BIOLOGY
1st Quarter
Benchmark Blueprint

Strand 1: Inquiry Process

Inquiry Process establishes the basis for students' learning in science. Students use scientific processes: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, and communicating results.

CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 1: Observations, Questions, and Hypotheses Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.	PO 1. Evaluate scientific information for relevance to a given problem.	
	PO 2. Develop questions from observations that transition into testable hypotheses.	
	PO 3. Formulate a testable hypothesis.	
	PO 4. Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring).	
Concept 2: Scientific Testing (Investigating and Modeling) Design and conduct controlled investigations.	PO 1. Demonstrate safe and ethical procedures (e.g., use and care of technology, materials, organisms) and behavior in all science inquiry.	
	PO 2. Identify the resources needed to conduct an investigation.	
	PO 3. Design an appropriate protocol (written plan of action) for testing a hypothesis: • Identify dependent and independent variables in a controlled investigation. • Determine an appropriate method for data collection (e.g., using balances, thermometers, microscopes, spectrophotometer, using qualitative changes). • Determine an appropriate method for recording data (e.g., notes, sketches, photographs, videos, journals (logs), charts, computers/calculators).	

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 2: Scientific Testing (Investigating and Modeling) Design and conduct controlled investigations.	PO 4. Conduct a scientific investigation that is based on a research design.	
	PO 5. Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.	
Concept 3: Analysis, Conclusions, and Refinements Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.	*PO 1. Interpret data that show a variety of possible relationships between variables, including:* • *positive relationship* • *negative relationship* • *no relationship*	
	PO 2. Evaluate whether investigational data support or do not support the proposed hypothesis.	
	PO 3. Critique reports of scientific studies (e.g., published papers, student reports).	
	PO 4. Evaluate the design of an investigation to identify possible sources of procedural error, including: • sample size • trials • controls • analyses	

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 3: Analysis, Conclusions, and Refinements Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.	PO 5. Design models (conceptual or physical) of the following to represent "real world" scenarios: • carbon cycle • water cycle • phase change • collisions	
	PO 6. Use descriptive statistics to analyze data, including: • mean • frequency • range (See MHS-S2C1-10)	
	PO 7. Propose further investigations based on the findings of a conducted investigation.	
Concept 4: Communication Communicate results of investigations.	PO 1. For a specific investigation, choose an appropriate method for communicating the results.	
	PO 2. Produce graphs that communicate data. (See MHS-S2C1-02)	
	PO 3. Communicate results clearly and logically.	
	PO 4. Support conclusions with logical scientific arguments.	

Strand 2: History and Nature of Science

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 1: History of Science as a Human Endeavor Identify individual, cultural, and technological contributions to scientific knowledge.		
Concept 2: Nature of Scientific Knowledge Understand how science is a process for generating knowledge.		

Strand 3: Science in Personal and Social Perspectives

Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world **–** as living creatures, consumers, decision makers, problem solvers, managers, and planners.

CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 1: Changes in Environments Describe the interactions between human populations, natural hazards, and the environment.		
Concept 2: Science and Technology in Society Develop viable solutions to a need or problem.	PO 1. Analyze the costs, benefits, and risks of various ways of dealing with the following needs or problems: • various forms of alternative energy • storage of nuclear waste • abandoned mines • greenhouse gases • hazardous wastes	
	PO 2. Recognize the importance of basing arguments on a thorough understanding of the core concepts and principles of science and technology.	
	PO 3. Support a position on a science or technology issue.	

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 2: Science and Technology in Society Develop viable solutions to a need or problem.	PO 4. Analyze the use of renewable and nonrenewable resources in Arizona: • water • land • soil • minerals • air	
	PO 5. Evaluate methods used to manage natural resources (e.g., reintroduction of wildlife, fire ecology).	
Concept 3: Human Population Characteristics Analyze factors that affect human populations.		

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Strand 4: Life Science

Life Science expands students' biological understanding of life by focusing on the characteristics of living things, the diversity of life, and how organisms and populations change over time in terms of biological adaptation and genetics. This understanding includes the relationship of structures to their functions and life cycles, interrelationships of matter and energy in living organisms, and the interactions of living organisms with their environment.

CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 1: The Cell Understand the role of the cell and cellular processes.	PO 1. Describe the role of energy in cellular growth, development, and repair.	
	PO 2. Compare the form and function of prokaryotic and eukaryotic cells and their cellular components.	
	PO 3. Explain the importance of water to cells.	
	PO 4. Analyze mechanisms of transport of materials (e.g., water, ions, macromolecules) into and out of cells: • passive transport • active transport	
	PO 5. Describe the purposes and processes of cellular reproduction.	

BIOLOGY
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Benchmark Blueprint

Strand 1: Inquiry Process

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 1: Observations, Questions, and Hypotheses Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.		
Concept 2: Scientific Testing (Investigating and Modeling) Design and conduct controlled investigations.		
Concept 3: Analysis, Conclusions, and Refinements Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.		
Concept 4: Communication Communicate results of investigations.		

Strand 2: History and Nature of Science

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 1: History of Science as a Human Endeavor Identify individual, cultural, and technological contributions to scientific knowledge.		
Concept 2: Nature of Scientific Knowledge Understand how science is a process for generating knowledge.		

Strand 3: Science in Personal and Social Perspectives

Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world **–** as living creatures, consumers, decision makers, problem solvers, managers, and planners.

CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 1: Changes in Environments Describe the interactions between human populations, natural hazards, and the environment.	PO 1. Evaluate how the processes of natural ecosystems affect, and are affected by, humans.	
	PO 2. Describe the environmental effects of the following natural and/or human-caused hazards: • flooding • drought • earthquakes • fires • pollution • extreme weather	
	PO 3. Assess how human activities (e.g., clear cutting, water management, tree thinning) can affect the potential for hazards.	
	PO 4. Evaluate the following factors that affect the quality of the environment: • urban development • smoke • volcanic dust	
	PO 5. Evaluate the effectiveness of conservation practices and preservation techniques on environmental quality and biodiversity.	

Strand 3: Science in Personal and Social Perspectives

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 2: Science and Technology in Society Develop viable solutions to a need or problem.		
Concept 3: Human Population Characteristics Analyze factors that affect human populations.	PO 1. Analyze social factors that limit the growth of a human population, including: • affluence • education • access to health care • cultural influences	
	PO 2. Describe biotic (living) and abiotic (nonliving) factors that affect human populations.	
	PO 3. Predict the effect of a change in a specific factor on a human population.	

BIOLOGY
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Strand 4: Life Science

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 2: Molecular Basis of Heredity Understand the molecular basis of heredity and resulting genetic diversity.	PO 1. Analyze the relationships among nucleic acids (DNA, RNA), genes, and chromosomes.	
	PO 2. Describe the molecular basis of heredity, in viruses and living things, including DNA replication and protein synthesis.	
	PO 3. Explain how genotypic variation occurs and results in phenotypic diversity.	
	PO 4. Describe how meiosis and fertilization maintain genetic variation.	
Concept 5: Matter, Energy, and Organization in Living Systems (Including Human Systems) Understand the organization of living systems, and the role of energy within those systems.	PO 1. Compare the processes of photosynthesis and cellular respiration in terms of energy flow, reactants, and products.	
	PO 2. Describe the role of organic and inorganic chemicals (e.g., carbohydrates, proteins, lipids, nucleic acids, water, ATP) important to living things.	
	PO 3. Diagram the following biogeochemical cycles in an ecosystem: • water • carbon • nitrogen	
	PO 4. Diagram the energy flow in an ecosystem through a food chain.	
	PO 5. Describe the levels of organization of living things from cells, through tissues, organs, organ systems, organisms, populations, and communities to ecosystems.	

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BIOLOGY
3rd Quarter
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Strand 1: Inquiry Process

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 1: Observations, Questions, and Hypotheses Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.		
Concept 2: Scientific Testing (Investigating and Modeling) Design and conduct controlled investigations.		
Concept 3: Analysis, Conclusions, and Refinements Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.		
Concept 4: Communication Communicate results of investigations.		

Strand 2: History and Nature of Science

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 1: History of Science as a Human Endeavor Identify individual, cultural, and technological contributions to scientific knowledge.	PO 1. Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide.	
	PO 2. Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.	
	PO 3. Analyze how specific changes in science have affected society.	
	PO 4. Analyze how specific cultural and/or societal issues promote or hinder scientific advancements.	
Concept 2: Nature of Scientific Knowledge Understand how science is a process for generating knowledge.	PO 1. Specify the requirements of a valid, scientific explanation (theory), including that it be: • logical • subject to peer review • public • respectful of rules of evidence	
	PO 2. Explain the process by which accepted ideas are challenged or extended by scientific innovation.	
	PO 3. Distinguish between pure and applied science.	
	PO 4. Describe how scientists continue to investigate and critically analyze aspects of theories.	

