## Statewide Framework Document for: 260102

**Standards may be added to this document prior to submission, but may not be removed from the framework to meet state credit equivalency requirements.** Performance assessments may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. **This course is eligible for 1 credit of laboratory science.** The Washington State Science Standards performance expectations for high school blend core ideas (Disciplinary Core Ideas, or DCIs) with scientific and engineering practices (SEPs) and crosscutting concepts (CCCs) to support students in developing usable knowledge that can be applied across the science disciplines. These courses are to be taught in a three-dimensional manner. The details about each performance expectation can be found at Next Generation Science Standards, and the supporting evidence statements can be found under Resources.

# Biomedical Sciences

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| **Course Title: Biomedical Sciences** | | **Total Framework Hours: 180** |
| **CIP Code: 260102** | ☒Exploratory ☐Preparatory | **Date Last Modified: May 5, 2015** |
| **Career Cluster: Health Science** | | **Cluster Pathway: Biotechnology Research and Development** |
| **Eligible for Equivalent Credit in: ☐ Math ☒ Science** | | **Total Number of Units: 6** |

## Course Overview

**Summary**:
This course provides an introduction to the biomedical sciences through engaging hands-on projects and problems. Students investigate the human body systems and various health conditions including heart disease, diabetes, sickle-cell disease, and infectious diseases. They determine the factors that lead to the death of a fictional person, and investigate lifestyle choices and medical treatments that might have prolonged the person's life. The activities and project introduce students to human physiology, medicine, research processes, and bioinformatics. Key biological concepts are embedded in the curriculum, including homeostasis, metabolism, inheritance of traits, and defense against disease. Engineering principles are also incorporated, including the design process, feedback loops, and the relationship of structure to function. This course is designed to provide an overview of all the courses in the Biomedical Sciences program and lay the scientific foundation for subsequent courses.

This framework contains a copyrighted curriculum through Project Lead the Way® (PLTW). This framework may only be used by PLTW member schools and trained teachers. This framework is based upon the PLTW Principles of Biomedical Sciences detailed outline.

| Unit 1: The Mystery | Total Learning Hours for Unit: 35 |
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**Unit Summary:**
Unit one provides the foundation and develops the theme for the course. Students are engaged by reading about a woman, Anna Garcia, who is found dead in her home. Students investigate the scene, gather evidence, and then move to the lab to analyze their findings. Through their examination of key evidence, students learn notebook organization, observation and documentation skills, as well as the fundamentals of experimental design. Students are introduced to the structure of DNA and investigate how basic molecular biology techniques can be used to connect suspects with a crime scene. Students also discuss the bioethics of scientific research and explore the bounds of HIPAA legislation. In each unit of the course, students obtain additional medical history information for Anna as well as details from her autopsy report as they explore the various illnesses she encountered throughout her life. Students will maintain a medical file for Anna Garcia, compile their ideas and findings over the duration of the course, and ultimately determine her cause of death in the final unit.

Lesson1.1: Investigating the Scene

1. Principles of biomedical science can be used to investigate the circumstances surrounding a mysterious death.
2. Experiments are designed to find answers to testable questions.

Lesson 1.2: DNA Analysis

1. Human DNA is a unique code of over three billion base pairs that provides a genetic blueprint of an individual.
2. DNA is packaged as chromosomes, which each contain numerous genes or segments of DNA sequence that code for traits.
3. DNA from all living organisms has the same basic structure – the differences are in the sequences of the nucleotides.
4. Restriction enzymes recognize and cut specific sequences in DNA.
5. Gel electrophoresis separates DNA fragments based on size and is used in Restriction Fragment Length Polymorphism (RFLP) analysis.

Lesson 1.3: The Findings

1. The purpose of an autopsy is to answer any questions about the illness, cause of death, and/or any coexisting conditions.
2. Determining the manner of death involves the investigation of many aspects, including the medical condition of the victim, the internal and external examination of the body, the chemical and microscopic analysis of tissues and body fluids, and the analysis of all evidence found at the scene.
3. A comprehensive set of standards and practices is necessary in order to give patients specific rights regarding their personal health information.

**Performance Assessments:**
*Additional performance assessments may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.*

Lesson 1.1: Investigating the Scene
*It is expected that students will:*

- Recognize that processing a crime scene involves purposeful documentation of the conditions at the scene and the collection of any physical evidence.
- Describe how evidence at a crime scene, such as blood, hair, fingerprints, and shoeprints, can help forensic investigators determine what might have occurred and help identify or exonerate potential suspects.
- Recognize that bloodstain patterns left at a crime scene can help investigators establish the events that took place during the crime.
- Recognize that all external variables in an experiment need to be controlled.
- Analyze key information.

Lesson 1.2: DNA Analysis
*It is expected that students will:*

- Describe the relationship between DNA, genes, and chromosomes.
- Describe the structure of DNA.
- Describe the structure of nucleotides.

- Explain how restriction enzymes cut DNA.
- Describe how gel electrophoresis separates DNA fragments.
- Recognize that gel electrophoresis can be used to examine DNA differences between individuals.
- Demonstrate how restriction enzymes work.

