

Format of Test Expectations

The expectations are formatted in the following ways.

- 1. Categorically – Each table indicates the standard and strand assessed.
- 2. Depth of Knowledge – Clarifications within each table indicate the depth of knowledge or skill intended within the standard.
- 3. Cognitive Range – Each table indicates the expected span of knowledge intended for assessment.
- 4. Test Representation of Standard – Each table indicates whether the standard is essential, important, or compact. The greatest number of DCAS items will come from essential standards, with less from important standards and no DCAS items will be compact standards.

V. SUMMARY

The course-level expectations are focused on the standards and the level of priority assigned to each standard. The majority of test items will be taken directly from standards that are essential with a smaller percentage of items written to the important standards. No compact standards will be tested in large-scale assessment. The cognitive levels are a guide to provide clarification to the test vendor as to the depth and breadth of the standard. Most standards give a range of possibilities within the various cognitive levels.

VI. BIOLOGY END-OF-COURSE EXPECTATIONS

The Delaware Content Standards for Science is a comprehensive document containing eight standards with corresponding grade-level expectations (GLEs). The Biology EOC Expectations provide a guide to indicate the level of emphasis to be placed on the standards and GLEs. By coding standards and GLEs taught in the Biology course, it enables teachers to distinguish between the essential, important, and compact elements of the curriculum. As a result, students receive similar instruction based on a common course.

Essential standards are those that emphasize the key knowledge and skills that students should understand at great depth and on which most instructional time is spent. Important standards comprise a lesser extent of the curriculum and lead to understanding essential knowledge and skills. Compact standards are not included on the DCAS assessment.

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.A In order to establish and maintain their complex organization and structure, organisms must obtain, transform, and transport matter and energy, eliminate waste products, and coordinate their internal activities. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"><li>Explain how organelles of single-celled organisms function as a system to perform the same basic life processes as are performed in multi-cellular organisms (e.g., acquisition of energy, elimination of waste, reproduction, gas exchange, growth, repair, and protein synthesis).</li></ul>
Clarifications and Cognitive Level(s) Expected	This is an important standard that creates a foundation for later biological concepts. Items for this standard should focus on how parts coordinate functions as a system. The specific functioning of each organelle is <u>not</u> a focus.  <b>Depth of Knowledge Categories</b>  Level 1 Items: Should focus on identifying requirements of all living things.

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.B Cells take highly varied forms in different plants, animals, and microorganisms. Structural variations among cells determine the function each cell performs. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"><li>Identify similarities and differences among a variety of cells (e.g., muscle, nerve, epithelial, blood, leaf, root). Explain how structural variations relate to the function that each of the cells performs.</li><li>Differentiate between prokaryotic cells and eukaryotic cells in terms of their general structures (cell membrane and genetic material) and degree of complexity. Give examples of prokaryotic organisms and organisms with eukaryotic cells.</li></ul>
Clarifications and Cognitive Level(s) Expected	This is an essential standard so it is expected that this will be a focus on the assessment.  Items for this standard should emphasize structure/function relationships.  <b>Depth of Knowledge Categories</b>  Level 1 Items: May ask students to recall the function of cell structures.  Level 2 Items: May ask students to compare/contrast structures of different cells.  Level 3 Items: May ask students to draw conclusions about cell function based on structures observed.

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.C Cells have distinct and separate structures (organelles), which perform and monitor processes essential for survival of the cell (e.g., energy use, waste disposal, synthesis of new molecules, and storage of genetic material). The highly specific function of each organelle is directly related to its structure. Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Differentiate between prokaryotic cells and eukaryotic cells in terms of their general structures (cell membrane &amp; genetic material) and degree of complexity. Give examples of prokaryotic organisms and organisms with eukaryotic cells.</li> <li>Explain how organelles of single-celled organisms function as a system to perform the same basic life processes as are performed in multi-cellular organisms (e.g., acquisition of energy, elimination of waste, reproduction, gas exchange, growth, repair, and protein synthesis). <i>(Note: This refers to the idea that single-celled organisms are self-sufficient, while multi-cellular organisms depend on a division of labor among cells.)</i></li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards. Items for this standard should focus on how parts coordinate functions as a system. The specific functioning of each organelle is not a focus.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: May focus on recall of general structures that all students should know that include the cell membrane, cell wall, nucleus, mitochondria, chloroplasts, and cytoplasm.</p> <p>Level 2 Items: May ask students to classify organisms according to the kingdom level only, e.g., bacteria, fungi, plants, animals and protists. Specific names of organisms are not the focus.</p>

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.D The cell membrane is dynamic and interacts with internal membranous structures as materials are transported into and out of the cell. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Use models or diagrams to explain how the structure of the cell membrane regulates the movement of materials across the membrane.</li> <li>Show how water moves in and out of cells down a concentration gradient. Recognize that this process, known as osmosis, requires no input of energy.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><i><b>Note: Students should be able to explain if water will enter or leave a cell based on solute concentration. They will not be accountable for vocabulary such as <u>hypo/hyper/isotonic</u> or <u>osmotic pressure</u>.</b></i></p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Define osmosis; describe the primary function of the cell membrane.</p> <p>Level 3 Items: Interpret the relative concentration of a solution based on the shape (shriveled or swollen) of the cell suspended in the solution.</p> <p>Level 4 Items: Predict whether a cell will shrink or swell based on concentration of the environment compared to the concentration of cell contents.</p>

