# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 1: "TOOLS" OF SCIENCE

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How do scientists use tools to aid in investigations?<br>2. How do scientists use hypothesis and experimental design to answer scientific questions?<br>3. How have advances in technology affected scientific investigations?<br>4. How is science ever changing and how do new discoveries and new ideas play a role in this change?<br>5. How can scientists make changes in their designed experiments to provide more validity? | Options include, but are not limited to:<br>• Microscope Performance Assessment<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 1 Exam (includes chapters 1 and 18) |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: The Practice of Science<br>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.<br>*(Standard NSE: 9.1.1.1.2)* | None. | | • Bio Opener Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: The Practice of Science<br>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.)<br>*(Standard NSE: 9.1.1.1.3)* | • Items will NOT require students to make ethical decisions. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: The Practice of Science<br>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.)<br>*(Standard NSE: 9.1.1.1.5)* | • Items will NOT require students to make ethical decisions.<br>• 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. | | • Video: "Lorenzo's Oil"<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 1: "TOOLS" OF SCIENCE (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<br>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.<br>*(Standard NSE: 9.1.1.2.1)* | • Context of items should demonstrate all appropriate safety considerations.<br>• Items may address part or all of the benchmark.<br>• 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).<br>• Items will NOT require students to define the term hypothesis.<br>• Items may require students to evaluate or draw an accurate conclusion based on presented evidence.<br>• Items may require students to identify which variables were changed, kept the same and measured in a given experiment.<br>• Items will NOT use the terms independent variable, dependent variable, manipulated variable or responding variables. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: The Practice of Science<br>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.<br>*(Standard NSE: 9.1.1.2.2)* | • Items may require students to evaluate a set of data to formulate possible conclusions. | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 1: "TOOLS" OF SCIENCE (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<br>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.<br>*(Standard NSE: 9.1.1.2.3)* | • Items may include product claims, pseudoscience and unsupported conclusions. | | • Video: "Classifying Living Things"<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.)<br>*(Standard NSE: 9.1.3.4.2)* | • All measurements will use the International System of Units (SI). | | • Safety Contract<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.)<br>*(Standard NSE: 9.1.3.4.4)* | • Examples of error include uncontrolled variables, operator error and measurement error.<br>• 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.<br>• Items will NOT require students to do mathematics without using the results to evaluate data.<br>• All measurements will use the SI system of measurement.<br>• Items that require students to do calculations will provide a calculator tool. | | • Prentice Hall Biology: Miller/Levine 2002 |
| **READING IN THE CONTENT AREA FOR UNIT 1: (Taken from "Standards for Literacy in History/Social Studies, Science, and Technical Subjects")** | | | | |
| | 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 (9.13.66) | | How Assessed: Formal Assessment | • Discussion of Redi's experiment on spontaneous generation |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 2: BIOCHEMISTRY

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How do scientists use hypothesis and experimental design to answer scientific questions?<br>2. How can scientists make changes in their designed experiments to provide more validity?<br>3. What are the building blocks of macromolecules (proteins, carbohydrates, fats, nuclear acids)?<br>4. What factors determine the function of an enzyme? | Options include, but are not limited to:<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 2 Quiz/Test (includes chapter 2)<br>• Lorenzo follow-up paper |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: The Practice of Science<br>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.<br>*(Standard NSE: 9.1.1.1.2)* | None. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: The Practice of Science<br>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.)<br>*(Standard NSE: 9.1.1.1.3)* | • Items will NOT require students to make ethical decisions. | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 2: BIOCHEMISTRY (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<br>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.<br>*(Standard NSE: 9.1.1.2.1)* | • Context of items should demonstrate all appropriate safety considerations.<br>• Items may address part or all of the benchmark.<br>• 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).<br>• Items will NOT require students to define the term hypothesis.<br>• Items may require students to evaluate or draw an accurate conclusion based on presented evidence.<br>• Items may require students to identify which variables were changed, kept the same and measured in a given experiment.<br>• Items will NOT use the terms independent variable, dependent variable, manipulated variable or responding variables. | | • Salivary Analysis Lab<br>• Unknown Compounds Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: The Practice of Science<br>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.<br>*(Standard NSE: 9.1.1.2.2)* | • Items may require students to evaluate a set of data to formulate possible conclusions. | | |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.)<br>*(Standard NSE: 9.1.3.4.2)* | • All measurements will use the International System of Units (SI). | | • Unknown Compounds Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 2: BIOCHEMISTRY (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<br>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.)<br>*(Standard NSE: 9.1.3.4.4)* | • Examples of error include uncontrolled variables, operator error and measurement error.<br>• 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.<br>• Items will NOT require students to do mathematics without using the results to evaluate data.<br>• All measurements will use the SI system of measurement.<br>• Items that require students to do calculations will provide a calculator tool. | | • Salivary Analysis Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Structure and Function of Living Systems<br>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.<br>*(Standard LS: 9.4.1.2.1)* | • Items may require students to know the elemental symbols for carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Structure and Function of Living Systems<br>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.<br>*(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.<br>• 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.<br>• Items will NOT assess the roles of specific enzymes.<br>• Items will NOT use the term activation energy.<br>• Items assessing this benchmark may also assess 9.4.3.1.3. | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 3: CELL ORGANELLES AND PROCESSES

