



Biology

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STANDARDS	PAGE REFERENCES
Strand 1: Inquiry Process	
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. (See R09-S3C1, R10-S3C1, R11-S3C1, and R12-S3C1)	Student Edition: <i>BioLab</i> 23, 173, 567, 593, 653, 899, 925, 1011, 1035 <i>Problem-Solving Skills</i> 1106, 1111 Teacher Wraparound Edition: 25T
PO 2. Develop questions from observations that transition into testable hypotheses.	Student Edition: 16, 18 <i>Assessment 21</i> (#6) <i>BioLab</i> 23, 173, 567, 593, 653, 925, 1035 Teacher Wraparound Edition: DE 16
PO 3. Formulate a testable hypothesis.	Student Edition: 18 <i>Assessment 21</i> (#6) <i>BioLab</i> 23, 173, 567, 593, 653, 925, 1035 <i>Data Analysis Lab</i> 611, 646 <i>MiniLab</i> 19 Teacher Wraparound Edition: CT 18

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PO 4. Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring).	Student Edition: <i>BioLab</i> 287, 443, 653 <i>MiniLab</i> 203, 281
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.	Student Edition: xxviii–xxxii, 21 <i>BioLab</i> 173, 351, 533, 593, 925, 1035 <i>MiniLab</i> 223, 500, 693 Teacher Wraparound Edition: DC 21
PO 2. Identify the resources needed to conduct an investigation.	Student Edition: <i>Assessment 21</i> (#5), 49 (#5) <i>BioLab</i> 23, 173, 235, 287, 533, 567, 593, 925, 1035 Teacher Wraparound Edition: CT 18
PO 3. Design an appropriate protocol (written plan of action) for testing a hypothesis: <ul style="list-style-type: none"> • 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). 	Student Edition: 18-21 <i>Assessment 21</i> (#5), 49 (#5) <i>BioLab</i> 23, 173, 235, 533, 567, 593, 925, 1035 Teacher Wraparound Edition: CT 18
PO 4. Conduct a scientific investigation that is based on a research design.	Student Edition: <i>BioLab</i> 23, 173, 235, 533, 567, 593, 925, 1035
PO 5. Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.	Student Edition: <i>BioLab</i> 23, 51, 173, 287, 505, 593, 653, 1035, 1067 <i>Skillbuilder Handbook</i> 1108, 1115-1118

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<p>Concept 3: Analysis, Conclusions, and Refinements Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.</p>	
<p>PO 1. Interpret data that show a variety of possible relationships between variables, including:</p> <ul style="list-style-type: none"> • positive relationship • negative relationship • no relationship 	<p>Student Edition: 20 <i>BioLab</i> 51, 173 <i>Data Analysis Lab</i> 14, 98, 164, 435, 837 <i>Skillbuilder Handbook</i> 1115-1116</p>
<p>PO 2. Evaluate whether investigational data support or do not support the proposed hypothesis.</p>	<p>Student Edition: 20 <i>BioLab</i> 23, 51, 173, 235, 533, 567, 593, 653, 925</p>
<p>PO 3. Critique reports of scientific studies (e.g., published papers, student reports).</p>	<p>Student Edition: <i>BioDiscoveries</i> 842, 924 <i>BioLab</i> 653, 783 <i>MiniLab</i> 19 <i>National Geographic: In the Field</i> 408 Teacher Wraparound Edition: CT 18</p>
<p>PO 4. Evaluate the design of an investigation to identify possible sources of procedural error, including:</p> <ul style="list-style-type: none"> • sample size • trials • controls • analyses 	<p>Student Edition: xxxiii <i>BioLab</i> 23, 51, 173, 235, 259, 533, 593, 1035 <i>MiniLab</i> 19 Teacher Wraparound Edition: CT 18</p>
<p>PO 5. Design models (conceptual or physical) of the following to represent "real world" scenarios:</p> <ul style="list-style-type: none"> • carbon cycle • water cycle • phase change • collisions 	<p>Student Edition: 46-47 Teacher Wraparound Edition: CT 47; FA 49</p>
<p>PO 6. Use descriptive statistics to analyze data, including:</p> <ul style="list-style-type: none"> • mean • frequency • range <p>(See MHS-S2C1-10)</p>	<p>Student Edition: <i>BioLab</i> 107, 983</p>