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.E The transportation of materials across the membrane can be passive (does not require the expenditure of cellular energy) or active (requires the expenditure of cellular energy) depending upon membrane structure and concentration gradients. Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Distinguish between active and passive transport. Recognize that active transport requires energy input to move molecules from an area of low concentration to an area of high concentration (against the concentration gradient).</li> <li>Interpret data from a controlled experiment to investigate the capacity of the cell membrane to regulate how materials enter and leave the cell.</li> <li>Interpret data from cell models (e.g., phenolphthalein-agar cubes, potato-iodine cubes) to explain the relationship among cell size, surface area to volume ratio and the rates of diffusion into and out of the cell. Explain why large organisms have developed from many cells rather than one large cell.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards.</p> <p><i>(Note: this may include a diagram of an experiment involving solutes crossing dialysis tubing).</i></p> <p><i>(Note: students should understand how surface area/volume ratios affect cell processes, but they will not be expected to calculate surface area/volume ratios.)</i></p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: May ask for a definition of passive or active transport.</p> <p>Level 2 Items: Given a “before and after” picture of a cell in a solution, students will describe how materials cross the membrane (e.g., by passive or active transport) based upon information about the concentration gradient.</p>

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.F Cells store and use information to guide their functions. DNA molecules in each cell carry coded instructions for synthesizing protein molecules. The protein molecules have important structural and regulatory functions. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Define a gene as a section of DNA that directs the synthesis of a specific protein. A protein has a specific regulatory or structural role.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Describe gene, codon, protein, and nucleic acid</p> <p>Level 2 Items: Describe the cause and effect relationship between mutations and protein structure/function.</p> <p>Level 3 Items: Predict consequences of a mutation on a protein and, therefore, on cell function.</p>

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.G Humans have a nervous system composed of a brain and specialized cells that conduct signals rapidly through the long cell extensions that make up nerves. The nerve cells communicate with each other by secreting specific molecules (neurotransmitters). Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Recognize that as a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable despite changes in the outside environment.</li> <li>Explain how the cells of a multi-cellular organisms work together for the benefit of the colonial or singular organism.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard, a definition by nature. It is intended as foundational content and therefore is not recommended for large-scale assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify parts of the nervous system or differentiate between parts/ structures of the nervous system and those that are not.</p>

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.H In multi-cellular organisms, cells perform specialized functions as parts of sub-systems (e.g., tissues, organs, and organ systems), <u>which work together to maintain optimum conditions for the benefit of the whole organism</u> Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain how the cells of a multi-cellular organisms work together for the benefit of the colonial or singular organism.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Choose from a list of terms that range from least to most complex (i.e., cell, tissue, organ, organ system, organism).</p> <p>Level 2 Items: Classify the levels of cellular organization by complexity.</p> <p>Level 3 Items: Explain why cells from a multi-cellular organism cannot live independently.</p>

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.I The endocrine system consists of glands which secrete chemical messengers (hormones) that are transported via the circulatory system and act on other body structures. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Recognize that as a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable despite changes in the outside environment.</li> <li>Explain how the cells of a multi-cellular organisms work together for the benefit of the colonial or singular organism.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Recognize that cells in a multi-cellular are interdependent or identify the purpose of the endocrine system (definitional).</p>

Standard Title	6 Life Processes
Strand 6.1	Structure and Function
Content Standard Statement	6.1.J The immune system consists of cells, organs, and secretions that protect the organism from toxins, irritants, and pathogens. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Recognize that as a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable despite changes in the outside environment.</li> <li>Explain how the cells of a multi-cellular organisms work together for the benefit of the colonial or singular organism.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Defines or identifies a function as being the responsibility of the immune system.</p> <p>Level 2 Items: May ask the student to describe why increased blood flow to an injury may be helpful in the healing process of an organism.</p> <p>Level 3 Items: May provide data and ask students to provide evidence that the immune system has protected the organism.</p>

Standard Title	6 Life Processes
Strand 6.2	Matter and Energy Transformation
Content Standard Statement	6.2.A Cells carry out a variety of chemical transformations (i.e., cellular respiration, photosynthesis, and digestion) which allow conversion of energy from one form to another, the breakdown of molecules into smaller units, and the building of larger molecules from smaller ones. Most of these transformations are made possible by protein catalysts called enzymes. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain that physically breaking down food into smaller pieces by mechanical digestion helps facilitate breakdown (by increasing surface area) into chemical components and that digestive enzymes are necessary for the breakdown of food into those chemical components (e.g., starch to glucose, lipids and glycerol to fatty acids, proteins to amino acids).</li> <li>Observe and recognize that unicellular organisms take in food from their environment and chemically digest it (if needed) within their cell body.</li> <li>Understand that nutrients are transported to cells where they serve as building blocks for the synthesis of body structures and as reactants for cellular respiration.</li> <li>Describe the process by which water is removed from sugar molecules (dehydration synthesis) to form carbohydrates and is added to break them down (hydrolysis).</li> <li>Recognize that during cellular respiration, chemical bonds between food molecules are broken (hydrolysis), and energy is transferred to ADP to create ATP (the energy storage molecule that fuels cellular processes). Acknowledge that all organisms must break the high energy chemical bonds in food molecules during cellular respiration to obtain the energy needed for life processes.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment. This is an overarching standard, and specific details will be associated with other standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify the purpose of food in a cell (provide energy and matter for growth and repair).</p>

Standard Title	6 Life Processes
Strand 6.2	Matter and Energy Transformation:
Content Standard Statement	6.2.B Plant cells contain chloroplasts, which convert light energy into chemical energy through the process of photosynthesis. This chemical energy is used by the plants to convert carbon dioxide and water into glucose molecules, that may be used for energy or to form plant structures. Photosynthesis adds oxygen to the atmosphere and removes carbon dioxide. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain the processes used by autotrophs to transform light energy into chemical energy in the form of simple sugars. Give examples of how these compounds are used by living things as sources of matter and energy.</li> <li>Describe photosynthesis as an energy storing process and explain how environmental factors such as temperature, light intensity, and the amount of water available can affect photosynthesis.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify the organelle where photosynthesis takes place. Describe how the products of photosynthesis are used by a plant.</p> <p>Level 2 Items: Classify the reactants and products of the photosynthesis equation.</p> <p>Level 3 Items: Explain how photosynthesis causes a plant to increase in mass. (<i>Note: we are not asking students to understand the Calvin Cycle or its steps—just to identify CO<sub>2</sub> as a source of matter.</i>)</p>