Lesson 1.3: The Findings
*It is expected that students will:*

- Describe how an autopsy is performed and the types of information it provides to officials regarding the manner and cause of death.
- Recognize that a variety of biomedical science professionals are involved in crime scene analysis and the determination of manner of death in mysterious death cases.
- Interpret information from an autopsy report to predict the manner of death.
- Explain the importance of confidentiality when dealing with patients, and describe the major patient protections written into the Health Insurance Portability and Accountability Act (HIPPA).
- Analyze patient confidentiality scenarios.

**Leadership Alignment:**

- Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed within the class for all students.
- The event, activity, or project and the associated 21st Century Skill should be clearly articulated.
  Example: Students will demonstrate the ability to communicate clearly through their group project presentation.

Students will demonstrate the ability to work effectively and respectfully with diverse teams. Students will work think creatively in laboratory activities such as the blood splatter lab and while creating a model of DNA. Students will access and evaluate information as they collect and analyze crime scene evidence. They will work to solve problems and reason effectively in order to make claims concerning persons of interest.

## *Industry Standards and Competencies*

**National Healthcare Foundation Standards and Accountability Criteria:**
Foundation Standard 1: Academic Foundation
Healthcare professionals will know the academic subject matter required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in a health science program of study.

1.1 Human Structure and Function
- 1.11 Classify the basic structural and functional organization of the human body (tissue, organ, and system).
- 1.13 Analyze the basic structure and function of the human body.

1.2 Diseases and Disorders
- 1.21 Research common diseases and disorders of each body system (prevention, pathology, diagnosis, and treatment).

1.3 Medical Mathematics
- 1.31 Apply mathematical computations related to healthcare procedures (metric and household, conversions and measurements).
- 1.32 Analyze diagrams, charts, graphs, and tables to interpret healthcare results.

Foundation Standard 2: Communications
Healthcare professionals will know the various methods of giving and obtaining information. They will communicate effectively, both orally and in writing.

2.1 Concepts of Effective Communication
- 2.11 Interpret verbal and nonverbal communication.
- 2.12 Identify barriers to communication.
- 2.13 Report subjective and objective information.

2.14 Interpret the elements of communication using a basic sender-receiver-feedback model.
2.15 Apply speaking and active listening skills.

2.3 Written Communication Skills

2.31 Critique elements of written and electronic communication (spelling, grammar, and formatting).
2.32 Prepare examples of technical, informative, and creative writing.

Foundation Standard 3: Systems

Healthcare professionals will understand how their role fits into their department, their organization and the overall healthcare environment. They will identify how key systems affect services they perform and quality of care.

3.1 Healthcare Delivery Systems

3.11 Understand the healthcare delivery system (public, private, government, and non-profit).
3.12 Describe the responsibilities of consumers within the healthcare system.

Foundation Standard 4: Employability Skills

Healthcare professionals will understand how employability skills enhance their employment opportunities and job satisfaction. They will demonstrate key employability skills and will maintain and upgrade skills, as needed.

4.1 Personal Traits of the Healthcare Professional

4.11 Classify the personal traits and attitudes desirable in a member of the healthcare team.
4.12 Summarize professional standards as they apply to hygiene, dress, language, confidentiality and behavior.

4.3 Career Decision-making

4.31 Discuss levels of education, credentialing requirements, and employment trends in healthcare.
4.32 Compare careers within the health science career pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).

4.4 Employability Preparation

4.41 Develop components of a personal portfolio.

Foundation Standard 5: Legal Responsibilities

Healthcare professionals will understand the legal responsibilities, limitations, and implications of their actions within the healthcare delivery setting. They will perform their duties according to regulations, policies, laws and legislated rights of clients.

5.1 Legal Implications

5.11 Analyze legal responsibilities and limitations.

5.2 Legal Practices

5.21 Apply standards for the privacy and confidentiality of health information (HIPAA).
5.23 Summarize the essential characteristics of a patient's basic rights within a healthcare setting.

Foundation Standard 6: Ethics

Healthcare professionals will understand accepted ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment. They will perform quality healthcare delivery.

6.1 Ethical Practice

6.13 Use procedures for reporting activities and behaviors that affect the health, safety, and welfare of others.

Foundation Standard 7: Safety Practices

Healthcare professionals will understand the existing and potential hazards to clients, co-workers, and self. They will prevent injury or illness through safe work practices and follow health and safety policies and procedures.

7.1 Infection Control

7.11 Explain principles of infection control.

7.12 Assess methods of controlling the spread and growth of microorganisms.

7.2 Personal Safety

7.21 Apply personal safety procedures based on Occupational Safety and Health Administration (OSHA) and Centers for Disease Control (CDC) regulations.

7.3 Environmental Safety

7.31 Apply safety techniques in the work environment.

7.4 Common Safety Hazards

7.42 Comply with safety signs, symbols, and labels.

Foundation Standard 8: Teamwork

Healthcare professionals will understand the roles and responsibilities of individual members as part of the healthcare team, including their ability to promote the delivery of quality healthcare. They will interact effectively and sensitively with all members of the healthcare team.

