

# APS DISTRICT HIGH SCHOOL SCIENCE CURRICULUM FRAMEWORK

Course Title: Anatomy and Physiology Course Number: 44115

Department: Science ADS Number: 17134944

Prerequisites: Biology I and Chemistry I are highly recommended.

Length of Course: One Year Credit/PRI Area: .50 per Sem/Elective Grade Level(s): 11-12

## *Important Notes:*

**COURSE DESCRIPTION:** Anatomy and Physiology is a survey course of study directed through the anatomical and physiological systems of humans. This laboratory course\* is designed for the student interested in health occupations and in how the body works. The student explores the structure and function of systems and how each contributes to the complete homeostasis of the body, including integumentary, skeletal, muscular, nervous, circulatory, digestive, renal, respiratory, and reproductive. The student also participates in the examination of cells, histology, and basic chemistry as it applies to the study of physiology. Dissection is required for the anatomy portion of the course.

\* Lab Courses: A minimum of 250 minutes per week of directed class activity for 36 weeks, 40% of which must be lab oriented, for a total of 150 clock hours (90 hours of class plus 60 hours of lab) shall be required for one (1) unit of credit, excluding passing period. [APS Procedural Directives, Section I – Instruction, Basis for offering credit].

References in parentheses following each performance standard refer to and are aligned with the State of New Mexico Science Standards (NM), and the Albuquerque Public Schools Language Arts Standards (APS-LA).

**STRATEGIES:**

The “Illustrations” column in the *Program of Studies* provides exemplars of the performance standards, strategies, and best practices suggested by the science teachers in the Albuquerque Public Schools (APS).

**ASSESSMENTS:**

Assessments may include the following: authentic and performance-based assessment, cooperative learning, teacher observations, checklists, tests and exams, formal and informal writing, small group and full class discussions, oral and multimedia presentations, projects, demonstrations, and portfolios. Assessments are based on appropriate rubrics.

**SUGGESTED TEXTBOOKS AND INSTRUCTIONAL MATERIALS:**

- *Essentials Of Human Anatomy And Physiology* By Elaine Nicpon Marieb; (Benjamin-Cummings Publishing Company; 2002)
- *Fundamentals of Anatomy and Physiology* by Frederic H. Martini, Kathleen Welch, Claire W. Garrison; (Benjamin-Cummings Publishing Company; 2003)
- *Human Anatomy and Physiology* by Elaine N. Marieb, Jon Mallatt, Matt Hutchinson; (Benjamin-Cummings Publishing Company; 2003)
- *Human Anatomy & Physiology Laboratory Manual, Cat Version, Media Update with PhysioEx 4.0* by Elaine N. Marieb, Linda S. Kollett, Lelaine N. Marieb; (Benjamin-Cummings Publishing Company; 2002)
- *Mammalian Anatomy: The Cat* by Aurora M. Sebastiani, Dale W. Fishback, Aurora Sebastiani; (Morton Publishing Company; 1998)
- *Pictorial Anatomy of the Cat* by Stephen G. Gilbert; (University of Washington Press; 1997)
- *Human Anatomy and Physiology Instructors Resource Guide* by Elaine N. Marieb (publisher information unavailable)
- *Human Anatomy and Physiology Testbank* by Elaine N. Marieb (Pearson Education, 1995)
- *Human Anatomy and Physiology Full Color Acetate Transparencies* by Elaine N. Marieb (publisher information unavailable)
- *Human Anatomy and Physiology Study Guide* by Elaine N. Marieb (Addison Wesley Longman; 1998)
- *Anatomy and Physiology Coloring Workbooks* by Elaine N. Marieb (Pearson Education; 1996)
- *The Anatomy Coloring Book* by Wynn Kapit and Lawrence M. Elson (Pearson Education; 1993)

**SUGGESTED TITLES/AUTHORS WEB SITES:**

- <http://www.biointeractive.org/> - virtual labs
- [www.webmd.com](http://www.webmd.com)
- <http://www.nih.gov> - National Institute of Health
- [http:// www.nlm .org](http://www.nlm.org) National Library of Medicine

Approved by HSCA: 12/04 .

