will NOT require a detailed understanding of the mechanisms of these cycles. • Items will NOT include glycolysis, Krebs cycle, electron transport system, fermentation or entropy. • Contexts for items will use examples of Minnesota ecosystems when appropriate. • Additional vocabulary may include terms such as producer, primary consumer, secondary consumer, tertiary consumer, decomposer, autotroph, heterotroph, energy pyramid, trophic level.		• Campbell, *Biology,* 7th Edition, Chapters 40-49
Substrand: Human Interactions with Living Systems Standard: Understand that personal and community health can be affected by the environment, body functions and human behavior.	Describe how the immune system sometimes attacks some of the body's own cells and how some allergic reactions are caused by the body's immune responses to usually harmless environmental substances. *(Standard LS: 9.4.4.2.3)*	• Items will NOT reference specific human diseases or genetic disorders. • Items may require students to understand the relationship between antigens and antibodies. • Items will NOT assess the specific processes by which antibodies are formed.		
Substrand: Human Interactions with Living Systems Standard: Understand that personal and community health can be affected by the environment, body functions and human behavior.	Explain how the body produces antibodies to fight disease and how vaccines assist this process. *(Standard LS: 9.4.4.2.2)*	• Items will NOT reference specific human diseases or genetic disorders. • Items will NOT require students to identify specific vaccines. • Items may require students to understand the relationship between antigens and antibodies. • Items will NOT assess the specific processes by which antibodies are formed.		

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 2: BIOLOGICAL SYSTEMS UTILIZE FREE ENERGY AND MOLECULAR BUILDING BLOCKS TO GROW, TO REPRODUCE, AND TO MAINTAIN DYNAMIC HOMEOSTASIS (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Structure and Function of Living Systems Standard: Understand that organisms use the interaction of cellular processes as well as tissues and organ systems to maintain homeostasis.	Describe how the functions of individual organ systems are integrated to maintain homeostasis in an organism. *(Standard LS: 9.4.1.1.2)*	• Items may be placed in contexts referring to body temperature, breathing and pulse rate as homeostatic disruptions of the human body or any context that addresses symptoms or disruptions of homeostasis. • Organ systems in animals are limited to digestive, respiratory, circulatory and nervous systems. • Organ systems in plants may include the function of vascular tissue and leaves. • The functions of individual organ systems in plants include nutrient uptake, gas exchange and material transport. • Items will NOT require students to identify specific plant structures, such as xylem or stoma, but may require students to understand their function. • Items will NOT address positive feedback in homeostasis.		• Campbell, *Biology,* 7th Edition, Chapters 40-49

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 3: LIVING SYSTEMS STORE, RETRIEVE, TRANSMIT, AND RESPOND TO INFORMATION ESSENTIAL TO LIFE PROCESSES

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How do living systems store, retrieve, transmit, and respond to information essential to life processes?	Options include, but are not limited to: • Unit tests • Lab assessments

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/ Activities
Substrand: Evolution in Living Systems Standard: Understand that genetic information found in the cell provides information for assembling proteins, which dictate the expression of traits in an individual.	Explain the relationships among DNA, genes and chromosomes. *(Standard LS: 9.4.3.1.1)*	• Items will NOT include the terms histone, chromatin or chromatid.		• Campbell, *Biology,* 7th Edition, Chapters 12-21
Substrand: Evolution in Living Systems Standard: Understand that genetic information found in the cell provides information for assembling proteins, which dictate the expression of traits in an individual.	In the context of a monohybrid cross, apply the terms phenotype, genotype, allele, homozygous and heterozygous. *(Standard LS: 9.4.3.1.2)*	• Items may require students to understand a Punnett square. • Items may require students to understand dominant and recessive inheritance. • Items will NOT reference specific human genetic disorders. • Items will NOT use the terms or assess concepts of sex-linked, polygenic, incomplete dominance, codominance or multiple allele inheritance patterns.		• Campbell, *Biology,* 7th Edition, Chapters 12-21 • *Brassica rapa* Plant Genetics Lab
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that science and engineering operate in the context of society and both influence and are influenced by this context.	Describe how scientific investigations and engineering processes require multi-disciplinary contributions and efforts. (For example: Nanotechnology, climate change, agriculture, or biotechnology.) *(Standard NSE: 9.1.3.3.3)*	• Examples of disciplines are limited to zoology, botany, microbiology, evolutionary biology, ecology, genetics, cell biology, anatomy and physiology. • Items will provide context with sufficient background information.		