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How do enzymes respond to changes in temperature and pH?<br>2. How do various organelles in prokaryotic and eukaryotic cells function in the following: cell reproduction, protein synthesis, and cell movement?<br>3. What cell organelles function in diffusion and osmosis?<br>4. How are the processes in active and passive transport important in cellular processes? | Options include, but are not limited to:<br>• Prentice Hall Biology (Miller/Levine 2002) Cell Organelle Quiz (includes chapter 7)<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 3 Exam (includes chapter 7)<br>• Prentice Hall Biology (Miller/Levine 2002) Diffusion/Osmosis Quiz (includes chapter 7) |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: The Practice of Science<br>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).<br>• Items assessing this benchmark may also assess benchmarks 9.1.3.2.1 and 9.4.4.1.3. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>• Items may require students to place appropriate variables on graph axes.<br>• Items may require students to determine appropriate increments on graphs. | | • Pineapple Enzyme Lab<br>• Cell Size Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 3: CELL ORGANELLES AND 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<br>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.<br>*(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.<br>• 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.<br>• Items will NOT assess the roles of specific enzymes.<br>• Items will NOT use the term activation energy.<br>• Items assessing this benchmark may also assess 9.4.3.1.3. | | • Pineapple Enzyme Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Structure and Function of Living Systems<br>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.<br>*(Standard LS: 9.4.1.2.3)* | • Viral structures are limited to genetic material and protein coat.<br>• 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.<br>• Items will use the terms cell parts for general structures. | | • Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 3: CELL ORGANELLES AND 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<br>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.<br>*(Standard LS: 9.4.1.2.4)* | • Cell organelles will be referred to in test items as cell parts.<br>• The cell part related to respiration in eukaryotes is limited to the mitochondria (transforms energy to a usable form for the cell).<br>• The cell part related to photosynthesis is limited to the chloroplast (converts light energy to chemical energy).<br>• Cell parts related to protein synthesis in eukaryotes are limited to nucleus (site of transcription) and ribosomes (site of Translation).<br>• Structures related to protein synthesis in prokaryotes are limited to genetic material (site of transcription) and ribosomes (site of translation).<br>• 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).<br>• Cell parts related to cell reproduction in prokaryotes are limited to genetic material (DNA) and cell membrane (cytoplasmic barrier).<br>• Items will NOT address prokaryotic respiration or photosynthesis.<br>• Cell division in prokaryotes is limited to binary fission.<br>• Items may use other cell parts not listed here as distractors. | | • 6 Kingdom Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Structure and Function of Living Systems<br>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.<br>*(Standard LS: 9.4.1.2.5)* | • Active transport is limited to endocytosis and exocytosis.<br>• Passive transport is limited to diffusion, osmosis and facilitated transport.<br>• Additional vocabulary may include terms such as concentration gradient and selective barrier. | | • Dialysis Tubing/Eggs Diffusion (demo lab)<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 4: CELLULAR ENERGY