Standard Title	6 Life Processes
Strand 6.2	Matter and Energy Transformation:
Content Standard Statement	6.2.C All organisms, including plants, use the process of cellular respiration to transform stored energy in food molecules into usable energy. The energy produced is stored in the form of ATP and is used by organisms to conduct their life processes. Cellular respiration may require oxygen and adds carbon dioxide to the atmosphere. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Recognize that during photosynthesis, plants use energy from the sun and elements from the atmosphere and the soil to make specific compounds. Recognize that these compounds are used by living things as sources of matter and energy.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify the organelle where respiration takes place. Describe how the products of respiration are used by a plant or animal.</p> <p>Level 2 Items: Classify the reactants and products of the respiration equation.</p> <p>Level 3 Items: Explain why a plant releases CO<sub>2</sub> at night. Explain how trees are able to survive in the winter after they have lost their leaves.</p>

Standard Title	6 Life Processes
Strand 6.2	Matter and Energy Transformation:
Content Standard Statement	6.2.D Photosynthesis and cellular respiration are complementary processes resulting in the flow of energy and the cycling of matter in ecosystems. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Investigate and describe the complementary relationship (cycling of matter and the flow of energy) between photosynthesis and cellular respiration.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 2 Items: Describe the complementary relationship (cycling of matter and the flow of energy) between photosynthesis and cellular respiration.</p> <p>Level 3 Items: Explain why photosynthesis does not deplete the total level of CO<sub>2</sub> in the atmosphere.</p> <p>Level 4 Items: May ask students to view a graph that illustrates CO<sub>2</sub> levels in a closed system and, based on knowledge of what is IN that system, explain why the data reads as it does.</p>

Standard Title	6 Life Processes
Strand 6.3	Regulation and Behavior
Content Standard Statement	6.3.A The endocrine, nervous, and immune systems coordinate and help maintain homeostasis in humans and other organisms. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Recognize that as a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable despite changes in the outside environment.</li> <li>Illustrate how nerve cells communicate with each other to transmit information from the internal and external environment often resulting in physiological or behavioral responses.</li> <li>Draw a schematic to illustrate a positive and negative feedback mechanism that regulates body systems in order to help maintain homeostasis.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p><i>(Do not have student list the component parts of these three systems. The focus of this standard is on homeostasis.)</i> This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: State the function of the immune system.</p> <p>Level 2 Items: Compare/contrast nervous system to endocrine system in terms of rate of response. Match the system with the response that is invoked to maintain homeostasis in a given situation.</p>

<b>Standard Title</b>	<b>6 Life Processes</b>
Strand 6.3	Regulation and Behavior
Content Standard Statement	6.3.B Multi-cellular animals have nervous systems that generate behavioral responses. These responses result from interactions between organisms of the same species, organisms of different species, and from environmental changes. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Recognize that as a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable despite changes in the outside environment.</li> <li>Recognize that in order to help maintain the health of an organism, the immune system works in nonspecific ways (e.g., skin, mucous, membranes) and specific ways (e.g., antibody-antigen interactions.)</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Levels 2-3 Items: Identify something as being or not being evidence of a stimulus/response behavior.</p>

<b>Standard Title</b>	<b>6 Life Processes</b>
Strand 6.4	Life Processes and Technology
Content Standard Statement	6.4.A Certain chemicals, pathogens, and high energy radiation seriously impair normal cell functions and the health of the organism. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Describe how environmental factors (e.g., UV light or the presence of carcinogens or pathogens) alter cellular functions.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: State the function of the immune system or define homeostasis.</p> <p>Level 2 Items: Identify situations or items that can seriously impair cellular function.</p> <p>Level 3 Items: Explain how interruptions to normal cell function can alter the health of an organism.</p>

<b>Standard Title</b>	<b>6 Life Processes</b>
Strand 6.4	Life Processes and Technology
Content Standard Statement	6.4.B The scientific investigation of cellular chemistry enables the biotechnology industry to produce medicines, foods, and other products for the benefit of society. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Investigate how scientists use biotechnology to produce more nutritious food, more effective medicine, and new ways to mitigate pollution.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 2 Items: Describe how knowing what sorts of things damage specific bacterial structures is beneficial to the medical profession.</p> <p>Level 3 Items: Describe how people protect themselves from high-energy radiation (i.e., using sun block).</p>

<b>Standard Title</b>	<b>6 Life Processes</b>
Strand 6.4	Life Processes and Technology
Content Standard Statement	6.4.C Many drugs exert their effects by mimicking or increasing the production or destruction of neurotransmitters. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Investigate how drugs can affect neurotransmission.</li> <li>Explain how antibiotics (e.g., penicillin, tetracycline) kill bacterial cells without harming human cells due to differences between prokaryotic and eukaryotic cell structure.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 3 Items: Describe the effect of introducing a stimulant, depressant, or hallucinogenic drug into the human system. (This is more of a health standard than a specific 10<sup>th</sup> grade biology standard, but the content listed in this depth of knowledge question is valid given the students' exposure to the information in health classes.)</p>