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PO 7. Propose further investigations based on the findings of a conducted investigation.	Use the following page references to help meet this standard. Student Edition: <i>BioLab</i> 23, 51, 107, 173, 235, 259, 533, 567, 593, 1035
Concept 4: Communication Communicate results of investigations.	
PO 1. For a specific investigation, choose an appropriate method for communicating the results. (See W09-S3C2-01 and W10-S3C3-01)	Student Edition: <i>BioLab</i> 23, 173, 235, 533, 567, 593, 843, 925
PO 2. Produce graphs that communicate data. (See MHS-S2C1-02)	Student Edition: 20 <i>BioLab</i> 51, 107, 173, 925 <i>MiniLab</i> 1002 <i>Skillbuilder Handbook</i> 1115-1118
PO 3. Communicate results clearly and logically.	Student Edition: <i>BioLab</i> 51, 107, 173, 287, 533, 593, 653, 809, 1035
PO 4. Support conclusions with logical scientific arguments.	Student Edition: <i>BioLab</i> 51, 107, 173, 287, 533, 593, 653, 809, 1035
Strand 2: History and Nature of Science	
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.	Student Edition: 5-6, 360-362, 363-371, 378-379 <i>Assessment</i> 379 (#3, #4) <i>BioDiscoveries</i> 22, 752 <i>Biology & Society</i> 258 <i>Cutting-Edge Biology</i> 208, 532, 952, 982 Teacher Wraparound Edition: CB 363
PO 2. Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.	Student Edition: 182-183, 277, 326-329, 402, 406, 418-420, 484-485 <i>BioDiscoveries</i> 22, 350, 474 Teacher Wraparound Edition: CB 149, 277

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PO 3. Analyze how specific changes in science have affected society.	Student Edition: 13, 15, 314-315, 363, 370-371, 378, 1076-1077 Teacher Wraparound Edition: CB 363; DC 363
PO 4. Analyze how specific cultural and/or societal issues promote or hinder scientific advancements.	Student Edition: 15, 256-257 <i>Assessment 15 (#5)</i> <i>Biology & Society</i> 258, 1096 Teacher Wraparound Edition: CB 363; DC 257, 363
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: <ul style="list-style-type: none"> • logical • subject to peer review • public • respectful of rules of evidence 	Student Edition: 11-12, 13-14, 20 Teacher Wraparound Edition: DC 11, 183; FA 15; WS 12
PO 2. Explain the process by which accepted ideas are challenged or extended by scientific innovation.	Student Edition: 11-14, 16, 20 <i>Cutting-Edge Biology</i> 234, 442 <i>National Geographic</i> 17 Teacher Wraparound Edition: CT 18; WS 12
PO 3. Distinguish between pure and applied science.	Use the following page references to help meet this standard. Student Edition: 5-6, 363-371 <i>BioDiscoveries</i> 22, 350 <i>Biology & Society</i> 258, 680 <i>Cutting-Edge Biology</i> 106, 208, 808, 952 <i>National Geographic: In the Field</i> 408
PO 4. Describe how scientists continue to investigate and critically analyze aspects of theories.	Student Edition: 11-14, 16, 18-20, 440-441 <i>Cutting-Edge Biology</i> 234, 442 <i>National Geographic</i> 17 <i>National Geographic: In the Field</i> 408 Teacher Wraparound Edition: CB 12; DC 16; WS 12

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Strand 3: Science in Personal and Social Perspectives	
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.	Student Edition: 123-128 <i>Assessment</i> 128 (#1, #4) <i>Biology & Society</i> 50, 870, 1010 <i>MiniLab</i> 77, 120 <i>National Geographic: In the Field</i> 172 Teacher Wraparound Edition: CB 124, 225; RS 123
PO 2. Describe the environmental effects of the following natural and/or human-caused hazards: <ul style="list-style-type: none"> • flooding • drought • earthquakes • fires • pollution • extreme weather 	Student Edition: 62-64, 123-128 <i>Assessment</i> 64 (#2) <i>Biology & Society</i> 1010 <i>National Geographic: In the Field</i> 172 Teacher Wraparound Edition: CB 124; DE 126; RS 64
PO 3. Assess how human activities (e.g., clear cutting, water management, tree thinning) can affect the potential for hazards.	Student Edition: <i>Biology & Society</i> 50 Teacher Wraparound Edition: AG 50; CB 124; DC 62; DIB 50
PO 4. Evaluate the following factors that affect the quality of the environment: <ul style="list-style-type: none"> • urban development • smoke • volcanic dust 	Student Edition: 125-126, 133 <i>MiniLab</i> 77 Teacher Wraparound Edition: CB 124; DC 133
PO 5. Evaluate the effectiveness of conservation practices and preservation techniques on environmental quality and biodiversity.	Student Edition: 129-131, 133-135 <i>Assessment</i> 135 (#1, #4) <i>National Geographic: In the Field</i> 136 Teacher Wraparound Edition: DE 129, 134; MI 129