Strand 3: Science in Personal and Social Perspectives Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world **–** as living creatures, consumers, decision makers, problem solvers, managers, and planners.		
CONCEPT	**PERFORMANCE OBJECTIVE**	**ASSESSMENT**
Concept 1: Changes in Environments Describe the interactions between human populations, natural hazards, and the environment.		
Concept 2: Science and Technology in Society Develop viable solutions to a need or problem.		
Concept 3: Human Population Characteristics Analyze factors that affect human populations.		

BIOLOGY
3rd Quarter
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Strand 4: Life Science

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 3: Interdependence of Organisms Analyze the relationships among various organisms and their environment.	PO 1. Identify the relationships among organisms within populations, communities, ecosystems, and biomes.	
	PO 2. Describe how organisms are influenced by a particular combination of biotic (living) and abiotic (nonliving) factors in an environment.	
	PO 3. Assess how the size and the rate of growth of a population are determined by birth rate, death rate, immigration, emigration, and carrying capacity of the environment.	
Concept 4: Biological Evolution Understand the scientific principles and processes involved in biological evolution.	PO 1. Identify the following components of natural selection, which can lead to speciation: • potential for a species to increase its numbers • genetic variability and inheritance of offspring due to mutation and recombination of genes • finite supply of resources required for life • selection by the environment of those offspring better able to survive and produce offspring	
	PO 2. Explain how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment.	
	PO 3. Describe how the continuing operation of natural selection underlies a population's ability to adapt to changes in the environment and leads to biodiversity and the origin of new species.	

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CONCEPT	PERFORMANCE OBJECTIVE	ASSESSMENT
Concept 4: Biological Evolution Understand the scientific principles and processes involved in biological evolution.	PO 4. Predict how a change in an environmental factor (e.g., rainfall, habitat loss, non-native species) can affect the number and diversity of species in an ecosystem.	
	PO 5. Analyze how patterns in the fossil record, nuclear chemistry, geology, molecular biology, and geographical distribution give support to the theory of organic evolution through natural selection over billions of years and the resulting present day biodiversity.	
	PO 6. Analyze, using a biological classification system (i.e., cladistics, phylogeny, morphology, DNA analysis), the degree of relatedness among various species.	

BIOLOGY
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CONCEPT	PERFORMANCE OBJECTIVE
Concept 6: Classification of Living Organisms (Analyze relationships among living organisms and define characteristics of each kingdom)	PO1 List the seven levels of biological classification. (Kingdom, Phylum, Class, Order, Family, Genus, Species) PO2 Describe the modern system of naming organisms (i.e. Linnaean's binomial nomenclature system) PO3 Differentiate organisms classified in K. Archaebacteria and K. Eubacteria (structure, means of obtaining energy, location in environment) PO4 Compare/contrast bacteria and viruses. Distinguish characteristics of living organisms and viruses PO5 Analyze the impact of bacteria and viruses on society (e.g. bioremediation, antibiotic resistance, food and chemical production, biowarfare, vaccinations) PO6 Distinguish animal-like, fungal-like, and plant-like members of K. Protista in structure, function, and mode of nutrition. PO7 Analyze the impact of protists on human health and food chains (e.g. malaria, red tides) PO8 Describe the structures, modes of nutrition, and modes of reproduction of organisms classified in K. Fungi. PO9 Identify the major ecological roles of fungi (e.g. mycorrhizae, lichens, antibiotic production)

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CONCEPT	PERFORMANCE OBJECTIVE
	PO10 Identify the distinguishing characteristics of plants. Analyze the structure and function of plant parts (i.e. fruits and flowers, monocots v. dicots) PO11 Analyze the impact of plants on the biosphere PO12 Identify structural characteristics that organisms in K. Animalia share. Describe essential functions that animals carry out. PO13 Compare/contrast invertebrate/vertebrate organisms. PO14 Analyze the impact of animals on humans and arthropods on the biosphere.