Standard Title	6 Life Processes
Strand 6.4	Life Processes and Technology
Content Standard Statement	6.4.D Biotechnology is a growing international field of research and industry. Many scientists conduct cutting-edge research in biotechnology. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Investigate how scientists use biotechnology to produce more nutritious food, more effective medicine, and new ways to mitigate pollution.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 2 Items: State examples of how biotechnology affects society, i.e., genetically modified foods.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.1	Reproduction, Heredity, and Development
Content Standard Statement	7.1.A. Hereditary/genetic information in chromosomes is contained in molecules of DNA. Genes are sections of DNA that direct syntheses of specific proteins associated with traits in organisms. These consist of various combinations of four different nucleotides that encode this information through their sequences. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Describe the relationship between DNA, genes, chromosomes and proteins.</li> <li>Explain that a gene is a section of DNA that directs the synthesis of a specific protein associated with a specific trait in an organism.</li> <li>Trace how a DNA sequence, through transcription and translation, results in a sequence of amino acids.</li> <li>Demonstrate that when DNA replicates, the complementary strands separate and the old strands serve as a template for the new complementary strands. Recognize that this results in two identical strands of DNA that are exact copies of the original.</li> <li>Illustrate how a sequence of DNA nucleotides codes for a specific sequence of amino acids.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Define terms DNA, gene, protein, nucleotide.</p> <p>Level 2 Items: Describe the hierarchy of DNA base, gene, DNA molecule, chromosome, and nucleus (possibly as an analogy with letter, word, sentence).</p> <p>Level 3 Items: Describe how DNA structure determines amino acid sequence of a protein.</p>