8.1 Healthcare Teams

8.11 Understand roles and responsibilities of team members.

8.12 Recognize characteristics of effective teams.

8.2 Team Member Participation

8.21 Differentiate creative methods for building positive team relationships.

8.2 Team Member Participation

8.23 Apply effective techniques for managing team conflict.

Foundation Standard 11: Information Technology Applications

Healthcare professionals will use information technology applications required within all career specialties. They will demonstrate use as appropriate to healthcare applications.

11.1 Health Information Literacy and Skills

11.11 Identify methods and types of data collected in healthcare.

11.2 Privacy and Confidentiality of Health Information

11.21 Apply the fundamentals of privacy and confidentiality policies and procedures.

11.22 Identify legal and regulatory requirements related to the use of personal health information.

11.23 Identify and apply policies and procedures for access and disclosure of personal health information.

11.24 Describe the consequences of inappropriate use of health data in terms of disciplinary action.

11.3 Basic Computer Literacy Skills

11.31 Apply basic computer concepts and terminology in order to use computers and other mobile devices.

11.32 Demonstrate basic computer operating procedures.

11.33 Demonstrate use of file organization and information storage.

11.34 Use basic word processing, spreadsheet, and database applications.

11.35 Evaluate the validity of web-based resources.

11.36 Demonstrate use of appropriate email and social media usage.

## *Aligned Washington State Standards*

**Washington Science Standards (Next Generation Science Standards):**

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

**Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):**
The local district must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

**Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL**
ALL BLANK DIMENSIONS BELOW MUST BE ADDED AT LOCAL LEVEL

| Science and Engineering Practice | Disciplinary Core Idea | Crosscutting Concept |
|---|---|---|
| Planning and Carrying Out Investigations | LS1A: Structure and Function | Cause and Effect |
| Planning and Carrying Out Investigations | PS4C: Information Technologies and Instrumentation | Systems and System Models |
| Using Mathematics and Computational Thinking | PS3B: Conservation of Energy and Energy Transfer | Energy and Matter: Flows, Cycles, and Conservation |
| Asking Questions and Defining Problems | | Patterns |
| Analyzing and Interpreting Data | | |
| Obtaining, Evaluating, and Communicating Information | | |

**Washington English Language Arts Standards (Common Core State Standards) - Science and Technology Literacy Standards (Grades 9-10):**

RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

| Unit 2: Diabetes | Total Learning Hours for Unit: 41 |
|---|---|

**Unit Summary:**
Students walk through Anna Garcia's diagnosis of diabetes by completing simulated laboratory tests. Given results of the tests, students can deduce the basic biology of both Type 1 and Type 2 diabetes. Students investigate the connection between insulin and glucose and discuss how feedback systems in the body regulate the function of key hormones. Students investigate the biochemical makeup of food and complete experiments to demonstrate the relationship between energy and food. As students explore diabetes, they are introduced to basic chemistry, the structure and function of macromolecules, and the relationship of these molecules to metabolic function. The causes, symptoms, treatments and side effects of diabetes are studied, as well as the life style implications associated with this disease.

Lesson 2.1: What is Diabetes?

1. Diabetes is a disorder characterized by high blood glucose levels and caused by insufficient insulin or the inability of the insulin to function properly.
2. Diabetes can be diagnosed and further characterized as Type 1 or Type 2 by measuring glucose and insulin levels in the blood or urine.
3. The human body uses feedback mechanisms to maintain homeostasis.
4. It is important to evaluate a source of information to ensure the information is accurate and unbiased.

Lesson 2.2: The Science of Food

1. Foods contain macromolecules, particularly carbohydrates, lipids, and proteins, which are broken down and reassembled for use in the human body.
2. The human body uses nutrients, vitamins, and minerals consumed in food to maintain overall health and homeostasis.
3. Energy is stored in the chemical bonds of the macromolecules found in food.

Lesson 2.3: Life with Diabetes

1. Diabetes affects the overall health of the individual as well as aspects of daily life.
2. Blood glucose concentration affects osmosis, the movement of water in and out of body cells.
3. Type 1 and Type 2 diabetes can cause significant complications in many human body systems.
4. Scientists need to make sure that what they present is accurate and is communicated in a way that keeps interest and focus.

**Performance Assessments:**
*Additional performance assessments may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.*

Lesson 2.1: What is Diabetes?
*It is expected that students will:*

- Recognize that insulin is the protein that regulates the transfer of glucose into body cells.
- Recognize that blood glucose levels are regulated by the feedback action of the hormones insulin and glucagon.
- Graph laboratory blood glucose and insulin level data and interpret results.
- Compare Type 1 and Type 2 diabetes.
- Demonstrate the role of insulin in transferring glucose from blood into cells.
- Diagram the feedback relationship of blood glucose and the hormones insulin and glucagon.
- Evaluate web resources to determine their level of credibility.

Lesson 2.2: The Science of Food
*It is expected that students will:*

- Describe which foods are high in carbohydrates, lipids, and proteins.
- Recognize that the nutritional content of food helps individuals make decisions about diet and maintain good health.
- Describe basic nutritional terms as well as identify the role of each nutrient in the body.

- Recognize that the structure of macromolecules is related to their function in the human body.
- Explain the process of calorimetry and how it is used to measure the amount of energy in food.
- Analyze food labels and food choices for nutritional content.
- Demonstrate the processes of dehydration, synthesis, and hydrolysis.
- Perform calorimetric measurements on food items and interpret the results.