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How do eukaryotic and prokaryotic cell organelles function in regards to photosynthesis?<br>2. How are the equations for cell respiration and photosynthesis similar/different? How does one depend on the other?<br>3. How does aerobic respiration differ from anaerobic respiration in living organisms?<br>4. What are the factors that affect photosynthesis?<br>5. How do microorganisms carry out the process of fermentation?<br>6. What is the primary source of energy for all living things? | Options include, but are not limited to:<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 4 Exam (includes chapters 1, 23) |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: Structure and Function of Living Systems<br>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.<br>*(Standard LS: 9.4.1.1.1)* | • Internal and external factors or stimuli include pH, temperature, light, gravity and concentration.<br>• A cell's response to maintain homeostasis may include single-celled organisms or individual cells of organisms.<br>• An organism's response to maintain homeostasis may include responses such as gravitropism and phototropism in plants and shivering or sweating in animals.<br>• Items may address both voluntary and involuntary responses.<br>• Items will NOT address the mechanisms of specific organ systems.<br>• Items will NOT require students to distinguish between innate and learned behaviors. | | • Fermentation Lab (Root Beer)<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 4: CELLULAR ENERGY (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<br>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.<br>*(Standard LS: 9.4.1.2.4)* | • Cell organelles will be referred to in test items as cell parts.<br>• The cell part related to respiration in eukaryotes is limited to the mitochondria (transforms energy to a usable form for the cell).<br>• The cell part related to photosynthesis is limited to the chloroplast (converts light energy to chemical energy).<br>• Cell parts related to protein synthesis in eukaryotes are limited to nucleus (site of transcription) and ribosomes (site of Translation).<br>• Structures related to protein synthesis in prokaryotes are limited to genetic material (site of transcription) and ribosomes (site of translation).<br>• 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).<br>• Cell parts related to cell reproduction in prokaryotes are limited to genetic material (DNA) and cell membrane (cytoplasmic barrier).<br>• Items will NOT address prokaryotic respiration or photosynthesis.<br>• Cell division in prokaryotes is limited to binary fission.<br>• Items may use other cell parts not listed here as distractors. | | • Observation: Leaf and Section<br>• Observation: Leaf Epidermis<br>• Observation: Leaf Stomata<br>• Paper Chroma-tography of Leaf Pigments Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interdependence Among Living Systems<br>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.<br>*(Standard LS: 9.4.2.2.1)* | • Items will refer to reactants and products of cellular respiration as oxygen, glucose, carbon dioxide, water, ATP.<br>• Items will refer to reactants and products of photosynthesis as carbon dioxide, water, oxygen, glucose.<br>• Molecular formulas will include labels, for example water ($H_20$).<br>• Items will NOT require students to understand absorption spectra.<br>• Items will NOT require students to recognize light reactions or the Calvin cycle.<br>• Items will NOT include glycolysis, Krebs cycle, electron transport system or fermentation. | | • $CO_2$ Lab (Cell Respiration Lab)<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 4: CELLULAR ENERGY (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** |
| **READING IN THE CONTENT AREA FOR UNIT 4: (Taken from "Standards for Literacy in History/Social Studies, Science, and Technical Subjects")** | | | | |
| | 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) | | How Assessed: Formal typed lab write-up | $CO_2$ Lab |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 5: CELL REPRODUCTION

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How does the process of mitosis assure genetic continuity?<br>2. What process ensures growth and repair will occur in living things?<br>3. How does normal cell division differ from cancer cell division?<br>4. What cell organelles play an important role in cell division?<br>5. How does the process of meiosis assure genetic variability in living things?<br>6. How does the reproductive cycle function in humans?<br>7. What are the stages of embryological development in animals? | Options include, but are not limited to:<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 5 Exam (includes chapters 10, 11, and 39)<br>• Meiosis Performance Evaluation (Group) |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: Structure and Function of Living Systems<br>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.<br>*(Standard LS: 9.4.1.2.4)* | • Cell organelles will be referred to in test items as cell parts.<br>• The cell part related to respiration in eukaryotes is limited to the mitochondria (transforms energy to a usable form for the cell).<br>• The cell part related to photosynthesis is limited to the chloroplast (converts light energy to chemical energy).<br>• Cell parts related to protein synthesis in eukaryotes are limited to nucleus (site of transcription) and ribosomes (site of Translation).<br>• Structures related to protein synthesis in prokaryotes are limited to genetic material (site of transcription) and ribosomes (site of translation).<br>• 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).<br>• Cell parts related to cell reproduction in prokaryotes are limited to genetic material (DNA) and cell membrane (cytoplasmic barrier).<br>• Items will NOT address prokaryotic respiration or photosynthesis.<br>• Cell division in prokaryotes is limited to binary fission.<br>• Items may use other cell parts not listed here as distractors. | | • University of Arizona Web Site<br>• Mitosis Lab Prepared Slides<br>• Meiosis Lab (Group)<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 5: CELL REPRODUCTION (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<br>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.<br>*(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.<br>• Items addressing the process of mitosis may include knowing the sequence of events.<br>• Items will NOT assess the terms haploid, diploid, interphase, prophase, metaphase, anaphase or telophase.<br>• Items assessing this benchmark may also assess benchmark 9.4.4.2.5. | | • Video: "Time for Mitosis"<br>• Meiosis Lab (Group)<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Evolution in Living Systems<br>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.<br>*(Standard LS: 9.4.3.2.2)* | • Examples of advantages to sexual (meiosis) reproduction include genetic diversity.<br>• Examples of disadvantages to sexual (meiosis) reproduction include expending increased energy and time.<br>• Examples of advantages to asexual reproduction (mitosis) include no requirement of a mate and the organism may reproduce more rapidly.<br>• Examples of disadvantages to asexual reproduction (mitosis) include decreased genetic variation.<br>• Items will NOT use the terms haploid or diploid.<br>• Additional vocabulary may include terms such as gamete, egg and sperm. | | • Video: "Miracle of Life"<br>• Reproductive Cycle Graphing<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Human Interactions with Living Systems<br>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.<br>*(Standard LS: 9.4.4.2.5)* | • Items will NOT require students to make ethical decisions.<br>• Items will NOT assess specific forms of cancer.<br>• Items assessing this benchmark may also assess benchmarks 9.4.1.2.6 and 9.4.3.2.3.<br>• Items may assess risk factors associated with cancer (e.g., genetic predisposition, viruses, carcinogens, mutagens). | | • Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 6: MENDEL GENETICS