**STRAND I: SCIENTIFIC THINKING AND PRACTICE**

**CONTENT STANDARD:** The student understands the processes of scientific investigations and uses inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.

**BENCHMARK:** The student uses accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.

| GRADE<br>11-12 | PERFORMANCE STANDARDS  | ILLUSTRATIONS   |
|----------------|--|---|
|                | <ol style="list-style-type: none"><li>1. Describes the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions (NM I.I.I.1).</li><li>2. Uses appropriate technologies to collect, analyze, and communicate scientific data (e.g., computers, calculators, balances, microscopes) (NM I.I.I.3).</li><li>3. Uses scientific reasoning and valid logic to recognize (NM I.I.II.2):<ul style="list-style-type: none"><li>• cause and effect, and</li><li>• potential bias.</li></ul></li><li>4. Examines investigations of current interest in science (e.g., superconductivity, molecular machines, age of the universe) (NM I.I.II.5).</li></ol> | <p><b>NOTE: Illustrations include suggested activities for attaining each performance standard. A check (✓) refers to a key feature to look for while assessing student performance.</b></p> <ol style="list-style-type: none"><li>1. When dissecting, the student uses scalpels, scissors, probes, and other equipment appropriately, safely, and follows dissection guidelines provided by the teacher.<ul style="list-style-type: none"><li>✓ choice of proper tool</li><li>✓ accurate dissection</li><li>✓ adherence to safety guidelines</li></ul></li><li>2. The student uses microscopes to compare different types of tissues.<ul style="list-style-type: none"><li>✓ correct focusing of the microscope</li><li>✓ accurate drawings</li><li>✓ ability to identify tissues</li></ul></li><li>3. The student uses various technology (i.e., PhysioEx CD from the <i>Human Anatomy and Physiology</i> textbook by Marieb) and completes the interactive lab on osmosis and facilitated diffusion to learn about cell membranes and cell processes.<ul style="list-style-type: none"><li>✓ analysis of lab results and correct answers of questions</li><li>✓ correct observance of procedures in computer program</li></ul></li><li>4. The student reads various articles on a specific topic and analyzes the information for reliability.<ul style="list-style-type: none"><li>✓ summation of article (who, what, where, when, why)</li><li>✓ written opinion paper of content in article</li></ul></li></ol> |

| <b>GRADE<br/>11-12</b> | <b>PERFORMANCE STANDARDS</b>  | <b>ILLUSTRATIONS</b>   |
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|                        | <p>5. Examines the scientific processes and logic used in investigations of past events (e.g., using data from crime scenes, fossils), investigations that can be planned in advance but are only done once (e.g., expensive or time consuming experiments such as medical clinical trials), and investigations of phenomena that can be repeated easily and frequently (NM I.I.II.6).</p> <p>6. Identifies and applies measurement techniques and considers possible effects of measurement errors (NM I.I.III.4).</p> | <p>5. The student actively participates in a lecture given by a guest speaker who is currently involved in relevant medical research.</p> <ul style="list-style-type: none"> <li>✓ demonstration of active listening skills</li> <li>✓ preparation of interview questions ahead of time</li> <li>✓ summation of and reaction to guest speaker points</li> </ul> <p>6. The student takes blood pressure readings and recognizes acceptable values and identifies variables that might affect the reading.</p> <ul style="list-style-type: none"> <li>✓ correct reading of blood pressure</li> <li>✓ proper use of equipment</li> <li>✓ understanding of acceptable values</li> <li>✓ correct analysis of the relationship between the reading to the life style of the participant</li> </ul> |

**STRAND II: THE CONTENT OF SCIENCE-LIFE****CONTENT STANDARD:** The student understands the properties, structures, and processes of living things and the interdependence of living things and their environments.**BENCHMARK:** The student understands the characteristics, structures, and functions of cells.