Standard Title	7 Diversity and Continuity of Living Things
Strand 7.1	Reproduction, Heredity, and Development
Content Standard Statement	7.1.B Known patterns of inheritance can be used to make predictions about genetic variation. Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Use Punnett squares, including dihybrid crosses, and pedigree charts to determine probabilities and patterns of inheritance (i.e., dominant/recessive, co-dominance, sex-linkage, multi-allele inheritance).</li> <li>Analyze a karyotype to determine chromosome numbers and pairs. Compare and contrast normal and abnormal karyotypes.</li> <li>Explain how crossing over and Mendel’s Laws of Segregation and Independent Assortment contribute to genetic variation in sexually reproducing organisms.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 2 Items: Distinguish among dominance, recessiveness, and co-dominance.</p> <p>Level 3 Items: Use a Punnett square to interpret the results of a mating involving a sex linked gene and make predictions about characteristics of the offspring.</p> <p>Level 4 Items: Sample questions.</p> <div style="text-align: center;"> </div> <p>a.) Are spotted noses the result of a dominant or recessive gene? How do you know?</p> <p>b.) What are the genotypes of individuals Lady and Spike?</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.1	Reproduction, Heredity, and Development
Content Standard Statement	7.1.C Mutations in DNA of organisms normally occur spontaneously at low rates, but can occur at higher rates (i.e., exposure to pathogens, radiation, and some chemicals). Most mutations have no effect on the organism, but some may be beneficial or harmful depending on the environment. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Describe how exposure to radiation, chemicals and pathogens can increase mutations.</li> <li>Explain that mutations in the DNA sequence of a gene may or may not affect the expression of the gene. Recognize that mutations may be harmful, beneficial, or have no impact on the survival of the organism.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Given a short strand of DNA as the original, provide three or four "mutated" strands—have student identify that the most different strand from the original is the most likely to cause a mutation.</p> <p>Given short strand of DNA as the original, choose from amongst several that are not a mutation.</p> <p>Level 2 Items: Describe how accidental changes in genetic code might result in greater survival rates of a given species (or vice versa).</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.1	Reproduction, Heredity, and Development
Content Standard Statement	7.1.D Only random mutations in germ cells (gametes) can create the variation that is inherited by an organism's offspring. Somatic mutations are not inherited, but may lead to cell death, uncontrolled cell growth, or cancer. Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain that mutations in the DNA sequence of a gene may or may not affect the expression of the gene. Recognize that mutations may be harmful, beneficial, or have no impact on the survival of the organism.</li> <li>Explain how the type of cell (gamete or somatic) in which a mutation occurs determines heritability of the mutation.</li> <li>Predict the possible consequences of a somatic cell mutation.</li> <li>Describe the cell cycle as an orderly process that results in new somatic cells that contain an exact copy of the DNA that make up the genes and chromosomes found in the parent somatic cells.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Define cancer.</p> <p>Level 2 Items: Compare/contrast somatic v. germ line mutations.</p> <p>Level 3 Items: Explain how a somatic cell mutation can cause overproduction of a cell substance. Explain how a mutation can alter a DNA sequence but not affect cell products.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.1	Reproduction, Heredity, and Development
Content Standard Statement	7.1.E During the cell cycle, DNA of the parent cell replicates and the cell divides into two cells that are identical to the parent. This process is used for growth and repair of body tissues and for asexual reproduction. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain how the cell cycle contributes to reproduction and maintenance of the cell and/or organism.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment. Students will not be held accountable for the stages of mitosis.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Ask students to state the result of a cell undergoing mitosis.</p> <p>Level 2 Items: Describe the genetic makeup of two daughter cells that have recently resulted from a cell undergoing mitosis.</p> <p>Level 3 Items: Explain how a cut is able to "heal" and form new skin over time.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.1	Reproduction, Heredity, and Development
Content Standard Statement	7.1.F Meiosis is the production of sex cells (gametes). The production and release of these gametes is controlled by hormones. In meiosis, the number of chromosomes is reduced by one-half and chromosomes may randomly exchange homologous parts to create new chromosomes with combinations not necessarily found in the parent cell. This may increase variation within the species. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Recognize that during the formation of gametes, or sex cells (meiosis), the number of chromosomes is reduced by one-half, so that when fertilization occurs the diploid number is restored.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment. Students will NOT be held accountable for naming the stages of meiosis.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Require students to know how many daughter cells result from meiosis.</p> <p>Level 2 Items: Compare number of chromosomes of parent cell to daughter cells -or- number of chromosomes of meiotic cell v. mitotic cell in an organism.</p> <p>Level 3 Items: Explain how the process of meiosis promotes diversity in a species.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.1	Reproduction, Heredity, and Development
Content Standard Statement	7.1.G Upon fertilization, the fusion of the gametes restores the original chromosome number, and new gene combinations lead to increased genetic variation, which, in turn, increases the likelihood of survival of the species. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Compare and contrast the processes of growth (cell division) and development (differentiation).</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Ask students to know the number of chromosomes in the body cells of a parent organisms given the number of chromosomes in an egg cell or explain why meiosis ensures that humans always have 46 chromosomes in their somatic cells.</p> <p>Level 2 Items: Ask students to explain why meiosis is needed in sexual reproduction.</p> <p>Level 3 Items: Explain how sexual reproduction is essential to genetic variation.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.1	Reproduction, Heredity, and Development
Content Standard Statement	7.1.H The sex chromosomes contain different genes, and therefore, certain traits will show patterns of inheritance based on gender. Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain why sex-linked traits are expressed more frequently in males.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Recognize what it means for a trait to be sex-linked.</p> <p>Level 2 Items: Describe how a genetic disorder could be more likely in the male population than in the female population.</p> <p>Level 3 Items: Show the pedigree of a sex-linked trait and ask students to identify possible/likely reasons for the patterns of inheritance.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.1	Reproduction, Heredity, and Development
Content Standard Statement	7.1.I Embryological development in plants and animals involves a series of orderly changes in which cells divide and differentiate. Development is controlled by genes whose expression is influenced by internal factors (i.e., hormones) and may also be influenced by environmental factors (i.e., nutrition, alcohol, radiation, drugs, and pathogens). Alteration in this balance may interfere with normal growth and development. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Recognize that any environmental factor that influences gene expression or alteration in hormonal balance may have an impact on development.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Recognize that environmental factors can affect cell growth.</p> <p>Level 3 Items: Explain why X-rays may cause more damage to a fetus than to an adult.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.2	Diversity and Evolution
Content Standard Statement	7.2.A Evolution is a change in allelic frequencies of a population over time. The theory of evolution is supported by extensive biochemical, structural, embryological, and fossil evidence. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Recognize random mutation (changes in DNA) and recombination within gametes as the sources of heritable variations that give individuals within a species survival and reproductive advantage or disadvantage over others in the species.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify some sources of evidence for the theory of evolution.</p> <p>Level 2 Items: Describe how fossil evidence supports the theory of evolution; describe how pieces of evidence support the theory of evolution.</p> <p>Level 3 Items: Draw conclusions about evolutionary relationships if two specimens have DNA that is very similar in its code.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.2	Diversity and Evolution
Content Standard Statement	7.2.B The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms. The millions of different species of plants, animals, and microorganisms that live on Earth today are related by descent with modification from common ancestors. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain how biochemical evidence, homologous structures, embryological development and fossil evidence support or refute prior hypotheses of common ancestry.</li> <li>Explain how species evolve through descent with modification, thus allowing them to adapt to different environments.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p>This is a foundational standard that encompasses most other evolution standards. This standard is essential but may be tested in a very broad manner with more specific questions being identified with more specific standard statements.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Define evolution.</p> <p>Level 2 Items: Show several structures (e.g., homologous body structures or DNA fingerprints), some very similar, some very different, and ask students to identify two structures that appear to be closely related.</p> <p>Level 3 Items: Display a specific body structure and provide students with four or more “environments” in which they would expect to find that structure useful to an organism; or explain why biochemical evidence of evolutionary relationships may contradict evidence based on homologous structures or fossil evidence.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.2	Diversity and Evolution
Content Standard Statement	7.2.C The process of natural selection occurs when some heritable variations that arise from random mutation and recombination give individuals within a species some survival advantages over others. These offspring with advantageous adaptations are more likely to survive and reproduce, thus increasing the proportion of individuals within a population with advantageous characteristics. When populations become isolated, these changes may accumulate and eventually result in new species. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Analyze natural selection simulations and use data generated from them to describe how environmentally-favored traits are perpetuated over generations resulting in species survival, while less favorable traits decrease in frequency or may lead to extinction.</li> <li>Compare and contrast the role of sexual selection to the role of natural selection on the evolutionary process.</li> <li>Relate a population’s survival to the reproductive success of adapted individuals in that population.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Define natural selection.</p> <p>Level 2 Items: Given an example of two “versions” of the same species, identify which is most likely to survive and procreate in a given environment (illustrating an understanding of selective pressures).</p> <p>Level 3 Items: Given an example of population data of a species over time, infer an evolutionary relationship between special characteristics and population fluctuations.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.2	Diversity and Evolution
Content Standard Statement	7.2.D Evolution does not proceed at the same rate in all populations, nor does it progress in a linear or set direction. Environmental changes have a strong influence on the evolutionary process. Other factors that influence evolution include: sexual selection, mutation, genetic drift, and genetic modification. Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Describe that evolution involves changes in the genetic make-up of whole populations over time, not changes in the genes of an individual organism.</li> <li>Discuss how environmental pressure, genetic drift, mutation and competition for resources influence the evolutionary process. Recognize that a change in a species over time does not follow a set pattern or timeline.</li> <li>Explain the roles of geographical isolation and natural selection on the evolution of new species.</li> <li>Predict possible evolutionary implications for a population due to environmental changes over time (e.g., volcanic eruptions, global climate change, and industrial pollution).</li> <li>Explain why homogeneous populations may be more vulnerable to environmental changes than heterogeneous populations.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards. Note: the GLEs provide good examples of material that are testable.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: List of things that might cause evolution—they pick the item that is not a cause of evolution. Note: evolution is a result of variation and likelihood of that variation being transmitted to offspring. Asking about “things that cause evolution” may be misleading.</p> <p>Level 2 Items: Compare natural selection to genetic drift or kin selection as an evolutionary process.</p> <p>Level 3 Items: Given population data that illustrates a genetic drift or founder’s effect scenario, have students identify a reason for the proliferation of a gene within a population (e.g., tay sachs).</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.2	Diversity and Evolution
Content Standard Statement	7.2.E Organisms are classified into a hierarchy of groups and subgroups based on similarities in structure, comparisons in DNA and protein and evolutionary relationships. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain how evolutionary relationships between species are used to group organisms together.</li> <li>Explain how DNA evidence can be used to determine evolutionary relationships.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Relates percentage of DNA similarity to evolutionary relationship.</p> <p>Level 2 Items: Provide pictures of multiple organisms and have students choose the ones that should be grouped together. Ideally students would explain or be given multiple choice reasons for their decisions.</p> <p>Level 3 Items: Provide multiple strands of DNA nucleotide code and have students determine which two samples are most likely related evolutionarily—ideally they would explain or be given multiple choices to explain why their choice is correct.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.2	Diversity and Evolution
Content Standard Statement	7.2.F Genetically diverse populations are more likely to survive changing environments. Priority: Essential
Grade-Level Expectation(s)	
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 3 Items: Make predictions on the survival of a population that is genetically diverse versus one that is genetically similar.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.2	Diversity and Evolution
Content Standard Statement	7.2.G Biological evolution is the foundation for modern biology and is used to make predictions for medical, environmental, agricultural and other societal purposes. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain how antibiotic resistance populations evolve from common bacterial populations.</li> <li>Research how invasive species have genetically altered an indigenous population.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify genetic modification as a tool used by humans to manipulate their world for their own purposes.</p> <p>Level 3 Items: Provide population data that suggests that an invasive species has caused a shift in genetic tendencies of another organism—have students choose the most valid reason for this shift in genetics; or explain why overuse of antibiotics may lead to emergence of resistant pathogens.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.3	Technology Applications
Content Standard Statement	7.3.A The expanding ability to manipulate genetic material, reproductive processes, and embryological development creates choices that raise ethical, legal, social, and public policy questions. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Discuss examples of how genetic engineering technology can be applied in biology, agriculture and medicine in order to meet human wants and needs.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is a compact standard so it is expected that less emphasis will be placed upon this than essential or important standards.</p> <p><b>DOK (Depth of Knowledge)</b></p> <p>Level 1 Items: Give examples of how technology has been used to monitor or manipulate genetic, reproductive, or embryological processes (e.g., disease resistant plants, fertility treatment, fetal ultrasound monitoring)</p> <p>Level 3 Items: Provide students with a scenario of being able to choose the sex of your child “pre-conception”; provide four questions that relate to this scenario, and ask for the one that is most pertinent to public policy or ethics or legality, etc.; or explain opposing views of fetal stem cell research.</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.3	Technology Applications
Content Standard Statement	7.3.B Recombinant DNA technology, which is a form of genetic engineering, involves the insertion of DNA from one cell into a cell of a different organism where the inserted DNA is expressed. Genetic engineering is being applied in biology, agriculture, and medicine in order to meet human wants and needs. Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Investigate how the human ability to manipulate genetic material and reproductive processes can be applied to many areas of medicine, biology, and agriculture. Evaluate the risks and benefits of various ethical, social and legal scenarios that arise from this ability.</li> <li>Explain the basic process of bacterial transformation and how it is applied in genetic engineering.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Define genetic engineering.</p> <p>Level 2 Items: Identify different organisms that would be good or bad candidates for genetic engineering and why.</p> <p>Level 3 Items: Have students identify a genetic modification suggestion for an area that needs an increase in plant production within a harsh environment (e.g., drought resistant crops).</p> <p>Level 4 Items: Ask students to explain how genetic engineering can be used to mass produce a human biological product (e.g., insulin, clotting factor).</p>