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How can a Punnett square be used to predict the offspring in a monohybrid genetics cross?<br>2. How do Mendel's laws of segregation and independent assortment help explain the variation in a species?<br>3. How does the process of Meiosis influence gamete formation? | Options include, but are not limited to:<br>• Monohybrid Quiz<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 6 Exam (includes chapter 11)<br>• Dihybrid Quiz |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: The Practice of Science<br>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.<br>*(Standard NSE: 9.1.1.2.4)* | • Disciplines are limited to zoology, botany, microbiology, evolutionary biology, ecology, genetics, cell biology, anatomy and physiology.<br>• Methodologies may include observation, gathering data, organizing information, analysis, experimentation and computer modeling. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>*(Standard NSE: 9.1.3.4.6)* | • Examples of models include population growth, bacterial growth and probability in genetics. | | |
| Substrand: Evolution in Living Systems<br>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.<br>*(Standard LS: 9.4.3.1.2)* | • Items may require students to understand a Punnett square.<br>• Items may require students to understand dominant and recessive inheritance.<br>• Items will NOT reference specific human genetic disorders.<br>• Items will NOT use the terms or assess concepts of sex-linked, polygenic, incomplete dominance, codominance or multiple allele inheritance patterns. | | • "DYG" Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 6: MENDEL GENETICS (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<br>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.<br>• 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).<br>• Items may require students to know that the products of meiosis are cells that are genetically unique with half the number of chromosomes.<br>• Items will NOT use the terms haploid or diploid.<br>• Additional vocabulary may include terms such as gamete, egg and sperm.<br>• Items assessing this benchmark may also assess 9.4.3.3.4. | | • Blood Typing Activity/Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Human Interactions with Living Systems<br>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.<br>• Items will NOT require students to make ethical decisions. | | • University of Arizona Biology Web Site (Interpreting a Karyotype)<br>• Prentice Hall Biology: Miller/Levine 2002 |
| **READING IN THE CONTENT AREA FOR UNIT 6: (Taken from "Standards for Literacy in History/Social Studies, Science, and Technical Subjects")** | | | | |
| | 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) | | How Assessed: Lab worksheet | Face Lab |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 7: DNA/PROTEIN SYNTHESIS AND GENETIC ENGINEERING

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How do ethics influence scientific investigations?<br>2. How have advances in technology affected scientific investigations?.<br>3. How are amino acids assembled to build proteins?<br>4. What role do gene and chromosome mutations play in living things?<br>5. How are DNA, genes, and chromosomes related?<br>6. What is the role of DNA, mRNA and tRNA in the processes of DNA replication and protein synthesis?<br>7. How does the sequence of DNA bases produce an order of amino acids?<br>8. How do genetically modified organisms (GMO) play an important role in agriculture and society? | Options include, but are not limited to:<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 7 Exam (includes chapter 12) |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: The Practice of Science<br>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.)<br>*(Standard NSE: 9.1.1.1.4)* | • Not assessed on the MCA-III. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: The Practice of Science<br>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.<br>*(Standard NSE: 9.1.1.1.7)* | • Items will address theories, models and the validity of scientific knowledge in the context of life science.<br>• Technological innovations may include microscopy, global positioning system (GPS), genetic engineering and molecular engineering. | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 7: DNA/PROTEIN SYNTHESIS AND GENETIC ENGINEERING (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<br>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. | | • Stem Cell Research Paper<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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. | | |
| Substrand: Evolution in Living Systems<br>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. | | • DNA Extraction Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 7: DNA/PROTEIN SYNTHESIS AND GENETIC ENGINEERING (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<br>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.<br>*(Standard LS: 9.4.3.1.3)* | • Items may include the terms mRNA, tRNA, amino acids, Uracil in RNA and ribosomes.<br>• 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.<br>• Items may require students to understand DNA base pairing rules A=T and G=C.<br>• Items may require students to understand RNA base pairing rules A=U and G=C.<br>• Items will NOT reference specific human genetic disorders.<br>• Items assessing this benchmark may also assess benchmark 9.4.1.2.2. | | • Use of MRNA Wheel<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Evolution in Living Systems<br>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.<br>*(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).<br>• Items may use terms that describe specific mutations.<br>• Items will NOT reference specific human genetic disorders.<br>• Items assessing this benchmark may also assess benchmarks 9.4.4.2.4 and 9.4.4.2.5. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Human Interactions with Living Systems<br>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.)<br>*(Standard LS: 9.4.4.1.1)* | • Items will NOT assess details of specific technological processes.<br>• Items will NOT reference specific human diseases, human genetic disorders or human cloning.<br>• 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. | | • GMO Paper<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 7: DNA/PROTEIN SYNTHESIS AND GENETIC ENGINEERING (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<br>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.<br>• 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.<br>• Items will NOT assess the roles of specific enzymes.<br>• Items will NOT use the term activation energy.<br>• Items assessing this benchmark may also assess 9.4.3.1.3. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>• Items will provide context with sufficient background information. | | |
| **READING IN THE CONTENT AREA FOR UNIT 7: (Taken from "Standards for Literacy in History/Social Studies, Science, and Technical Subjects")** | | | | |
| | 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. (9.13.22) | | How Assessed: Conclusion Summary and Exam | Avery/Griffith/ Chase (contributions to DNA) |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 8: EVOLUTIONARY THEORY/POPULATION BIOLOGY