| GRADE<br>11-12 | PERFORMANCE STANDARDS  | ILLUSTRATIONS  |
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|                | <ol style="list-style-type: none"> <li>1. Understands variation within and among species, including (NM II.II.1.9):               <ul style="list-style-type: none"> <li>• mutations.</li> </ul> </li> <br/> <li>2. Knows that specialized structures inside cells in most organisms carry out different functions, including (NM – II.II.III.2):               <ul style="list-style-type: none"> <li>• parts of a cell and their functions (e.g., nucleus, chromosomes, plasma, and mitochondria).</li> </ul> </li> <br/> <li>3. Describes the mechanisms for cellular processes (e.g., energy production and storage, transport of molecules, waste disposal, synthesis of new molecules) (NM II.II.III.3).</li> <br/> <li>4. Knows how the cell membrane controls which ions and molecules enter and leave the cell based on membrane permeability and transport (i.e., osmosis, diffusion, active transport, passive transport) (NM II.III.4).</li> <br/> <li>5. Describes how most cell functions involve chemical reactions, including (NM II.II.III.7):               <ul style="list-style-type: none"> <li>• promotion or inhibition of biochemical reactions by enzymes, and</li> <li>• communication from cell to cell by secretion of a variety of chemicals (e.g., hormones).</li> </ul> </li> </ol> | <ol style="list-style-type: none"> <li>1. The student carries out a simulated ABO blood lab (e.g., Ward’s <i>Biology</i>) and recognizes variations among the American population with regard to blood group.               <ul style="list-style-type: none"> <li>✓ accurate analysis of results of lab</li> <li>✓ active participation in a class discussion about frequency of different human blood types</li> <li>✓ solution of the problem presented in the lab (e.g., who are the parents of the child, who committed the crime.)</li> </ul> </li> <br/> <li>2. The student constructs a cell model, accurately labeling the various organelles, and writes analogies for the functions of each organelle.               <ul style="list-style-type: none"> <li>✓ accurate representation of the parts of a cell</li> <li>✓ correct labeling of organelles</li> <li>✓ written analogies that precisely demonstrate an understanding of the functions of each organelle</li> </ul> </li> <br/> <li>3, 4. See Strand I, Illustration 3.</li> <br/> <li>5. The student draws a diagram accurately showing where protein, lipid, and carbohydrate digestion begins, what enzymes are associated with these reactions, and the products of these reactions.               <ul style="list-style-type: none"> <li>✓ correct citations of which organs are responsible for each type of digestion</li> <li>✓ exact showing of which enzymes are responsible for each reaction</li> <li>✓ correct showing of the structure of the products of the enzyme-catalyzed reaction.</li> </ul> </li> </ol> |

| GRADE<br>11-12 | PERFORMANCE STANDARDS | ILLUSTRATIONS   |
|----------------|-----------------------|---|
|                |                       | <p style="text-align: center;">OR</p> <p>The student participates in a discussion about what would happen at a synapse if one introduced an agent (e.g., pesticide) that blocked the activity of chemically gated sodium and potassium channels.</p> <ul style="list-style-type: none"> <li>✓ accurate responses to questions directed by teacher or peers</li> <li>✓ reasonable conclusions about neural reactions in the presence of different types of agents</li> </ul> |

**STRAND III: THE CONTENT OF SCIENCE - LIFE - ANATOMY AND PHYSIOLOGY**

**CONTENT STANDARD:** The student understands the characteristics, structures, and functions of organs and organ systems, and the fundamental processes associated with the physiology of the human body.

- BENCHMARKS:**
- A. The student explores the integumentary, skeletal, and muscular systems, and relates the structures of the various parts to the functions they serve.
  - B. The student investigates methods of body control by the nervous system.
  - C. The student investigates the structure and function of the cardiovascular system with an emphasis on the blood and heart.
  - D. The student investigates the respiratory, digestive, and urinary systems of the body and relates the structures of the various components of the systems to the functions that they serve associated with gas exchange, absorption, and excretion of materials.
  - E. The student investigates the male and female reproductive systems and relates the structures of the various organs to the functions they serve.
  - F. The student explores the organizational structures of the body from the molecular to the organism level.