Lesson 2.3: Life with Diabetes
*It is expected that students will:*

- Recognize that a wide variety of treatment and management medical interventions are available to diabetics.
- Recognize that regulation of blood sugar is necessary to avoid severe and life-threatening diabetic emergencies.
- Be able to advise a patient newly diagnosed with diabetes on treating and living with the disease.
- Compare Type 1 and Type 2 diabetes.
- Demonstrate how water moves across a cell membrane to balance level of dissolved solutes on either side.
- Diagram complications of diabetes on a human body graphic organizer.
- Assess the qualities of a successful oral and visual presentation.

**Leadership Alignment:**

- Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed within the class for all students.
- The event, activity, or project and the associated 21st Century Skill should be clearly articulated.
  Example: Students will demonstrate the ability to communicate clearly through their group project presentation.

Students will apply technology effectively as a tool to research, organize, evaluate, and communicate information. Students conduct research on different careers involved in the health sciences. For example, in the diabetes unit, students research the position of endocrinologist.

Students will manage projects in order to produce their blood, glucose, and diabetes model. Students collaborate with others as they design, create, and present their project. Students communicate clearly in a variety of forms and contexts as they diagram and present specific complications due to diabetes to the entire class. Students will make judgments and decisions as they evaluate websites to determine their credibility while researching the treatment and management of diabetes.

## *Industry Standards and Competencies*

**National Healthcare Foundation Standards and Accountability Criteria:**
Foundation Standard 1: Academic Foundation
Healthcare professionals will know the academic subject matter required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in a health science program of study.

1.1 Human Structure and Function
- 1.11 Classify the basic structural and functional organization of the human body (tissue, organ, and system).
- 1.13 Analyze the basic structure and function of the human body.

1.2 Diseases and Disorders
- 1.21 Research common diseases and disorders of each body system (prevention, pathology, diagnosis, and treatment).
- 1.23 Investigate biomedical therapies as they relate to the prevention, pathology, and treatment of disease.

1.3 Medical Mathematics
- 1.31 Apply mathematical computations related to healthcare procedures (metric and household, conversions and measurements).
- 1.32 Analyze diagrams, charts, graphs, and tables to interpret healthcare results.

Foundation Standard 2: Communications
Healthcare professionals will know the various methods of giving and obtaining information. They will communicate effectively, both orally and in writing.

- 2.1 Concepts of Effective Communication
  - 2.11 Interpret verbal and nonverbal communication.
  - 2.13 Report subjective and objective information.
  - 2.14 Interpret the elements of communication using a basic sender-receiver-feedback model.
  - 2.15 Apply speaking and active listening skills.
  - 2.16 Modify communication to meet the needs of the patient/client and to be appropriate to the situation.
- 2.2 Medical Terminology
  - 2.21 Use roots, prefixes, and suffixes to communicate information.
- 2.3 Written Communication Skills
  - 2.31 Critique elements of written and electronic communication (spelling, grammar, and formatting).
  - 2.32 Prepare examples of technical, informative, and creative writing.

Foundation Standard 4: Employability Skills
Healthcare professionals will understand how employability skills enhance their employment opportunities and job satisfaction. They will demonstrate key employability skills and will maintain and upgrade skills, as needed.

- 4.1 Personal Traits of the Healthcare Professional
  - 4.11 Classify the personal traits and attitudes desirable in a member of the healthcare team.
  - 4.12 Summarize professional standards as they apply to hygiene, dress, language, confidentiality and behavior.
- 4.3 Career Decision-making
  - 4.31 Discuss levels of education, credentialing requirements, and employment trends in healthcare.
  - 4.32 Compare careers within the health science career pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).

Foundation Standard 7: Safety Practices
Healthcare professionals will understand the existing and potential hazards to clients, co-workers, and self. They will prevent injury or illness through safe work practices and follow health and safety policies and procedures.

- 7.3 Environmental Safety
  - 7.31 Apply safety techniques in the work environment.
- 7.4 Common Safety Hazards
  - 7.42 Comply with safety signs, symbols, and labels.

Foundation Standard 8: Teamwork
Healthcare professionals will understand the roles and responsibilities of individual members as part of the healthcare team, including their ability to promote the delivery of quality healthcare. They will interact effectively and sensitively with all members of the healthcare team.

- 8.1 Healthcare Teams
  - 8.11 Understand roles and responsibilities of team members.
- 8.2 Team Member Participation
  - 8.21 Differentiate creative methods for building positive team relationships.
  - 8.23 Apply effective techniques for managing team conflict.

Foundation Standard 9: Health Maintenance Practices
Healthcare professionals will understand the fundamentals of wellness and the prevention of disease processes. They will practice preventive health behaviors among the clients.

- 9.1 Healthy Behaviors

9.11 Apply behaviors that promote health and wellness.
9.12 Describe strategies for the prevention of diseases including health screenings and examinations.
9.13 Investigate complementary (alternative) health practices as they relate to wellness and disease prevention.

Foundation Standard 11: Information Technology Applications
Healthcare professionals will use information technology applications required within all career specialties. They will demonstrate use as appropriate to healthcare applications.