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How do scientists communicate their findings in an experiment?<br>2. How has the development of $0_2$ on the Earth lead to a change in life?<br>3. How did Charles Darwin use evidence for the theory of natural selection?<br>4. How does competition for resources lead to natural selection?<br>5. What scientific evidence indicates relationships among living things?<br>6. How does genetic variation lead to evolution? | Options include, but are not limited to:<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 8 Exam (includes chapters 15-16) |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: The Practice of Science<br>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.<br>*(Standard NSE: 9.1.1.2.4)* | • Disciplines are limited to zoology, botany, microbiology, evolutionary biology, ecology, genetics, cell biology, anatomy and physiology.<br>• Methodologies may include observation, gathering data, organizing information, analysis, experimentation and computer modeling. | | • Analyze Lamarck/ Darwin/Wallace Writings<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>*(Standard NSE: 9.1.3.4.6)* | • Examples of models include population growth, bacterial growth and probability in genetics. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Earth Structure and Processes<br>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.).<br>*(Standard ESS: 9.3.1.3.2)* | None | | • Video: "Understanding Evolution" |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 8: EVOLUTIONARY THEORY/POPULATION BIOLOGY (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 Universe<br>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.<br>*(Standard ESS: 9.3.3.2.2)* | None | | |
| Substrand: The Universe<br>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.<br>*(Standard ESS: 9.3.3.2.3)* | None | | |
| Substrand: Evolution Living Systems<br>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.<br>*(Standard LS: 9.4.3.3.1)* | • Items may require students to connect evidence to the development of Darwin's ideas. | | • Natural Selection Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Evolution Living Systems<br>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.<br>*(Standard LS: 9.4.3.3.2)* | • Items may illustrate the concept of analogous structures but will NOT use the term.<br>• 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.<br>• Items will NOT use specific terms involved in geological time scales.<br>• Additional vocabulary may include terms such common ancestor, relatedness and anatomical evidence. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Evolution Living Systems<br>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.<br>*(Standard LS: 9.4.3.3.3)* | None. | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 8: EVOLUTIONARY THEORY/POPULATION BIOLOGY (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<br>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. | | • Genes and Population Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Evolution Living Systems<br>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. | | • Natural Selection Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Evolution Living Systems<br>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.<br>• Items may address the following processes and terms: divergence, convergence, adaptive radiation and co-evolution.<br>• Items will NOT address the concept of bottlenecks, founder effects or genetic drift.<br>• Contexts for items will use examples of Minnesota ecosystems when appropriate. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: The Practice of Science<br>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).<br>• Items assessing this benchmark may also assess benchmarks 9.1.3.2.1 and 9.4.4.1.3. | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 8: EVOLUTIONARY THEORY/POPULATION BIOLOGY (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 Universe<br>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.<br>*(Standard ESS: 9.3.3.2.2)* | None | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: The Universe<br>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.<br>*(Standard ESS: 9.3.3.2.3)* | None | | |
| Substrand: Evolution Living Systems<br>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.<br>*(Standard LS: 9.4.3.3.5)* | • Contexts for items will use examples of Minnesota ecosystems when appropriate. | | • Prentice Hall Biology: Miller/Levine 2002 |
| **READING IN THE CONTENT AREA FOR UNIT 1: (Taken from "Standards for Literacy in History/Social Studies, Science, and Technical Subjects")** | | | | |
| | Cite specific textual evidence to support analysis of technical texts, attending to the precise details of explanations or descriptions (9.13.1.1) | | How Assessed: Reading Analysis Sheet | Wallace/Darwin/ Lamarck Readings |
| | 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) | | How Assessed: Formal Write-Up | Genes and Populations Lab |
| | 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) | | How Assessed: Lab Write-Up | Genes and Population Lab |
| | 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) | | How Assessed: Text Questions/Summative Assessment | Evidence for Evolution Reading |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| | | | | |
|---|---|---|---|---|