| GRADE<br>11-12 | PERFORMANCE STANDARDS   | ILLUSTRATIONS   |
|----------------|---|---|
|                | <ul style="list-style-type: none"><li>1. Identifies the components of the integumentary system and explains the physiological mechanisms that make the functions of this system possible.</li><br/><li>2. Identifies the bones and their parts that make up the skeletal system, and relates the physiological mechanisms that help the skeletal system fulfill its functions.</li><br/><li>3. Identifies the various kinds of muscles, major muscles of the body, and explains the physiology of muscle contraction.</li></ul> | <ul style="list-style-type: none"><li>1. The student draws and labels different components of the dermis and epidermis and identifies the function of each component.<ul style="list-style-type: none"><li>✓ accurate drawings</li><li>✓ correct labeling</li><li>✓ correct identification of functions</li></ul></li><br/><li>2. The student accurately assembles a disarticulated skeleton and identifies each bone therein and answers questions regarding structure or function of these bones.<ul style="list-style-type: none"><li>✓ correct assemblage in demonstrations</li><li>✓ correct identification of bones</li><li>✓ correct responses to questions</li></ul></li><br/><li>3. The student dissects a cat and identifies muscle groups, attachments, origins, and insertion points and the action produced by the contraction of specific muscles.<ul style="list-style-type: none"><li>✓ demonstration of respect for deceased cat</li><li>✓ correct identification of muscle groups, attachments, origin and insertion points</li><li>✓ explanation of action produced by contraction</li></ul></li></ul> |

| GRADE<br>11-12 | PERFORMANCE STANDARDS  | ILLUSTRATIONS  |
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|                | <p>4. Investigates the anatomy and physiology of the brain and its associated coverings.</p> <p>5. Describes the structure and function of neurons and their supporting glial cells.</p> <p>6. Investigates the physiology of electrochemical impulses and neural integration.</p> <p>7. Investigates organs utilized by the body for perception of external stimuli and to the maintenance of homeostasis.</p> <p>8. Identifies the molecular and cellular components of the blood.</p> | <p>4. The student creates a butcher paper cap on which he/she diagrams the major areas of the brain. He/She then participates in an interactive lecture about physiology of the areas while pointing to the proper places on his/her caps.</p> <ul style="list-style-type: none"> <li>✓ accurate diagram of brain</li> <li>✓ participation in lecture</li> <li>✓ correct location of brain areas</li> <li>✓ understanding of brain physiology in question and answer session</li> </ul> <p>5. In groups the student acts out the functioning of neurons by creatively exhibiting nodes of Ranvier, dendrites, axons, synaptic terminals, cell body, and communication across synapse kinesthetically.</p> <ul style="list-style-type: none"> <li>✓ correct line up to represent neurons</li> <li>✓ the action at each part of the neuron accurately represents the action exhibited by the cell</li> </ul> <p>6. The student uses a Van de Graff generator to imitate a nerve impulse by static electricity going from one student to another, resulting in a release of neurotransmitters in the form of paper confetti at the end of the chain of students.</p> <ul style="list-style-type: none"> <li>✓ the explanation of how each component of the line represents a neuron</li> <li>✓ active demonstration of the functioning of a typical neuron</li> </ul> <p>7. The student conducts a taste and olfactory reception lab by the following:</p> <ul style="list-style-type: none"> <li>• tasting foods with his/her eyes closed,</li> <li>• drying his/her tongue and then putting sugar on it,</li> <li>• smelling one oil while tasting another to see which is perceived as taste,</li> <li>• mapping his/her tongue for various tastes,</li> <li>• putting ice cubes on his/her tongue and then tasting something again to determine if there is a change,</li> <li>• answering lab questions correctly,</li> <li>• developing an accurate conclusion about the effect of smell on the sense of taste, and</li> <li>• carrying out lab procedures correctly.</li> </ul> <p>8. Using a microscope, the student distinguishes between the different components of the blood.</p> <ul style="list-style-type: none"> <li>✓ correct drawings from microscope slides</li> <li>✓ precise labeling of drawings</li> </ul> |