11.1 Health Information Literacy and Skills
11.11 Identify methods and types of data collected in healthcare.
11.3 Basic Computer Literacy Skills
11.31 Apply basic computer concepts and terminology in order to use computers and other mobile devices.
11.32 Demonstrate basic computer operating procedures.
11.33 Demonstrate use of file organization and information storage.
11.34 Use basic word processing, spreadsheet, and database applications.
11.35 Evaluate the validity of web-based resources.

## *Aligned Washington State Standards*

**Washington Science Standards (Next Generation Science Standards):**
Next Generation Science Standards: Life Sciences
HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

**Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):**
The local district must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

**Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL**
ALL BLANK DIMENSIONS BELOW MUST BE ADDED AT LOCAL LEVEL

| Science and Engineering Practice | Disciplinary Core Idea | Crosscutting Concept |
|---|---|---|
| Analyzing and Interpreting Data | ETS1A: Defining and Delimiting an Engineering Problem | Systems and System Models |
| Analyzing and Interpreting Data | LS1C: Organization for Matter and Energy Flow in Organisms | Cause and Effect |
| Analyzing and Interpreting Data | LS3B: Variation of Traits | Cause and Effect |
| Analyzing and Interpreting Data | PS3D: Energy in Chemical Processes and Everyday Life | Energy and Matter: Flows, Cycles, and Conservation |
| Planning and Carrying Out Investigations | LS1A: Structure and Function | Systems and System Models |
| Planning and Carrying Out Investigations | LS1B: Growth and Development of Organisms | Structure and Function |
| Planning and Carrying Out Investigations | LS1C: Organization for Matter and Energy Flow in Organisms | Systems and System Models |
| Using Mathematics and Computational Thinking | LS3B: Variation of Traits | Structure and Function |
| | ETS1C: Optimizing the Design Solution | |
| | PS1B: Chemical Reactions | |
| | PS2B: Types of Interactions | |
| | PS3B: Conservation of Energy and Energy Transfer | |

**Washington English Language Arts Standards (Common Core State Standards) - Science and Technology Literacy Standards (Grades 9-10):**
RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

## Unit 3: Sickle Cell Disease | Total Learning Hours for Unit: 28

**Unit Summary:**
Students learn basic concepts of genetics and inheritance as they explore Anna Garcia's struggle with sickle cell disease. Students examine sickled red blood cells under a microscope and learn what life is like with the disease by reading and writing patient diary entries. They simulate the process of protein synthesis, examine the assembly of the protein hemoglobin, and demonstrate how sickle cell disease results from a mutation that alters a protein product.

Lesson 3.1: The Disease
1. Sickle cell disease is caused by an abnormal type of hemoglobin that causes red blood cells to become shaped like crescents or sickles.
2. Sickle cell disease and anemia cause many health problems and affect daily life for someone with the disease.

Lesson 3.2: It's In The Genes
1. Proteins are produced through the processes of transcription and translation.
2. Changes in the genetic material may cause changes in the structure and function of a protein and consequently the traits of an organism.

Lesson 3.3: Chromosomes
1. Chromosomes transfer genetic material from cell to cell as well as from generation to generation, in processes called mitosis and meiosis.
2. There are often several forms of each gene, some being dominant over the others.
3. There are many moral, ethical, and legal considerations surrounding the right to a person's tissues and organs.

Lesson 3.4: Inheritance
1. The expression of a trait through the generations of a family can be visualized using a pedigree.
2. A Punnett square is a simple graphical way of discovering all of the potential combinations of genotypes of an offspring and can be used to determine the percent chance of each genotype occurring.

**Performance Assessments:**
*Performance assessments may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.*

Lesson 3.1: The Disease
*It is expected that students will:*
- Explain the function of each of the major components of blood.

- Recognize that anemia is a deficiency in red blood cells or hemoglobin.
- Recognize that a hematocrit, a test performed to determine if someone is anemic, is the percent of the volume of whole blood that is composed of red blood cells.
- Compare normal vs. sickle-shaped red blood cells.
- Demonstrate how sickle-shaped red blood cells lead to decreased oxygen flow to body tissues.
- Create diary entries for a sickle cell patient and reflect on what living with sickle cell anemia is like.

Lesson 3.2: It's In The Genes
*It is expected that students will:*
- Recognize that the sequence of nucleotides in DNA determines the sequence of amino acids in a protein.
- Explain the process of protein synthesis.
- Explain how changes in the b-globin protein are due to the mutation associated with sickle cell disease.
- Demonstrate transcription and translation to create a simulated protein.
- Analyze the effect that base pair mutations have on a simulated protein.
- Manipulate computer-simulated protein to visualize the interactions between amino acids and analyze protein structural changes.

Lesson 3.3: Chromosomes
*It is expected that students will:*
- Recognize that in order for cellular division to occur, exact copies of the DNA must be transferred to the resulting daughter cells.
- Recognize that chromosomes in reproductive cells contain numerous genes that carry traits through the generations.
- Demonstrate the processes of mitosis and meiosis.
- Model the inheritance of genetic diseases.
- Analyze genotype to determine phenotype.
- Use proper techniques to examine, count, and measure chromosomes.
- Apprise the rights a person has to the use of his or her tissues and/or organs.