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 9: ECOLOGY

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How are the elements carbon, nitrogen, and sulfur cycled through the atmosphere?<br>2. How are human activities (fossil fuel use) affecting life on Earth?<br>3. What abiotic/biotic factors affect the carrying capacity of a population?<br>4. What impact can invasive species have on an ecosystem?<br>5. How is chemical energy transferred in an ecosystem?<br>6. How is heat produced in the passing on of chemical energy?<br>7. How do different cultures view human interaction with the environment? | Options include, but are not limited to:<br>• Prentice Hall Biology (Miller/Levine 2002) Population Biology Quiz (includes chapter 5)<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 9 Exam (includes chapters 3-6) |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: The Practice of Engineering<br>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.<br>• Items will be placed in contexts that give sufficient background information.<br>• Items are limited to environmental effects on ecosystems and their physical and biological components. | | |
| Substrand: The Practice of Engineering<br>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.<br>• Items will be placed in contexts that give sufficient background information.<br>• Items are limited to environmental effects on ecosystems and their physical and biological components.<br>• Items may require students to identify risks and benefits of a new technology or design. | | • Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 9: ECOLOGY (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<br>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.<br>*(Standard NSE: 9.1.2.1.3)* | • Items will NOT require students to know details of specific technologies.<br>• Items will be placed in contexts that provide sufficient background information.<br>• Items are limited to environmental effects on ecosystems and their physical and biological components. | | • Analyze Recycling Efforts<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: The Practice of Engineering<br>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.)<br>*(Standard NSE: 9.1.2.2.1)* | None | | • Sampling Populations Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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)<br>*(Standard NSE: 9.1.3.1.1)* | • Items may use either natural or designed systems.<br>• Items will be placed in contexts that give sufficient background information. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>*(Standard NSE: 9.1.3.1.2)* | • Items may use either natural or designed systems.<br>• Examples of systems include ecosystems, organ systems, power plants and water treatment systems. | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 9: ECOLOGY (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<br>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)<br>*(Standard NSE: 9.1.3.1.3)* | • Items may use either natural or designed systems.<br>• Items may require students to analyze positive and negative feedback from a set of data or information.<br>• Items will NOT require students to know specific feedback mechanisms within an organism.<br>• Additional examples may include ecosystem and population dynamics, greenhouses and aquaculture.<br>• Items will NOT address organ systems.<br>• 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. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.)<br>*(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.<br>• Items will be placed in contexts that give sufficient background information.<br>• Items will NOT require students to match an individual to a specific idea or invention.<br>• Items may require students to recognize how an idea or invention has contributed to the field of science. | | |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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. | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 9: ECOLOGY (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<br>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.<br>*(Standard NSE: 9.1.3.4.1)* | • Not assessed on the MCA-III. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>*(Standard NSE: 9.1.3.4.6)* | • Examples of models include population growth, bacterial growth and probability in genetics. | | |
| Substrand: Interdependence Within the Earth System<br>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.<br>*(Standard ESS: 9.3.2.2.1)* | None | | |
| Substrand: Interdependence Within the Earth System<br>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.<br>*(Standard ESS: 9.3.2.2.2)* | None | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 9: ECOLOGY (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 Within the Earth System<br>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.)<br>*(Standard ESS: 9.3.2.3.1)* | None | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Human Interactions with the Earth System<br>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.)<br>*(Standard ESS: 9.3.4.1.1)* | None | | |
| Substrand: Human Interactions with the Earth System<br>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.)<br>*(Standard ESS: 9.3.4.1.2)* | None | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 9: ECOLOGY (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<br>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.<br>*(Standard LS: 9.4.2.1.1)* | • Examples of factors include resources such as food or nutrient availability, shelter, water and light.<br>• Items may address how competition for the same resources decreases carrying capacity such as predators competing for the same resources.<br>• Contexts will use examples of Minnesota ecosystems when appropriate. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interdependence Among Living Systems<br>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.)<br>*(Standard LS: 9.4.2.1.2)* | • Contexts for items will use examples of Minnesota ecosystems when appropriate.<br>• Items may require students to predict, analyze and reflect on global issues.<br>• Items may include invasive species. | | |
| Substrand: Interdependence Among Living Systems<br>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.<br>*(Standard LS: 9.4.2.2.2)* | • Items may address the processes of photosynthesis, respiration and decomposition in recycling matter.<br>• Items may include energy and matter cycling in food chains and food webs.<br>• 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.<br>• Items will NOT include glycolysis, Krebs cycle, electron transport system, fermentation or entropy.<br>• Contexts for items will use examples of Minnesota ecosystems when appropriate.<br>• Additional vocabulary may include terms such as producer, primary consumer, secondary consumer, tertiary consumer, decomposer, autotroph, heterotroph, energy pyramid, trophic level. | | |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 9: ECOLOGY (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<br>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.<br>*(Standard LS: 9.4.4.1.2)* | • Contexts for items will use examples of Minnesota ecosystems when appropriate.<br>• Items assessing this benchmark may also assess benchmarks in standards 9.1.2.1 and 9.1.3.1. | | • Invasive Species Research (Minnesota DNR)<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Human Interactions with Living Systems<br>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.)<br>*(Standard LS: 9.4.4.1.3)* | • Items will be placed in contexts that give sufficient background information.<br>• Items will NOT require standards to match an individual to a specific contribution.<br>• Items assessing this benchmark may also assess benchmarks 9.1.3.2.1 and 9.1.1.1.6. | | • Video: "People Bomb"<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Human Interactions with Living Systems<br>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.<br>*(Standard LS: 9.4.4.2.4)* | • Items will NOT require students to make ethical decisions.<br>• Items may include point and nonpoint sources of pollution.<br>• 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. | | • Prentice Hall Biology: Miller/Levine 2002 |
| **READING IN THE CONTENT AREA FOR UNIT 9: (Taken from "Standards for Literacy in History/Social Studies, Science, and Technical Subjects")** | | | | |
| | 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) | | How Assessed: Ecology Project/Biomass Problems | Food Chains/Food Webs/10% Rule |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 10: MICROBIOLOGY