UNIT 3: LIVING SYSTEMS STORE, RETRIEVE, TRANSMIT, AND RESPOND TO INFORMATION ESSENTIAL TO LIFE PROCESSES (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that science, technology, engineering and mathematics rely on each other to enhance knowledge and understanding.	Describe how technological problems and advances often create a demand for new scientific knowledge, improved mathematics, and new technologies. *(Standard NSE: 9.1.3.4.1)*	• Not assessed on the MCA-III.		• Campbell, *Biology,* 7th Edition, Chapters 12-21 • *Brassica rapa* Plant Genetics Lab
Substrand: Evolution in Living Systems Standard: Understand that variation within a species is the natural result of new inheritable characteristics occurring from new combinations of existing genes or from mutations of genes in reproductive cells.	Use concepts from Mendel's laws of segregation and independent assortment to explain how sorting and recombination (crossing over) of genes during sexual reproduction (meiosis) increases the occurrence of variation in a species. *(Standard LS: 9.4.3.2.1)*	• Items will NOT reference specific human genetic disorders. • The term recombination may be used to describe any event that results in new combinations of genetic material (e.g., crossing over, mutation, random fertilization). • Items may require students to know that the products of meiosis are cells that are genetically unique with half the number of chromosomes. • Items will NOT use the terms haploid or diploid. • Additional vocabulary may include terms such as gamete, egg and sperm. • Items assessing this benchmark may also assess 9.4.3.3.4.		• Campbell, *Biology,* 7th Edition, Chapters 12-21
Substrand: Evolution in Living Systems Standard: Understand that variation within a species is the natural result of new inheritable characteristics occurring from new combinations of existing genes or from mutations of genes in reproductive cells.	Use the processes of mitosis and meiosis to explain the advantages and disadvantages of asexual and sexual reproduction. *(Standard LS: 9.4.3.2.2)*	• Examples of advantages to sexual (meiosis) reproduction include genetic diversity. • Examples of disadvantages to sexual (meiosis) reproduction include expending increased energy and time. • Examples of advantages to asexual reproduction (mitosis) include no requirement of a mate and the organism may reproduce more rapidly. • Examples of disadvantages to asexual reproduction (mitosis) include decreased genetic variation. • Items will NOT use the terms haploid or diploid. • Additional vocabulary may include terms such as gamete, egg and sperm.		

UNIT 3: LIVING SYSTEMS STORE, RETRIEVE, TRANSMIT, AND RESPOND TO INFORMATION ESSENTIAL TO LIFE PROCESSES (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Evolution in Living Systems Standard: Understand that genetic information found in the cell provides information for assembling proteins, which dictate the expression of traits in an individual.	Describe the process of DNA replication and the role of DNA and RNA in assembling protein molecules. *(Standard LS: 9.4.3.1.3)*	• Items may include the terms mRNA, tRNA, amino acids, Uracil in RNA and ribosomes. • Items may require students to know the location of replication, transcription and translation in addition to the role of DNA, mRNA and proteins (amino acids) in these processes. • Items may require students to understand DNA base pairing rules A=T and G=C. • Items may require students to understand RNA base pairing rules A=U and G=C. • Items will NOT reference specific human genetic disorders. • Items assessing this benchmark may also assess benchmark 9.4.1.2.2.		• Campbell, *Biology,* 7th Edition, Chapters 12-21
Substrand: Evolution in Living Systems Standard: Understand that variation within a species is the natural result of new inheritable characteristics occurring from new combinations of existing genes or from mutations of genes in reproductive cells.	Explain how mutations like deletions, insertions, rearrangements or substitutions of DNA segments in gametes may have no effect, may harm, or rarely may be beneficial, and can result in genetic variation within a species. *(Standard LS: 9.4.3.2.3)*	• Items will NOT require students to define or identify specific types of mutations (e.g., deletion, insertion, rearrangement, substitution). • Items may use terms that describe specific mutations. • Items will NOT reference specific human genetic disorders. • Items assessing this benchmark may also assess benchmarks 9.4.4.2.4 and 9.4.4.2.5.		
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.	Provide examples of how diverse cultures, including natives from all of the Americas, have contributed scientific mathematical ideas and technological inventions. (For example: Native American understanding of ecology; Lisa Meitner's contribution to understanding radioactivity; Tesla's ideas and inventions relating to electricity; Watson, Crick and Franklin's discovery of the structure of DNA; or how George Washington Carver's ideas changed land use.) *(Standard NSE: 9.1.3.2.1)*	• Items assessing this benchmark may also assess benchmarks 9.1.1.1.6 and 9.4.4.1.3. • Items will be placed in contexts that give sufficient background information. • Items will NOT require students to match an individual to a specific idea or invention. • Items may require students to recognize how an idea or invention has contributed to the field of science.		