Lesson 3.4: Inheritance
*It is expected that students will:*
- Explain how pedigrees can be used to determine the mode of inheritance of genetic diseases.
- Draw and analyze pedigree charts to illustrate passage of a trait through generations.
- Determine and compare the experimental probability and the theoretical probability of inheriting a trait.
- Analyze pedigrees to calculate the probability of inheriting a trait or disease.

**Leadership Alignment:**
- Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed within the class for all students.
- The event, activity, or project and the associated 21st Century Skill should be clearly articulated.
  Example: Students will demonstrate the ability to communicate clearly through their group project presentation.

Students will communicate clearly while engaging in the debate surrounding the commodification or commercialization of human body parts. They will complete a speech containing a claim with clear evidence on the ownership of body parts and debate what should or should not be able to be sold for profit.

Students will access and evaluate information when they analyze gel electrophoresis obtained from restriction fragment length polymorphisms of Anna Garcia's family members. They will use and manage this information to create a pedigree.

## *Industry Standards and Competencies*

**National Healthcare Foundation Standards and Accountability Criteria:**

Foundation Standard 1: Academic Foundation

Healthcare professionals will know the academic subject matter required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in a health science program of study.

- 1.1 Human Structure and Function
  - 1.13 Analyze the basic structure and function of the human body.
- 1.2 Diseases and Disorders
  - 1.21 Research common diseases and disorders of each body system (prevention, pathology, diagnosis, and treatment).
  - 1.23 Investigate biomedical therapies as they relate to the prevention, pathology, and treatment of disease.
- 1.3 Medical Mathematics
  - 1.31 Apply mathematical computations related to healthcare procedures (metric and household, conversions and measurements).
  - 1.32 Analyze diagrams, charts, graphs, and tables to interpret healthcare results.

Foundation Standard 2: Communications

Healthcare professionals will know the various methods of giving and obtaining information. They will communicate effectively, both orally and in writing.

- 2.1 Concepts of Effective Communication
  - 2.11 Interpret verbal and nonverbal communication.
  - 2.13 Report subjective and objective information.
  - 2.15 Apply speaking and active listening skills.
  - 2.16 Modify communication to meet the needs of the patient/client and to be appropriate to the situation.
- 2.3 Written Communication Skills
  - 2.31 Critique elements of written and electronic communication (spelling, grammar, and formatting).
  - 2.32 Prepare examples of technical, informative, and creative writing.

Foundation Standard 4: Employability Skills

Healthcare professionals will understand how employability skills enhance their employment opportunities and job satisfaction. They will demonstrate key employability skills and will maintain and upgrade skills, as needed.

- 4.1 Personal Traits of the Healthcare Professional
  - 4.11 Classify the personal traits and attitudes desirable in a member of the healthcare team.
  - 4.12 Summarize professional standards as they apply to hygiene, dress, language, confidentiality and behavior.
- 4.3 Career Decision-making
  - 4.31 Discuss levels of education, credentialing requirements, and employment trends in healthcare.
  - 4.32 Compare careers within the health science career pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).

Foundation Standard 6: Ethics

Healthcare professionals will understand accepted ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment. They will perform quality healthcare delivery.

- 6.1 Ethical Practice
  - 6.12 Recognize ethical issues and their implications related to healthcare.

Foundation Standard 7: Safety Practices
Healthcare professionals will understand the existing and potential hazards to clients, co-workers, and self. They will prevent injury or illness through safe work practices and follow health and safety policies and procedures.

- 7.3 Environmental Safety
  - 7.31 Apply safety techniques in the work environment.
- 7.4 Common Safety Hazards
  - 7.42 Comply with safety signs, symbols, and labels.

Foundation Standard 8: Teamwork
Healthcare professionals will understand the roles and responsibilities of individual members as part of the healthcare team, including their ability to promote the delivery of quality healthcare. They will interact effectively and sensitively with all members of the healthcare team.

- 8.1 Healthcare Teams
  - 8.11 Understand roles and responsibilities of team members.
- 8.2 Team Member Participation
  - 8.21 Differentiate creative methods for building positive team relationships.
  - 8.23 Apply effective techniques for managing team conflict.

Foundation Standard 11: Information Technology Applications
Healthcare professionals will use information technology applications required within all career specialties. They will demonstrate use as appropriate to healthcare applications.

- 11.1 Health Information Literacy and Skills
  - 11.11 Identify methods and types of data collected in healthcare.
- 11.3 Basic Computer Literacy Skills
  - 11.31 Apply basic computer concepts and terminology in order to use computers and other mobile devices.
  - 11.32 Demonstrate basic computer operating procedures.
  - 11.33 Demonstrate use of file organization and information storage.
  - 11.34 Use basic word processing, spreadsheet, and database applications.
  - 11.35 Evaluate the validity of web-based resources.