| <b>GRADE<br/>11-12</b> | <b>PERFORMANCE STANDARDS</b>   | <b>ILLUSTRATIONS</b>  |
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|                        | <p>9. Describes the functions of the blood within the human body.</p> <p>10. Demonstrates an understanding of the anatomy of the heart, its external coverings, and the flow of blood through the heart.</p> <p>11. Elucidates the biochemical and physiological nature of the heart's functions.</p> <p>12. Describes the structure of blood vessels.</p> <p>13. Describes the physiological basis of circulation and blood pressure.</p> | <p>9. The student performs a case study involving a genetic disorder of the blood and determines from the disorder what long-term and short-term effects result from this disorder.</p> <ul style="list-style-type: none"> <li>✓ answers to questions in the case study</li> <li>✓ citation of resources</li> <li>✓ accurate conclusions about effects on various organ systems</li> </ul> <p>10. The student dissects a sheep heart and traces the flow of blood through the heart identifying the major chambers, valves, and blood vessels involved.</p> <ul style="list-style-type: none"> <li>✓ proper technique to dissect the heart</li> <li>✓ chambers, valves, and blood vessels pointed out by name</li> <li>✓ ability to show the direction of blood flow throughout the heart</li> </ul> <p>11. The student looks at different EKGs and describes which part of the intrinsic conduction system is malfunctioning. The student visits the Howard Hughes Medical Institute Interactive Cardiology Lab online and solves a case study involving pedigrees, EKGs, MRIs, ultrasounds, and auscultation as a class.</p> <ul style="list-style-type: none"> <li>✓ accurate responses to questions in the interactive lab</li> <li>✓ correct determination from what disorder the patient is suffering</li> </ul> <p>12. The student visits a university cadaver lab and compares the structure of arteries and veins by touch and sight.</p> <ul style="list-style-type: none"> <li>✓ use of medical gloves to feel veins and arteries</li> <li>✓ correct identification of which vessels are veins and which are arteries</li> <li>✓ explanation of why veins and arteries look and feel different</li> </ul> <p>13. The student listens to a lecture provided by a health professional (e.g., school nurse or nursing assistant) about the background on blood pressure and a demonstration of how to take a blood pressure. The student then practices using sphygmomanometers and accurately taking blood pressure.</p> <ul style="list-style-type: none"> <li>✓ active listening skills</li> <li>✓ adherence of correct technique for taking blood pressure</li> <li>✓ accurate measurement of blood pressure</li> </ul> |

| GRADE<br>11-12 | PERFORMANCE STANDARDS   | ILLUSTRATIONS   |
|----------------|---|---|
|                | <p>14. Demonstrates the role of the cardiovascular system in maintaining homeostasis.</p> <p>15. Identifies the organs and tissues of the respiratory system and describes their functions.</p> <p>16. Summarizes the physical principles governing the movement of air into the lungs and the diffusion of gases into and out of the lungs.</p> <p>17. Identifies the major organs of the digestive and urinary systems.</p> <p>18. Observes the gross anatomy and functional histology of each organ within the digestive and urinary systems.</p> <p>19. Describes mechanisms of digestion and absorption within the body.</p> | <p>14. The student views portions of <i>Hemo the Magnificent</i> DVD and then answers questions regarding the cardiovascular system, including precapillary sphincters, the pumping mechanism of the heart, brain control of distribution, and its relationship to homeostasis.</p> <ul style="list-style-type: none"> <li>✓ explanation of the functioning of the valves and four chambers of the mammalian heart</li> <li>✓ explanation of how pre-capillary sphincters function (i.e., why it really isn't a good idea to swim right after eating)</li> <li>✓ written description of homeostatic control of blood distribution</li> </ul> <p>15, 16. The student takes a field trip to or participates in a videoconference with Lovelace Respiratory Research Institute focused on the structure and function of the respiratory system.</p> <ul style="list-style-type: none"> <li>✓ preparation of interview questions in advance</li> <li>✓ interaction with professionals in an adult manner</li> <li>✓ description of lung function in a summary report at the end of the meeting</li> </ul> <p>17, 18. The student dissects the digestive and urinary systems of a cat, identifying the major organs of each system and their accessory organs. He/She explores the microscopic anatomy by dissecting each organ and looking at slides.</p> <ul style="list-style-type: none"> <li>✓ ability to point out each organ involved in digestion and urine formation</li> <li>✓ identification of various types of tissue on slides involved in the primary functioning of these organs</li> <li>✓ written explanation on how each tissue completes its function</li> </ul> <p>19. With a group the student designs a board game for 9-11 year old children that appropriately teaches the structure and function of the digestive system. The game board requirements include illustrations and questions that players are required to answer regarding different parts or functions of the digestive system. Each group evaluates another group's game for creativity, accuracy and age-level appropriateness.</p> <ul style="list-style-type: none"> <li>✓ age-appropriate game design</li> <li>✓ accurate facts</li> <li>✓ colorful and entertaining game board</li> <li>✓ educational content</li> <li>✓ collaboration/teamwork</li> </ul> |