UNIT 3: LIVING SYSTEMS STORE, RETRIEVE, TRANSMIT, AND RESPOND TO INFORMATION ESSENTIAL TO LIFE PROCESSES (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Human Interactions with Living Systems Standard: Understand that personal and community health can be affected by the environment, body functions and human behavior.	Recognize that a gene mutation in a cell can result in uncontrolled cell division called cancer, and how exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer. *(Standard LS: 9.4.4.2.5)*	• Items will NOT require students to make ethical decisions. • Items will NOT assess specific forms of cancer. • Items assessing this benchmark may also assess benchmarks 9.4.1.2.6 and 9.4.3.2.3. • Items may assess risk factors associated with cancer (e.g., genetic predisposition, viruses, carcinogens, mutagens).		• Campbell, *Biology,* 7th Edition, Chapters 12-21
Substrand: Human Interactions with Living Systems Standard: Understand that personal and community health can be affected by the environment, body functions and human behavior.	Describe how some diseases can sometimes be predicted by genetic testing and how this affects parental and community decisions. *(Standard LS: 9.4.4.2.1)*	• Items will NOT reference specific human diseases or genetic disorders. • Items will NOT require students to make ethical decisions.		• Campbell, *Biology,* 7th Edition, Chapters 12-21 • Video: "A Question of Genes – Inherited Risks"
Substrand: Human Interactions with Living Systems Standard: Understand that human activity has consequences on living organisms and ecosystems.	Describe the social, economic and ecological risks and benefits of biotechnology in agriculture and medicine. (For example: Selective breeding, genetic engineering, and antibiotic development and use.) *(Standard LS: 9.4.4.1.1)*	• Items will NOT assess details of specific technological processes. • Items will NOT reference specific human diseases, human genetic disorders or human cloning. • Items assessing this benchmark may also assess benchmarks in standards 9.1.2.1 and 9.1.3.1 and benchmarks 9.1.3.4.1 and 9.4.3.3.3.		• Campbell, *Biology,* 7th Edition, Chapters 12-21 • pGlo Bacterial Transformation Lab
Substrand: The Practice of Science Standard: Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	Understand that scientists conduct investigations for a variety of reasons, including: to discover new aspects of the natural world, to explain observed phenomena, to test the conclusions of prior investigations, or to test the predictions of current theories. *(Standard NSE: 9.1.1.1.2)*	None.		• pGlo Bacterial Transformation Lab • DNA Finger-printing Lab

UNIT 3: LIVING SYSTEMS STORE, RETRIEVE, TRANSMIT, AND RESPOND TO INFORMATION ESSENTIAL TO LIFE PROCESSES (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: The Practice of Science Standard: Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	Explain how the traditions and norms of science define the bounds of professional scientific practice and reveal instances of scientific error or misconduct. (For example: The use of peer review, publications and presentations.) *(Standard NSE: 9.1.1.1.3)*	• Items will NOT require students to make ethical decisions.		• pGlo Bacterial Transformation Lab • DNA Finger-printing Lab
Substrand: The Practice of Science Standard: Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	Explain how societal and scientific ethics impact research practices. (For example: Research involving human subjects may be conducted only with the informed consent of the subjects.) *(Standard NSE: 9.1.1.1.4)*	• Not assessed on the MCA-III.		
Substrand: The Practice of Science Standard: Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	Identify sources of bias and explain how bias might influence the direction of research and the interpretation of data. (For example: How funding of research can influence questions studied, procedures used, analysis of data, and communication of results.) *(Standard NSE: 9.1.1.1.5)*	• Items will NOT require students to make ethical decisions. • Sources of bias may include gender bias, misconception, cultural bias, funding bias, procedural bias, individual bias based on prior experience with the subject and political bias.		• pGlo Bacterial Transformation Lab • DNA Finger-printing Lab • Video: "Race – The Power of an Illusion"
Substrand: The Practice of Science Standard: Understand that science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	Describe how changes in scientific knowledge generally occur in incremental steps that include and build on earlier knowledge. *(Standard NSE: 9.1.1.1.6)*	• Items may require students to show how one scientific understanding leads to another (e.g., show how new evidence or analysis led to further development of the theory of evolution, germ theory or theory of inheritance). • Items assessing this benchmark may also assess benchmarks 9.1.3.2.1 and 9.4.4.1.3.		• pGlo Bacterial Transformation Lab • DNA Finger-printing Lab