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<p>Concept 2: Science and Technology in Society Develop viable solutions to a need or problem.</p>	
<p>PO 1. Analyze the costs, benefits, and risks of various ways of dealing with the following needs or problems:</p> <ul style="list-style-type: none"> • various forms of alternative energy • storage of nuclear waste • abandoned mines • greenhouse gases • hazardous wastes 	<p>Use the following page references to help meet this standard.</p> <p>Student Edition: 66, 126 <i>National Geographic</i> 67</p>
<p>PO 2. Recognize the importance of basing arguments on a thorough understanding of the core concepts and principles of science and technology.</p>	<p>Student Edition: 11-15 <i>Assessment</i> 15 (#1, #3, #5) <i>Biology & Society</i> 680, 1066, 1096</p> <p>Teacher Wraparound Edition: DIB 681, 1066, 1096; FA 15</p>
<p>PO 3. Support a position on a science or technology issue.</p>	<p>Student Edition: <i>Assessment</i> 15 (#3) <i>Biology & Society</i> 680, 1066, 1096</p> <p>Teacher Wraparound Edition: DIB 681, 1066, 1096; RS 370</p>
<p>PO 4. Analyze the use of renewable and nonrenewable resources in Arizona:</p> <ul style="list-style-type: none"> • water • land • soil • minerals • air 	<p>Use the following page references to help meet this standard.</p> <p>Student Edition: 123, 129-130 <i>Assessment</i> 135 (#2) <i>Biology & Society</i> 50 <i>MiniLab</i> 77</p> <p>Teacher Wraparound Edition: DC 130; SP 129, 130</p>
<p>PO 5. Evaluate methods used to manage natural resources (e.g., reintroduction of wildlife, fire ecology).</p>	<p>Student Edition: 130, 131, 133-135 <i>Assessment</i> 135 (#1, #3-#4) <i>National Geographic: In the Field</i> 136</p> <p>Teacher Wraparound Edition: DC 133, 134; DE 131, 134</p>

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<p>Concept 3: Human Population Characteristics</p>	
<p>Analyze factors that affect human populations.</p>	
<p>PO 1. Analyze social factors that limit the growth of a human population, including:</p> <ul style="list-style-type: none"> • affluence • education • access to health care • cultural influences 	<p>Student Edition: 101, 102-103, 105 <i>MiniLab</i> 101</p> <p>Teacher Wraparound Edition: SP 102</p>
<p>PO 2. Describe biotic (living) and abiotic (nonliving) factors that affect human populations.</p>	<p>Student Edition: 100-105 <i>Assessment</i> 105 (#5) <i>MiniLab</i> 101</p> <p>Teacher Wraparound Edition: CT 105; DC 101; SP 102</p>
<p>PO 3. Predict the effect of a change in a specific factor on a human population.</p>	<p>Student Edition: 100-105 <i>Assessment</i> 105 (#5) <i>MiniLab</i> 101</p> <p>Teacher Wraparound Edition: CT 105</p>
<p>Strand 4: Life Science</p>	
<p>Concept 1: The Cell</p>	
<p>Understand the role of the cell and cellular processes.</p>	
<p>PO 1. Describe the role of energy in cellular growth, development, and repair.</p>	<p>Student Edition: 197, 205-206, 219-221, 228</p> <p>Teacher Wraparound Edition: CT 221</p>
<p>PO 2. Compare the form and function of prokaryotic and eukaryotic cells and their cellular components.</p>	<p>Student Edition: 185-186, 193-200, 332, 335, 516-518 <i>Assessment</i> 186 (#5) <i>National Geographic</i> 192</p> <p>Teacher Wraparound Edition: SP 185, 518</p>
<p>PO 3. Explain the importance of water to cells.</p>	<p>Student Edition: 161-165, 203-205 <i>Assessment</i> 165 (#1)</p>

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PO 4. Analyze mechanisms of transport of materials (e.g., water, ions, macromolecules) into and out of cells: <ul style="list-style-type: none"> • passive transport • active transport 	Student Edition: 201-207 <i>Assessment</i> 207 (#1, #4) <i>MiniLab</i> 203 Teacher Wraparound Edition: DC 201, 206; FA 207; WS 205
PO 5. Describe the purposes and processes of cellular reproduction.	Student Edition: 246-247, 248, 250-252, 270-272, 274 <i>Launch Lab</i> 269 <i>National Geographic</i> 249, 273 Teacher Wraparound Edition: DC 250
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.	Student Edition: 171, 247, 270 Teacher Wraparound Edition: MI 270
PO 2. Describe the molecular basis of heredity, in viruses and living things, including DNA replication and protein synthesis.	Student Edition: 333-335, 336-338, 340 <i>Assessment</i> 341 (#1) <i>MiniLab</i> 334 <i>National Geographic</i> 339 Teacher Wraparound Edition: AC 335; MI 336; WS 336
PO 3. Explain how genotypic variation occurs and results in phenotypic diversity.	Student Edition: 275, 279 Teacher Wraparound Edition: AC 275; CB 436; RS 279
PO 4. Describe how meiosis and fertilization maintain genetic variation.	Student Edition: 271-272, 274-276, 283 <i>National Geographic</i> 273 Teacher Wraparound Edition: DC 276; RS 283