| GRADE<br>11-12 | PERFORMANCE STANDARDS  | ILLUSTRATIONS   |
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|                | <p>20. Explains how nutrition and metabolism are interrelated.</p> <p>21. Explains the role of the urinary system in body waste management.</p> <p>22. Identifies the structures and related functions of the male and female reproductive systems.</p> <p>23. Identifies the organ systems of the human body and the major components of each system.</p> | <p>20, 27. The student reads the article, "Rebuilding the Food Pyramid," January 2003 by Walter C. Willett and Meir J. Stampfe found in <i>Scientific American</i> and writes a reaction paper in response to the article.</p> <ul style="list-style-type: none"> <li>✓ analysis of how the new pyramid is different from what he/she has previously heard</li> <li>✓ description of how eating habits can be improved</li> </ul> <p>21. The student creates a book for children ages 5 to 7 that addresses one of two issues, "How urine is formed" or "How the kidney works." The book requirements include a 10-page length with illustrations, a cover, a title page, author's name, illustrator's name, and a bibliography.</p> <ul style="list-style-type: none"> <li>✓ accurate facts</li> <li>✓ age appropriate interest level</li> <li>✓ entertaining presentation</li> <li>✓ educational content</li> </ul> <p>22. The student researches a topic relating to the male or female reproductive system (e.g., various causes of infertility in males and females and how fertility can be enhanced, or latest advances in birth control and their mechanisms).</p> <ul style="list-style-type: none"> <li>✓ accurate facts</li> <li>✓ correct relation of the functions of the various organs to the mechanism being researched</li> <li>✓ correct grammar and citations</li> <li>✓ follow directions for paper</li> <li>✓ logical order of paper flow</li> <li>✓ appropriate reasoning in reaching a conclusion</li> </ul> <p>23. The student identifies the major organ systems on the human body and their components on a torso model.</p> <ul style="list-style-type: none"> <li>✓ ability to point to various organs when asked to do so</li> <li>✓ ability to identify to which organ system each organ belongs</li> </ul> |

| GRADE<br>11-12 | PERFORMANCE STANDARDS  | ILLUSTRATIONS  |
|----------------|--|--|
|                | <p>24. Describes how positive and negative feedback mechanisms are involved in homeostatic regulation and their significance for living organisms.</p> <p>25. Applies correct anatomical terminology when discussing the orientation of body parts and regions.</p> <p>26. Distinguishes among the major types of chemical reactions that are important for studying physiology.</p> <p>27. Discusses the structures and functions of carbohydrates, lipids, proteins, nucleic acids, and high-energy compounds.</p> <p>28. Identifies the four major tissue types of the body and their structure and function.</p> | <p>24. Presented with a variety of scenarios, the student recognizes and differentiates between positive and negative feedback mechanisms and their components and describes the cause and effect of changes associated with feedback loops.</p> <ul style="list-style-type: none"> <li>✓ prediction of what must happen in order for homeostasis to be maintained</li> <li>✓ ability to diagram a positive feedback loop</li> <li>✓ ability to diagram a negative feedback loop</li> <li>✓ identification of what components of metabolism are maintained by positive or negative feedback mechanisms (i.e., blood clotting is positive, body temperature regulation is negative)</li> </ul> <p>25. The student creates labels for anatomical and body orientation terms and accurately places these labels on either a doll or a drawing to illustrate his/her understanding.</p> <ul style="list-style-type: none"> <li>✓ correct placement of labels</li> <li>✓ correct spelling of anatomical terms correctly</li> <li>✓ use of all required terms</li> </ul> <p>26, 27. The student constructs models of carbohydrates, proteins, lipids, and nucleic acids and demonstrates synthesis and hydrolysis reactions.</p> <ul style="list-style-type: none"> <li>✓ correct construction of models of the various molecules</li> <li>✓ demonstration of how condensation reactions link two monomers</li> <li>✓ demonstration of how a polymer can be broken apart by hydrolysis</li> </ul> <p>28. The student constructs a tissue flowchart including categories of tissues with components and function of each.</p> <ul style="list-style-type: none"> <li>✓ accurate division of tissue types into each of four general categories</li> <li>✓ realistic representation of each tissue type</li> <li>✓ correct citation functions of each type of tissue</li> </ul> |

**STRAND IV: SCIENCE AND SOCIETY**

**CONTENT STANDARD:** The student understands how scientific discoveries, inventions, practices, and knowledge influence and are influenced by individuals and societies.