## *Aligned Washington State Standards*

**Washington Science Standards (Next Generation Science Standards):**

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

**Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):**
The local district must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

**Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL**

| Science and Engineering Practice | Disciplinary Core Idea | Crosscutting Concept |
|---|---|---|
| Asking Questions and Defining Problems | LS1A: Structure and Function | Patterns |
| Asking Questions and Defining Problems | LS3A: Inheritance of Traits | Patterns |
| Developing and Using Models | LS1A: Structure and Function | Patterns |
| Developing and Using Models | LS1B: Growth and Development of Organisms | Cause and Effect |
| Developing and Using Models | LS3A: Inheritance of Traits | Cause and Effect |
| Developing and Using Models | LS3A: Inheritance of Traits | Systems and System Models |
| Developing and Using Models | LS3B: Variation of Traits | Systems and System Models |

**Washington English Language Arts Standards (Common Core State Standards) - Science and Technology Literacy Standards (Grades 9-10):**

RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

| Unit 4: Heart Disease | Total Learning Hours for Unit: 42 |
|---|---|

**Unit Summary:**
Students examine the normal function of the human heart and investigate malfunctions in the cardiovascular system that can lead to heart disease. Students complete a dissection to tour heart anatomy and study heart function using probes and data acquisition software. They collect and analyze heart data including heart rate, blood pressure, and EKG readings and analyze cardiac test results for Anna Garcia. Students explore the role cholesterol plays in the body. Students further their knowledge of molecular biology as they run gel electrophoresis and complete RFLP analysis to diagnose familial hypercholesterolemia. Students design models to simulate the function of a pump and design visuals to show interventions for blocked coronary vessels.

Lesson 4.1: Heart Structure

1. The human heart is a four-chambered muscular pump designed to provide the force needed to transport blood through all the tissues of the body.
2. The heart's pulmonary circuit pumps blood to the lungs to pick up oxygen, while the systemic circuit pumps oxygenated blood out to the tissues of the body.
3. The structure of blood vessels relates to their overall function.

Lesson 4.2: The Heart at Work

1. Heart rate, EKG, and blood pressure measurements are indicators of a person's overall cardiac health.
2. Experiments are designed to find answers to testable questions.

Lesson 4.3: Heart Dysfunction

1. Cholesterol is a lipid that is necessary for the proper functioning of cells and for maintaining a healthy body.
2. The measurement of the HDL and LDL complexes may indicate a person's risk for heart disease.
3. Restriction fragment length polymorphism (RFLP) analysis can be used to diagnose genetic disease and disorders.
4. The human heart pumps blood around the body, and the efficiency of this pump is affected by the rate at which blood can move through the vessels.
5. Experiments are designed to find answers to testable questions.

Lesson 4.4: Heart Intervention

1. A blocked coronary artery can lead to tissue death causing a myocardial infarction, or heart attack.
2. Risk factors such as genetics, poor diet, high cholesterol, high blood pressure, diabetes, and smoking increase a person's risk of developing heart disease.

**Performance Assessments:**
*Performance assessments may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.*

Lesson 4.1: Heart Structure
*It is expected that students will:*

- Identify the main structures of the heart and describe their functions.
- Outline the path of the major blood vessels to and from the heart.
- Recognize the heart valves function to keep blood moving in the proper direction.
- Recognize that arteries move blood away from the heart and veins carry blood back to the heart.
- Compare the structure and function of arteries and veins.

Lesson 4.2: The Heart at Work
*It is expected that students will:*

- Recognize that the heartbeat is caused by the contraction of muscle cells and results in the movement of blood from the heart to the arteries and the rest of the body.
- Recognize that heart rate is the number of heart contractions per unit of time, usually per minute.
- Recognize that blood pressure is a measure of the force put on vascular walls by blood as it is pushed by the cardiac muscles through the blood vessels.
- Recognize that the electrical activity of the heart can be measured and recorded by an electrocardiogram (EKG or ECG).
- Describe how internal and external factors can affect heart function and can contribute to the development of heart disease.
- Recognize that all external variables in an experiment need to be controlled.
- Measure heart rate and blood pressure manually and with scientific software and probes.
- Design controlled experiments to test the effect of factors such as exercise or body position on heart rate and blood pressure.
- Analyze EKG readings and relate resultant data to heart function.

Lesson 4.3: Heart Dysfunction
*It is expected that students will:*

- Recognize that cholesterol is transported in the blood by protein complexes called high-density lipoprotein (HDL) and low-density lipoprotein (LDL).
- Describe how restriction enzymes and gel electrophoresis can be used to analyze genetic information.
- Describe how cholesterol buildup can impact blood flow through arteries.
- Compare and contrast the role of HDL and LDL in the body and how each relates to health.
- Use proper laboratory techniques to separate DNA fragments by gel electrophoresis.
- Analyze the results of the gel electrophoresis to correctly diagnose the presence of the familial hypercholesterolemia mutation.
- Generate ideas as a team to solve a problem.
- Design a controlled experiment to demonstrate how cholesterol plaques impact flow rate in blood vessels.

Lesson 4.4: Heart Intervention
*It is expected that students will:*

- Describe the function of an angiogram in diagnosing blocked vessels.
- Recognize that blocked blood vessels can be treated surgically using procedures that tunnel through or around the areas that disrupt normal blood flow.
- Explain how lifestyle changes as well as medication or medical treatment may help decrease heart disease risk.
- Demonstrate a technique used to open a blocked vessel.
- Analyze medical data and brainstorm causes of death linked to the cardiovascular system.
- Analyze heart disease risk and design a risk reduction program.