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 3: LIVING SYSTEMS STORE, RETRIEVE, TRANSMIT, AND RESPOND TO INFORMATION ESSENTIAL TO LIFE PROCESSES (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Structure and Function of Living Systems Standard: Understand that cells and cell structures have specific functions that allow an organism to grow, survive and reproduce.	Explain the process of mitosis in the formation of identical new cells and maintaining chromosome number during asexual reproduction. *(Standard LS: 9.4.1.2.6)*	• Items may require students to know that mitosis is part of the process that produces cells that are genetically identical with the same number of chromosomes. • Items addressing the process of mitosis may include knowing the sequence of events. • Items will NOT assess the terms haploid, diploid, interphase, prophase, metaphase, anaphase or telophase. • Items assessing this benchmark may also assess benchmark 9.4.4.2.5.		• Campbell, *Biology,* 7th Edition, Chapters 2-12

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 4: BIOLOGICAL SYSTEMS INTERACT, AND THESE SYSTEMS AND THEIR INTERACTIONS POSSESS COMPLEX PROPERTIES

Big Questions	Formative/ Summative Assessments Formative and summative assessments created by teachers/teams
1. How do biological systems interact, and what complex properties do these systems possess?	Options include, but are not limited to: • Unit tests • Lab assessments

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency Description of what students must show to demonstrate proficiency (created by teachers/teams)	Resources/ Activities
Substrand: Structure and Function of Living Systems Standard: Understand that cells and cell structures have specific functions that allow an organism to grow, survive and reproduce.	Recognize that the work of the cell is carried out primarily by proteins, most of which are enzymes, and that protein function depends on the amino acid sequence and the shape it takes as a consequence of the interactions between those amino acids. *(Standard LS: 9.4.1.2.2)*	• Items may require students to analyze the effect of a change in the amino acid sequence on protein shape and resulting function. • Items addressing enzymes are limited to understanding that enzymes are catalysts in reactions, are specific to particular molecules and are affected by pH and temperature. • Items will NOT assess the roles of specific enzymes. • Items will NOT use the term activation energy. • Items assessing this benchmark may also assess 9.4.3.1.3.		• Campbell, *Biology,* 7th Edition, Chapters 2-12
Substrand: The Practice of Science Standard: Understand that scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.	Formulate a testable hypothesis, design and conduct an experiment to test the hypothesis, analyze the data, consider alternative explanations, and draw conclusions supported by evidence from the investigation. *(Standard NSE: 9.1.1.2.1)*	• Context of items should demonstrate all appropriate safety considerations. • Items may address part or all of the benchmark. • Hypothesis is defined as "a testable statement about the natural world that can be used to build more complex inferences and explanations" (National Academy of Sciences, Teaching About Evolution and the Nature of Science, [National Academy Press, 1988], 5). • Items will NOT require students to define the term hypothesis. • Items may require students to evaluate or draw an accurate conclusion based on presented evidence. • Items may require students to identify which variables were changed, kept the same and measured in a given experiment. • Items will NOT use the terms independent variable, dependent variable, manipulated variable or responding variables.		• Campbell, *Biology,* 7th Edition, Chapters 35-39 • Transpiration Lab