Standard Title	7 Diversity and Continuity of Living Things
Strand 7.3	Technology Applications
Content Standard Statement	7.3.C DNA is analyzed to determine evolutionary relationships, study populations, identify individuals, and diagnose genetic disorders. Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain how DNA evidence can be used to determine evolutionary relationships.</li> <li>Explain how developments in technology (e.g., gel electrophoresis) have been used to identify individuals based on DNA as well as to improve the ability to diagnose genetic diseases.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 2 Items: Give reasons why DNA is a suitable chemical for identification of genetic and/or evolutionary relationships.</p> <p>Level 3 Items: Given a diagram of electrophoresis gels from a possible paternity test, determine the parentage of a test subject.</p>

Standard Title	2 Materials and Their Properties
Strand 2.1	Properties and Structures of Materials
Content Standard Statement	2.1.B Elements and compounds are pure substances. Elements cannot be decomposed into simpler materials by chemical reactions. Elements can react to form compounds. Elements and/or compounds may also be physically combined to form mixtures Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Observe formulas and diagrams of compounds found in food (fats, proteins, carbohydrates). Identify elements that comprise these compounds. (2.1.2)</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Determine the number of carbon atoms in <math>3C_6H_{12}O_6</math>. Identify elements important in biological molecules. Identify an element found in proteins not found in carbohydrates. Identify a structural diagram of glucose as a building block of complex carbohydrates. OR Describe how matter is conserved between the reactants and products of photosynthesis and/or cellular respiration</p> <p>Level 3 Items: Explain why carbon's bonding properties make it a good "backbone" for many biological molecules.</p> <p>Level 4 Items: Explain why a high protein diet over long periods of time may be dangerous for someone with kidney disease.</p>