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<p>Concept 3: Interdependence of Organisms Analyze the relationships among various organisms and their environment.</p>	
<p>PO 1. Identify the relationships among organisms within populations, communities, ecosystems, and biomes.</p>	<p>Student Edition: 35, 36, 38-40, 41-42 <i>Assessment 40 (#5)</i> Teacher Wraparound Edition: FA 40</p>
<p>PO 2. Describe how organisms are influenced by a particular combination of biotic (living) and abiotic (nonliving) factors in an environment.</p>	<p>Student Edition: 34, 38, 60-61, 94-96 <i>Assessment 40 (#6)</i> <i>BioLab 107</i> Teacher Wraparound Edition: DC 35, 38, 61; SP 38</p>
<p>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.</p>	<p>Student Edition: 97-98, 101-105 Teacher Wraparound Edition: FA 99</p>
<p>Concept 4: Biological Evolution Understand the scientific principles and processes involved in biological evolution.</p>	
<p>PO 1. Identify the following components of natural selection, which can lead to speciation:</p> <ul style="list-style-type: none"> • 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 	<p>Student Edition: 420, 434-436, 438 <i>Assessment 422 (#3)</i> <i>BioLab 443</i> <i>Launch Lab 417</i> <i>National Geographic 421</i> Teacher Wraparound Edition: DC 421; DE 429</p>
<p>PO 2. Explain how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment.</p>	<p>Student Edition: 275-276, 420, 428-430, 434 <i>Assessment 422 (#5), 430 (#6)</i> <i>National Geographic 421</i> Teacher Wraparound Edition: CB 436</p>

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<p>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.</p>	<p>Student Edition: 421, 428-430, 434-436 <i>Assessment</i> 430 (#6), 441 (#3) <i>Data Analysis Lab</i> 435 <i>National Geographic</i> 421 Teacher Wraparound Edition: DC 421; DE 429</p>
<p>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.</p>	<p>Student Edition: 35, 62-63, 94-95, 122-128 <i>Assessment</i> 128 (#3) <i>Biology & Society</i> 870 Teacher Wraparound Edition: WS 122</p>
<p>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.</p>	<p>Student Edition: 393-396, 402-407, 423-428 <i>Assessment</i> 430 (#1-#5) Teacher Wraparound Edition: DC 407, 428; DE 406, 426; MI 423</p>
<p>PO 6. Analyze, using a biological classification system (i.e., cladistics, phylogeny, morphology, DNA analysis), the degree of relatedness among various species.</p>	<p>Student Edition: 458-459, 461, 486-488, 490-496, 498 <i>Assessment</i> 498 (#4) <i>BioLab</i> 505 <i>Data Analysis Lab</i> 459, 494 <i>National Geographic</i> 497 Teacher Wraparound Edition: CT 493; DC 493; SP 497; WS 492</p>
<p>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.</p>	
<p>PO 1. Compare the processes of photosynthesis and cellular respiration in terms of energy flow, reactants, and products.</p>	<p>Student Edition: 47, 197, 219-220, 222-224, 226-227, 228-231, 233 <i>Chapter Assessment</i> 239 (#43) <i>MiniLab</i> 220 <i>National Geographic</i> 225 Teacher Wraparound Edition: FA 233</p>

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PO 2. Describe the role of organic and inorganic chemicals (e.g., carbohydrates, proteins, lipids, nucleic acids, water, ATP) important to living things.	Student Edition: 161, 163-165, 166-171, 221 <i>Assessment</i> 165 (#1), 171 (#2-#4), 221 (#4) <i>National Geographic</i> 162 Teacher Wraparound Edition: CT 221
PO 3. Diagram the following biogeochemical cycles in an ecosystem: <ul style="list-style-type: none"> • water • carbon • nitrogen 	Student Edition: 45-49 Teacher Wraparound Edition: DC 45; FA 49; WS 45
PO 4. Diagram the energy flow in an ecosystem through a food chain.	Student Edition: 42-43 <i>Assessment</i> 44 (#2) <i>Chapter Assessment</i> 54 (#23) <i>MiniLab</i> 42 Teacher Wraparound Edition: DC 43; DE 43; FA 44
PO 5. Describe the levels of organization of living things from cells, through tissues, organs, organ systems, organisms, populations, and communities to ecosystems.	Student Edition: 8, 36, 183, 694 <i>Assessment</i> 40 (#2) <i>National Geographic</i> 37 Teacher Wraparound Edition: DC 36; SP 37