UNIT 4: BIOLOGICAL SYSTEMS INTERACT, AND THESE SYSTEMS AND THEIR INTERACTIONS POSSESS COMPLEX PROPERTIES (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: The Practice of Engineering Standard: Understand that engineering is a way of addressing human needs by applying science concepts and mathematical techniques to develop new products, tools, processes, and systems.	Understand that engineering designs and products are often continually checked and critiqued for alternatives, risks, costs and benefits, so that subsequent designs are refined and improved. (For example: If the price of an essential raw material changes, the product design may need to be changed.) *(Standard NSE: 9.1.2.1.1)*	• Items will NOT require students to know details of specific technologies. • Items will be placed in contexts that give sufficient background information. • Items are limited to environmental effects on ecosystems and their physical and biological components.		• Campbell, *Biology,* 7th Edition, Chapters 35-39 • Transpiration Lab
Substrand: The Practice of Engineering Standard: Understand that engineering is a way of addressing human needs by applying science concepts and mathematical techniques to develop new products, tools, processes, and systems.	Recognize that risk analysis is used to determine the potential positive and negative consequences of using a new technology or design, including the evaluation of causes and effects of failures. (For example: Risks and benefits associated with using lithium batteries.) *(Standard NSE: 9.1.2.1.2)*	• Items will NOT require students to know details of specific technologies. • Items will be placed in contexts that give sufficient background information. • Items are limited to environmental effects on ecosystems and their physical and biological components. • Items may require students to identify risks and benefits of a new technology or design.		
Substrand: The Practice of Engineering Standard: Understand that engineering is a way of addressing human needs by applying science concepts and mathematical techniques to develop new products, tools, processes, and systems.	Explain and give examples of how, in the design of a device, engineers consider how it is to be manufactured, operated, maintained, replaced and disposed of. *(Standard NSE: 9.1.2.1.3)*	• Items will NOT require students to know details of specific technologies. • Items will be placed in contexts that provide sufficient background information. • Items are limited to environmental effects on ecosystems and their physical and biological components.		
Substrand: The Practice of Engineering Standard: Understand that engineering design is an analytical and creative process of devising a solution to meet a need or solve a specific problem.	Identify a problem and the associated constraints on possible design solutions. (For example: Constraints can include time, money, scientific knowledge and available technology.) *(Standard NSE: 9.1.2.2.1)*	None		

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

UNIT 4: BIOLOGICAL SYSTEMS INTERACT, AND THESE SYSTEMS AND THEIR INTERACTIONS POSSESS COMPLEX PROPERTIES (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.	Analyze possible careers in science and engineering in terms of educational requirements, working practices and rewards. *(Standard NSE: 9.1.3.2.2)*	• Not assessed on the MCA-III.		• Campbell, *Biology,* 7th Edition, Chapters 35-39 • Transpiration Lab
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that science and engineering operate in the context of society and both influence and are influenced by this context.	Describe how values and constraints affect science and engineering. (For example: Economic, environmental, social, political, ethnical, health, safety, and sustainability issues.). *(Standard NSE: 9.1.3.3.1)*	• Not assessed on the MCA-III.		
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that science and engineering operate in the context of society and both influence and are influenced by this context.	Communicate, justify, and defend the procedures and results of a scientific inquiry or engineering design project using verbal, graphic, quantitative, virtual, or written means. *(Standard NSE: 9.1.3.3.2)*	• Items may require students to justify or defend procedures and results based on data, observations, or other evidence. • Items may require students to interpret or create a graphic in order to communicate procedures and results. • Items may require students to analyze or produce quantitative information in order to communicate procedures and results.		

UNIT 4: BIOLOGICAL SYSTEMS INTERACT, AND THESE SYSTEMS AND THEIR INTERACTIONS POSSESS COMPLEX PROPERTIES (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that science, technology, engineering and mathematics rely on each other to enhance knowledge and understanding.	Determine and use appropriate safety procedures, tools, computers and measurement instruments in science and engineering contexts. (For example: Consideration of chemical and biological hazards in the lab.) *(Standard NSE: 9.1.3.4.2)*	• All measurements will use the International System of Units (SI).		• Campbell, *Biology,* 7th Edition, Chapters 35-39 • Transpiration Lab
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that science, technology, engineering and mathematics rely on each other to enhance knowledge and understanding.	Select and use appropriate numeric, symbolic, pictorial, or graphical representation to communicate scientific ideas, procedures and experimental results. *(Standard NSE: 9.1.3.4.3)*	• All measurements will use the SI system of measurement. • Items may require students to place appropriate variables on graph axes. • Items may require students to determine appropriate increments on graphs.		
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that science, technology, engineering and mathematics rely on each other to enhance knowledge and understanding.	Relate the reliability of data to consistency of results, identify sources of error, and suggest ways to improve the data collection and analysis. (For example: Use statistical analysis or error analysis to make judgments about the validity of results.) *(Standard NSE: 9.1.3.4.4)*	• Examples of error include uncontrolled variables, operator error and measurement error. • Mathematics will be limited to grade 8 mathematics or below, per the Minnesota Academic Standards in Mathematics, and can include the concepts of percent, mean, median, mode and line of best fit. • Items will NOT require students to do mathematics without using the results to evaluate data. • All measurements will use the SI system of measurement. • Items that require students to do calculations will provide a calculator tool.		