Standard Title	2 Materials and Their Properties
Strand 2.3	Conservation of Matter
Standard Statement	2.3.A The total mass of the system remains the same regardless of how atoms and molecules in a closed system interact with one another, or how they combine or break apart. Priority: Essential
Grade Level Expectation(s)	<ul style="list-style-type: none"> <li>Identify the reactants and the products in equations that represent photosynthesis and cellular respiration. Explain how the equations demonstrate the Law of Conservation of Matter and Energy in terms of balanced equations.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Describe how matter is conserved between the reactants and products of photosynthesis and/or cellular respiration.</p> <p>Level 3 Items: Explain why a plant becomes appears to lose mass when placed in salt water for several hours.</p>

Standard Title	2 Materials and Their Properties
Strand 2.4	Chemical Reactions
Content Standard Statement	2.4.C The rate of a chemical reaction depends on the properties and concentration of the reactants, temperature, and the presence or absence of a catalyst. Priority: Essential
Grade-Level Expectation(s)	
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment. <i>This will be tested in terms of enzyme reactivity.</i></p> <p><b>Depth of Knowledge Categories</b></p> <p>Examples of cognitive levels:</p> <p>Level 1 Items: Describe the effect of raising reaction temperature on reaction rate (assuming no enzyme denaturation).</p> <p>Level 2 Items: Provide students with a description of environmental conditions in which an enzyme is functioning; provide four possible rates of reaction graphs and ask for the one that best describes what would happen in this situation.</p> <p>Level 3 Items: Give students a procedure for determining rate of an enzymatic reaction (e.g. amylase/starch reaction, test with iodine). Ask students how to interpret results.</p>



Standard Title	2 Materials and Their Properties
Strand 2.4	Chemical Reactions
Content Standard Statement	2.4.D Energy is transformed in chemical reactions. Energy diagrams can illustrate this transformation. Exothermic reactions release energy. Endothermic reactions absorb energy. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Identify the reactants and the products in equations that represent photosynthesis and cellular respiration. Explain how the equations demonstrate the Law of Conservation of Matter and Energy in terms of balanced equations. (2.3.1) (2.4.1)</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1: Given an energy diagram that includes values for kcal, determine (from the graph) kcal of energy absorbed or released (in other words, students must find the difference in energy from the beginning of the reaction and the end).</p> <p>Level 2: Explain that breaking bonds requires energy but forming bonds releases energy. (NOTE: This is also found in standard 3.1.6.)</p> <p>Look at an energy diagram and decide if energy is required for the reaction or released by the reaction.</p>

Standard Title	2 Materials and Their Properties
Strand 2.4	Chemical Reactions
Content Standard Statement	2.4.E A catalyst lowers the activation energy of a chemical reaction. The catalyst remains unchanged and is not consumed in the overall reaction. Enzymes are protein molecules that catalyze chemical reactions in living systems. Priority: Important
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Explain how enzymes permit low temperature chemical reactions to occur in cells.</li> <li>Investigate how various factors (temperature, pH, enzyme/substrate concentration) affect the rate of enzyme activity.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards.</p> <p>Emphasis should be on the role of enzymes in cellular metabolism and not digestion.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Define enzymes as biological catalysts or Identify enzymes as proteins.</p> <p>Level 2 Items: Identify catalytic characteristics of enzymes (e.g., specificity, reusability, susceptibility to conditions that disrupt protein structure) or explain why an enzyme is not included as a reactant or a product in a biochemical reaction.</p> <p>Show a chemical reaction on an energy diagram and ask students to identify the reaction as exothermic or endothermic.</p> <p>Level 3 Items: Explain why temperature and pH can affect an enzyme catalyzed reaction or explain why biological specimens (and/or food) are preserved by refrigeration in terms of enzyme activity.</p>

Standard Title	2 Materials and Their Properties
Strand 2.4	Chemical Reactions
Content Standard Statement	2.4.F Certain small molecules (monomers) react with one another in repetitive fashion (polymerization) to form long chain macromolecules (polymers). The properties of the macromolecules depend on the properties of the molecules used in their formation and on the lengths and structure of the polymer chain. Polymers can be natural or synthetic. Priority: Compact
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Expectation: Use molecular models to explain how carbon atoms uniquely bond to one another to form a large variety of molecules, including those necessary for life (e.g., polysaccharides, polypeptides). (2.4.6)</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an important standard so it is expected that less emphasis will be placed upon this standard in the assessment than is on essential standards.</p> <p>Students need to understand that large molecules (polymers) are made of smaller molecules (monomers) and should not be held accountable for the terms dehydration synthesis or hydrolysis.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify the monomers of a large polymer—i.e., protein is made from amino acids or items identify structural diagrams of monomers that are the building blocks of biological polymers.</p> <p>Level 2 Items: Show an equation for a biological reaction that begins with multiple monomers and results in a smaller number of polymer products. Ask students to identify the reactants and products and identify where the material came from to produce the polymer.</p> <p>Level 3 Items: Suggest reasons why the cell benefits by storing sugars as a polysaccharide.</p>

Standard Title	3 Energy and Its Effects
Strand 3.1	Forms and Sources of Energy
Content Standard Statement	3.1.F Chemical energy is derived from the making and breaking of chemical bonds. Priority: Essential
Grade-Level Expectation(s)	
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Define “biological energy” as a form of chemical energy.</p> <p>Level 2 Items: Explain that breaking bonds requires energy but forming bonds releases energy. Prepare an energy diagram of a biological reaction and ask students to identify the reaction as endothermic or exothermic.</p> <p>Level 3 Items: Relate a net gain or loss of energy from a biological reaction to the end result being achieved (i.e., photosynthesis and cell respiration as energy storing or energy releasing summative reactions). Explain how a series of biochemical reactions (a pathway) may release energy overall even if individual reactions require energy.</p>