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How do prokaryotic cells differ from eukaryotic cells?<br>2. How does the structure of a virus compare to the structure of bacteria?<br>3. How do vaccines function in the fight of diseases?<br>4. What is the role of the immune system in the disease process? | Options include, but are not limited to:<br>• Growth Conditions Lab<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 10 Exam (includes chapter 19)<br>• Bacteria ID Quiz |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: The Practice of Science<br>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.<br>*(Standard NSE: 9.1.1.2.4)* | • Disciplines are limited to zoology, botany, microbiology, evolutionary biology, ecology, genetics, cell biology, anatomy and physiology.<br>• Methodologies may include observation, gathering data, organizing information, analysis, experimentation and computer modeling. | | • Antibiotic Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>*(Standard NSE: 9.1.3.2.2)* | • Not assessed on the MCA-III. | | • Video: "On the Job Science"<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 10: MICROBIOLOGY (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<br>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.<br>*(Standard NSE: 9.1.3.4.1)* | • Not assessed on the MCA-III. | | • Video: "Rise of Wondeudery"<br>• Gram Staining<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Structure and Function of Living Systems<br>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.<br>*(Standard LS: 9.4.1.2.3)* | • Viral structures are limited to genetic material and protein coat.<br>• 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.<br>• Items will use the terms cell parts for general structures. | | • Microscope (Prepared Slides)<br>• Video: "What are Bacteria?"<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Human Interactions with Living Systems<br>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.<br>*(Standard LS: 9.4.4.2.2)* | • Items will NOT reference specific human diseases or genetic disorders.<br>• Items will NOT require students to identify specific vaccines.<br>• Items may require students to understand the relationship between antigens and antibodies.<br>• Items will NOT assess the specific processes by which antibodies are formed. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Human Interactions with Living Systems<br>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.<br>*(Standard LS: 9.4.4.2.3)* | • Items will NOT reference specific human diseases or genetic disorders.<br>• Items may require students to understand the relationship between antigens and antibodies.<br>• Items will NOT assess the specific processes by which antibodies are formed. | | • Immunology Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 10: MICROBIOLOGY (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<br>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.<br>• Technological innovations may include microscopy, global positioning system (GPS), genetic engineering and molecular engineering. | | • Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Structure and Function of Living Systems<br>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.<br>• 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.<br>• Items will use the terms cell parts for general structures. | | |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>• Items may require students to interpret or create a graphic in order to communicate procedures and results.<br>• Items may require students to analyze or produce quantitative information in order to communicate procedures and results. | | • Growth Conditions Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 10: MICROBIOLOGY (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** |
| **READING IN THE CONTENT AREA FOR UNIT 10: (Taken from "Standards for Literacy in History/Social Studies, Science, and Technical Subjects")** | | | | |
| | 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) | | How Assessed: Lab Worksheet | Antibiotics Lab |
| | 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) | | How Assessed: Worksheet | Reading "Typhoid Mary" |
| | 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) | | How Assessed: Lab Reporting | Growth Conditions for Bacteria<br>Gram Staining Bacteria |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 11: PLANT BIOLOGY