UNIT 4: BIOLOGICAL SYSTEMS INTERACT, AND THESE SYSTEMS AND THEIR INTERACTIONS POSSESS COMPLEX PROPERTIES (continued)				
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** Description of what students must show to demonstrate proficiency (created by teachers/teams)	**Resources/ Activities**
Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society Standard: Understand that science, technology, engineering and mathematics rely on each other to enhance knowledge and understanding.	Analyze the strengths and limitations of physical, conceptual, mathematical and computer models used by scientists and engineers. *(Standard NSE: 9.1.3.4.6)*	• Examples of models include population growth, bacterial growth and probability in genetics.		• Campbell, *Biology,* 7th Edition, Chapters 35-39 • Transpiration Lab

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

READING IN THE CONTENT AREA FOR GRADES 9-10: (Taken from "Standard for Literacy in History/Social Studies/Science/Technical Subjects")		
Minnesota Benchmark	**Activities**	**How Assessed**
Cite specific textual evidence to support analysis of technical texts, attending to the precise details of explanations or descriptions (9.13.1.1). (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
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 (9.13.2.2). (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Follow precisely a complex multi-step procedure when carrying out experiments, designing solutions, taking measurements, or performing technical tasks< attending to special cases (constraints) or exceptions defined in the text (9.13.3.3). (All units/All quarters)	Experimental design/labs	Homework, unit tests, labs
Determine the meaning of symbols, equations, graphical representations, tabular representations, key terms, and other domain-specific words and phrases as they are used in a specific technical context relevant to grades 9-10 texts and topics (9.13.4.4) (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy)(9.13.5.5). (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Analyze the author's purpose in describing phenomena, providing an explanation, describing a procedure, or discussing/reporting an experiment in a text, defining the question the author seeks to address (9.13.6.6) (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework
Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words (9.13.7.7). (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a technical problem (9.13.8.8). (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, labs
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(9.13.9.9) (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, labs
By the end of grade 10, read and comprehend technical texts in the grades 9-10 text complexity band independently and proficiently (9.13.10.10).		

ADVANCED PLACEMENT BIOLOGY CURRICULUM FRAMEWORKS

READING IN THE CONTENT AREA FOR GRADES 11-12: (Taken from "Standard for Literacy in History/Social Studies/Science/Technical Subjects")		
Minnesota Benchmark	**Activities**	**How Assessed**
Cite specific textual evidence to support analysis of technical texts, attending to important distinctions the author make and to any gaps or inconsistencies in the account (11.13.1.1). (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms (11.13.2.2). (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Follow precisely a complex multistep procedure when carrying out experiments, designing solutions, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text (11.13.3.3.). (All units/All quarters)	Experimental design/labs	Homework, unit tests, labs
Determine the meaning of symbols, equations, graphical representations, tabular representations, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics (11.13.4.4) (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas (11.13.5.5).		
Analyze the author's purpose in describing phenomena, providing an explanation, describing a procedure, or discussing/reporting an experiment in a text, identifying important issues and questions that remain unresolved (11.13.6.6). (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Integrate and evaluate multiple sources of information presented in diverse formats and media (e.gh., quantitative data, video, multimedia) in order to address a question or solve a problem (11.13.7.7)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Evaluate the hypotheses, data, analysis, and conclusions in a technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information (11.13.8.8) (All units/All quarters)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible (11.13.9.9)	Worksheets, experimental design/labs, essays	Homework, unit tests, labs
By the end of grade 12, read and comprehend technical texts in the grades 11-12 text complexity band independently and proficiently (11.13.10.10)		