**BENCHMARK:** The student examines and analyzes how scientific discoveries and their applications affect the world and explains how societies influence scientific investigations and applications.

| GRADE<br>11-12 | PERFORMANCE STANDARDS   | ILLUSTRATIONS   |
|----------------|---|---|
|                | <ol style="list-style-type: none"><li>1. Knows how science enables technology but also constrains it, and recognizes the difference between real technology and science fiction (e.g., rockets vs. antigravity machines, nuclear reactors vs. perpetual-motion machines, medical X-rays vs. Star-Trek tricorders) (NM – III.I.I.1).</li><li>2. Understands how advances in technology enable further advances in science (e.g., microscopes and cellular structure, telescopes and understanding of the universe) (NM – III.I.I.2).</li><li>3. Evaluates the influences of technology on society (e.g., communications, petroleum, transportation, nuclear energy, computers, medicine, genetic engineering) including both desired and undesired effects, and including some historical examples (e.g., the wheel, the plow, the printing press, the lightning rod) (NM – III.I.I.3).</li><li>4. Understands that applications of genetics can meet human needs and can create new problems (e.g., agriculture, medicine, cloning) (NM – III.I.I.5).</li></ol> | <ol style="list-style-type: none"><li>1, 3. See Strand III, Illustration set 17, 18.</li><li>2. See Strand I, Illustration 2.</li><li>4. The student constructs a family medical history on the death of family members to include date of death, age of the individual at death, the cause of death, if known, and any other medical conditions or complications. He/She draws any conclusion possible on how the information reflected in the medical history might affect his/her life span and quality of health. This information, along with data such as average age of death and major cause of death by gender in the family, should be included. The student should attempt to answer the following question based on the medical history information: How long do you think you will live compared to the national average?<ul style="list-style-type: none"><li>✓ links natural causes of death and lifespan to genetics</li><li>✓ detailed written family medical history</li><li>✓ conclusion based on available evidence</li></ul></li></ol> |

| GRADE<br>11-12 | PERFORMANCE STANDARDS   | ILLUSTRATIONS   |
|----------------|---|---|
|                | <p>5. Identifies how science has produced knowledge that is relevant to individual health and material prosperity (NM – III.I.I.15).</p> <p>6. Understands that scientists have characteristics in common with other individuals (e.g., employment and career needs, curiosity, desire to perform public service, greed, preconceptions and biases, temptation to be unethical, core values including honesty and openness) (NM – III.I.I.18).</p> <p>7. Knows that science plays a role in many different kinds of careers and activities (e.g., public service, volunteers, public office holders, researchers, teachers, doctors, nurses, technicians, farmers, ranchers) (NM – III.I.I.19).</p> | <p>5. The student researches and orally presents findings on current advances in cancer treatment and compares those to the treatments of a decade ago.</p> <ul style="list-style-type: none"> <li>✓ recognition and utilization of reliable sources of information</li> <li>✓ a presentation that shows an understanding of the changes in treatment during the specified time period</li> <li>✓ demonstration of an awareness of the level of the audience</li> <li>✓ clear and concise description of treatments</li> </ul> <p>6, 7. The student participates in career exploration, via guest speakers or library resources, researching various fields (e.g., research, dentistry, nursing, medical technology, veterinary medicine). He/She examines the following:</p> <ul style="list-style-type: none"> <li>• job description,</li> <li>• education/training,</li> <li>• New Mexico salary,</li> <li>• average national salary, and</li> <li>• job outlook/trends complete and accurate research information.</li> </ul> <p><b>For guest speaker:</b></p> <ul style="list-style-type: none"> <li>✓ active listening skills (for guest speaker)</li> <li>✓ justification for best choice and worst choice</li> <li>✓ interview questions and answers</li> <li>✓ analysis of information from interviews</li> </ul> <p><b>For research:</b></p> <ul style="list-style-type: none"> <li>✓ research conventions (notes, outlining, summarizing, final draft)</li> <li>✓ citation of sources</li> <li>✓ presentation of findings</li> </ul> |