<b>Standard Title</b>	<b>3 Energy and Its Effects</b>
Strand 3.3	The Transformation and Conservation of Energy
Content Standard Statement	3.3.A Energy cannot be created nor destroyed. Energy can be transferred from one object to another and can be transformed from one form to another, but the total amount of energy never changes. Recognizing that energy is conserved, the processes of energy transformation and energy transfer can be used to understand the changes that take place in physical systems. Priority: Essential
Grade-Level Expectation(s)	
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify types/examples of biological energy transformations (e.g., photosynthesis as solar to chemical).</p> <p>Level 2 Items: Provide energy-illustrating diagrams and ask students to identify the net gain (endothermic) of energy to the system or the net “loss” (exothermic) of energy from the system.</p> <p>Level 3 Items: Have students relate a net gain or loss of energy from a biological reaction to the end result being achieved (i.e., photosynthesis and cell respiration as energy storing or energy releasing summative reactions).</p>

<b>Standard Title</b>	<b>1 The Nature and Application of Science and Technology</b>
Strand 1.1	Understandings and Abilities of Scientific Inquiry
Content Standard Statement	1.1.A Understand that: Scientists conduct investigations for a variety of reasons including to explore new phenomena, to replicate other’s results, to test how well a theory predicts, to develop new products, and to compare theories. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Be able to: identify and form questions that generate a specific testable hypothesis that guide the design and breadth of the scientific investigation.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify a question as scientifically testable or not.</p> <p>Level 3 Items: Compare two or more hypotheses on a related question and evaluate which is the best hypothesis.</p>

<b>Standard Title</b>	<b>1 The Nature and Application of Science and Technology</b>
Strand 1.1	Understandings and Abilities of Scientific Inquiry
Content Standard Statement	1.1.B Understand that: Science is distinguished from other ways of knowing by the use of empirical observations, experimental evidence, logical arguments, and healthy skepticism. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Be able to: design and conduct valid scientific investigations to control all but the testable variable in order to test a specific hypothesis.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Identify variables and controls in an experiment scenario. Identify a statement as either an qualitative, quantitative observation, or an inference.</p> <p>Level 2 Items: Compare two experimental designs and identify the better design (add explanation to up to level 3).</p> <p>Level 3 Items: Evaluate a scientific procedure/process for validity; or select a scientific method to best address different types of scientific studies. Suggest using field or observational research, correlation studies, or cause/effect. Which method would be best to determine if humans that smoke develop lung cancer at a greater rate than nonsmokers? Which method would be best to determine the effect of a hormone on plant cell growth? How could you best determine the preferred food source for a species of bird?</p>

<b>Standard Title</b>	<b>1 The Nature and Application of Science and Technology</b>
Strand 1.1	Understandings and Abilities of Scientific Inquiry
Content Standard Statement	1.1.C Understand that: theories in science are well-established explanations of natural phenomena that are supported by many confirmed observations and verified hypotheses. The application of theories allows people to make reasonable predictions. Theories may be amended to become more complete with the introduction of new evidence. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Be able to: collect accurate and precise data through the selection and use of tools and technologies appropriate to the investigations. Display and organize data through the use of tables, diagrams, graphs, and other organizers that allow analysis and comparison with known information and allow for replication of results.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 1 Items: Define theory.</p> <p>Level 2 Items: Contrast the layperson's definition and use of the word theory to a scientist's definition and use of the word theory or distinguish a theory from a hypothesis, idea, or other scientific statement.</p> <p>Level 3 Items: Explain why theories may change over time.</p> <p>Level 4 Items: Compare data from two related experiments then evaluate if the data is confirming or contradictory (with explanations).</p>

<b>Standard Title</b>	<b>1 The Nature and Application of Science and Technology</b>
Strand 1.1	Understandings and Abilities of Scientific Inquiry
Content Standard Statement	1.1.D Understand that: investigating most real-world problems requires building upon previous scientific findings and cooperation among individuals with knowledge and expertise from a variety of scientific fields. The results of scientific studies are considered valid when subjected to critical review where contradictions are resolved and the explanation is confirmed. Priority: Essential
Grade-Level Expectation(s)	<ul style="list-style-type: none"> <li>Be able to: Construct logical scientific explanations and present arguments which defend proposed explanations through the use of closely examined evidence.</li> </ul>
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 2 Items: Compare and contrast two sets of data regarding variables and controls used and quality of information obtained.</p> <p>Level 3 Items: Given background information and data from several researchers' experiments involving the effect of fertilizers on plant growth, reach a conclusion about the most effective fertilizer and give supporting evidence.</p> <p>Level 4 Items: Given data from the above experiments, select the most appropriate fertilizer in certain circumstances and considering specific parameters (e.g., cost, ease of use, environmental impact versus relative efficacy).</p>

Standard Title	1 The Nature and Application of Science and Technology
Strand 1.1	Understandings and Abilities of Scientific Inquiry
Content Standard Statement	<p>1.1.E. Understand that: in communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge. (American Association for the Advancement of Science, 2001)</p> <p>Priority: Essential</p>
Grade-Level Expectation(s)	Be able to: communicate and defend the results of scientific investigations using logical arguments and connections with the known body of scientific information.
Clarifications and Cognitive Level(s) Expected	<p>This is an essential standard so it is expected that this will be a focus on the assessment.</p> <p><b>Depth of Knowledge Categories</b></p> <p>Level 4 Items: Analyze data such as:</p> <ul style="list-style-type: none"> <li>Maps with volcano and earthquake locations;</li> <li>Fossil finds of similar animals on different continents; and</li> <li>Patterns of antibiotic use and antibiotic resistant bacteria.</li> </ul> <p>Use data, historical knowledge, reading passages, Darwin excerpts, the theories of Plate Tectonics, and the Theory of Natural Selection to explain and relate these geologic and biologic patterns.</p>