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How do plants respond to changes in their environment?<br>2. How do the parts of a flower determine the function of the flower?<br>3. How do the organs of vascular plants (leaves, roots, stems) work together to aid the function of a plant?<br>4. How are growth rings in a tree used to analyze changes in the environment? | Options include, but are not limited to:<br>• Identify growth factors of plants<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 11 Exam (includes chapters 21-25)<br>• Flower Quiz |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>• Examples of systems include ecosystems, organ systems, power plants and water treatment systems. | | • Root Lab<br>• Stem Lab<br>• Tree ID Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Structure and Function of Living Systems<br>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.<br>• Organ systems in animals are limited to digestive, respiratory, circulatory and nervous systems.<br>• Organ systems in plants may include the function of vascular tissue and leaves.<br>• The functions of individual organ systems in plants include nutrient uptake, gas exchange and material transport.<br>• Items will NOT require students to identify specific plant structures, such as xylem or stoma, but may require students to understand their function.<br>• Items will NOT address positive feedback in homeostasis. | | • Dendrochronology Lab<br>• Flower Lab<br>• Fruit/ Vegetable Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 11: PLANT BIOLOGY | | | | |
|---|---|---|---|---|
| **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<br>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.<br>*(Standard LS: 9.4.1.1.1)* | • Internal and external factors or stimuli include pH, temperature, light, gravity and concentration.<br>• A cell's response to maintain homeostasis may include single-celled organisms or individual cells of organisms.<br>• An organism's response to maintain homeostasis may include responses such as gravitropism and phototropism in plants and shivering or sweating in animals.<br>• Items may address both voluntary and involuntary responses.<br>• Items will NOT address the mechanisms of specific organ systems.<br>• Items will NOT require students to distinguish between innate and learned behaviors. | | • Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

## UNIT 12: ANIMAL AND HUMAN BIOLOGY

| Big Questions | Formative/ Summative Assessments<br>Formative and summative assessments created by teachers/teams |
|---|---|
| 1. How do the functions of the digestive, respiratory, nervous, and circulatory systems work to maintain homeostasis in the body?<br>2. What are the distinguishing characteristics of the classes of invertebrates/vertebrates?<br>3. What are the major structures and functions of the respiratory, circulatory, digestive, reproductive, and excretory systems of the fetal pig?<br>4. How does fetal pig anatomy compare/contrast to human anatomy? | Options include, but are not limited to:<br>• Prentice Hall Biology (Miller/Levine 2002) Unit 12 Exam (includes chapters 3, 26-33)<br>• Fetal Pig Dissection Practical Exam (instructor constructed)<br>• Animal Survey Lab<br>• Analyzing Fish Scales<br>• Fish Respiration Lab |

| Substrand/Standard | Curriculum Benchmark | MCA III Test Item Specifications | Standards of Proficiency<br>Description of what students must show to demonstrate proficiency (created by teachers/teams) | Resources/ Activities |
|---|---|---|---|---|
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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.<br>• Examples of systems include ecosystems, organ systems, power plants and water treatment systems. | | • Fetal Pig Dissection<br>• Animal Survey Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |
| Substrand: Interactions Among Science, Technology, Engineering, Mathematics, and Society<br>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. | | • Minnesota DNR Web Site<br>• Analyzing Fish Scales<br>• Prentice Hall Biology: Miller/Levine 2002 |

# BIOLOGY 10/BASIC BIOLOGY CURRICULUM FRAMEWORKS

| UNIT 12: ANIMAL AND HUMAN BIOLOGY (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<br>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.<br>*(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.<br>• Organ systems in animals are limited to digestive, respiratory, circulatory and nervous systems.<br>• Organ systems in plants may include the function of vascular tissue and leaves.<br>• The functions of individual organ systems in plants include nutrient uptake, gas exchange and material transport.<br>• Items will NOT require students to identify specific plant structures, such as xylem or stoma, but may require students to understand their function.<br>• Items will NOT address positive feedback in homeostasis. | | • Fish Respiration Lab<br>• Prentice Hall Biology: Miller/Levine 2002 |