**STRAND V: LITERACY****CONTENT STANDARD:** The student communicates scientific principles through reading, writing, and speaking opportunities.**BENCHMARK:** The student demonstrates proficiency in reading comprehension, specialized vocabulary, and a variety of writing and speaking requirements.

| GRADE<br>11-12 | PERFORMANCE STANDARDS  | ILLUSTRATIONS  |
|----------------|--|--|
|                | <ol style="list-style-type: none"> <li>1. Develops and demonstrates proficiency with the following strategies to approach reading for information across content areas: (APS – LA I.1):               <ul style="list-style-type: none"> <li>• scans reading selection to determine whether a text contains relevant information,</li> <li>• uses the headings and subheadings of the material to make predictions and to validate comprehension of text,</li> <li>• reads and rereads to decode meaning, and</li> <li>• reviews and summarizes essential elements of text for overview.</li> </ul> </li> <li>2. Identifies and uses roots, prefixes, and suffixes to determine meaning of words (APS – LA I.4).</li> <li>3. Uses textual evidence to develop and support an interpretation of a scientific process or concept (APS – LA II.2).</li> <li>4. Develops increased competence in using the writing process to create a final product (APS – LA III.1).</li> <li>5. Develops increased competence in using elements of effective writing (APS – LA III.2).</li> </ol> | <ol style="list-style-type: none"> <li>1. The student reads the textbooks and other reading material applying various strategies and shows comprehension through class discussion and written work.               <ul style="list-style-type: none"> <li>✓ notes in outline format from textbook while reading</li> <li>✓ responses to questions at the end of a section or chapter after reading the text</li> <li>✓ active participation in class discussion about reading topic</li> </ul> </li> <li>2. The student completes worksheets to develop proficiency with certain Latin and Greek roots, prefixes, and suffixes, and later decodes words containing these elements.               <ul style="list-style-type: none"> <li>✓ correct definition of word roots, prefixes, and suffixes</li> <li>✓ ability to figure out what words made of known roots, prefixes, and suffixes mean</li> <li>✓ use of roots, prefixes, and suffixes to 'create' words that make logical sense</li> </ul> </li> <li>3. The student uses laboratory dissection manuals appropriately and develops conclusions based on information on those manuals.               <ul style="list-style-type: none"> <li>✓ proper dissection technique</li> <li>✓ adheres to lab manual guidelines (i.e., removes tissue, opens organs, and separates muscles)</li> </ul> </li> <li>4 – 6. See Strand III, Illustration 22.</li> </ol> |

| GRADE<br>11-12 | PERFORMANCE STANDARDS   | ILLUSTRATIONS   |
|----------------|---|---|
|                | <p>6. Supports an informed opinion: (APS – LA III.6):</p> <ul style="list-style-type: none"> <li>• uses appropriate language, reasoning, and organizational structure for the audience and purpose,</li> <li>• provides relevant and convincing reasons, uses various types of evidence, and</li> <li>• demonstrates an awareness of possible questions, concerns, or counterarguments</li> </ul> <p>7. Responds to a variety of written, electronic, and other media (APS – LA III.7).</p> <p>8. Develops increased competence with speaking and language conventions (APS – LA IV.3).</p> | <p>7. The student responds in written form to a variety of materials available in class (e.g., vital signs articles in <i>Discovery</i> magazines, CD-Roms that accompany textbooks, websites (<a href="http://www.webmd.com">www.webmd.com</a> <a href="http://www.nih.gov">http://www.nih.gov</a> - National Institute of Health and National Library of Medicine).</p> <ul style="list-style-type: none"> <li>✓ written evidence of developing an informed opinion</li> <li>✓ ability to access various materials, given the proper tools</li> <li>✓ reponse to specific questions about reading</li> </ul> <p>8. See Strand IV, Illustration set 5 or set 6, 7.</p> |