**Leadership Alignment:**

- Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed within the class for all students.
- The event, activity, or project and the associated 21st Century Skill should be clearly articulated.
  Example: Students will demonstrate the ability to communicate clearly through their group project presentation.

Students will be self-directed learners as they design various controlled experiments that can affect heart rate and blood pressure. They will communicate clearly as they present findings to the class and/or the public.

Students will apply technology effectively as they use an online risk calculator to explore the risk of a heart attack or coronary disease of an assigned patient. They will use systems thinking as they design a heart disease intervention plan for the patient to use as valuable information for heart health.

## *Industry Standards and Competencies*

**National Healthcare Foundation Standards and Accountability Criteria:**

Foundation Standard 1: Academic Foundation

Healthcare professionals will know the academic subject matter required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in a health science program of study.

- 1.1 Human Structure and Function
  - 1.11 Classify the basic structural and functional organization of the human body (tissue, organ, and system).
  - 1.12 Recognize body planes, directional terms, quadrants, and cavities.
  - 1.13 Analyze the basic structure and function of the human body.
- 1.2 Diseases and Disorders
  - 1.21 Research common diseases and disorders of each body system (prevention, pathology, diagnosis, and treatment).
  - 1.23 Investigate biomedical therapies as they relate to the prevention, pathology, and treatment of disease.
- 1.3 Medical Mathematics
  - 1.31 Apply mathematical computations related to healthcare procedures (metric and household, conversions and measurements).
  - 1.32 Analyze diagrams, charts, graphs, and tables to interpret healthcare results.

Foundation Standard 2: Communications

Healthcare professionals will know the various methods of giving and obtaining information. They will communicate effectively, both orally and in writing.

- 2.1 Concepts of Effective Communication
  - 2.11 Interpret verbal and nonverbal communication.
  - 2.13 Report subjective and objective information.
  - 2.15 Apply speaking and active listening skills.
  - 2.16 Modify communication to meet the needs of the patient/client and to be appropriate to the situation.
- 2.2 Medical Terminology
  - 2.21 Use roots, prefixes, and suffixes to communicate information.
  - 2.22 Use medical abbreviations to communicate information.
- 2.3 Written Communication Skills
  - 2.31 Critique elements of written and electronic communication (spelling, grammar, and formatting).
  - 2.32 Prepare examples of technical, informative, and creative writing.

Foundation Standard 4: Employability Skills

Healthcare professionals will understand how employability skills enhance their employment opportunities and job satisfaction. They will demonstrate key employability skills and will maintain and upgrade skills, as needed.

- 4.1 Personal Traits of the Healthcare Professional
  - 4.11 Classify the personal traits and attitudes desirable in a member of the healthcare team.
  - 4.12 Summarize professional standards as they apply to hygiene, dress, language, confidentiality and behavior.
- 4.3 Career Decision-making
  - 4.31 Discuss levels of education, credentialing requirements, and employment trends in healthcare.
  - 4.32 Compare careers within the health science career pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).

Foundation Standard 7: Safety Practices

Healthcare professionals will understand the existing and potential hazards to clients, co-workers, and self. They will prevent injury or illness through safe work practices and follow health and safety policies and procedures.

- 7.3 Environmental Safety
  - 7.31 Apply safety techniques in the work environment.

7.4 Common Safety Hazards
7.42 Comply with safety signs, symbols, and labels.

Foundation Standard 8: Teamwork
Healthcare professionals will understand the roles and responsibilities of individual members as part of the healthcare team, including their ability to promote the delivery of quality healthcare. They will interact effectively and sensitively with all members of the healthcare team.
8.1 Healthcare Teams
8.11 Understand roles and responsibilities of team members.

Foundation Standard 9: Health Maintenance Practices
Healthcare professionals will understand the fundamentals of wellness and the prevention of disease processes. They will practice preventive health behaviors among the clients.
9.1 Healthy Behaviors
9.11 Apply behaviors that promote health and wellness.
9.12 Describe strategies for the prevention of diseases including health screenings and examinations.
9.13 Investigate complementary (alternative) health practices as they relate to wellness and disease prevention.

Foundation Standard 10: Technical Skills
Healthcare professionals will apply technical skills required for all career specialties. They will demonstrate skills and knowledge as appropriate.
10.1 Technical Skills
10.11 Apply procedures for measuring and recording vital signs including the normal ranges.

Foundation Standard 11: Information Technology Applications
Healthcare professionals will use information technology applications required within all career specialties. They will demonstrate use as appropriate to healthcare applications.
11.1 Health Information Literacy and Skills
11.11 Identify methods and types of data collected in healthcare.
11.3 Basic Computer Literacy Skills
11.31 Apply basic computer concepts and terminology in order to use computers and other mobile devices.
11.32 Demonstrate basic computer operating procedures.
11.33 Demonstrate use of file organization and information storage.
11.34 Use basic word processing, spreadsheet, and database applications.
11.35 Evaluate the validity of web-based resources.

## *Aligned Washington State Standards*

**Washington Science Standards (Next Generation Science Standards):**
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

**Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):**
The local district must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

**Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL**

| Science and Engineering Practice | Disciplinary Core Idea | Crosscutting Concept |
|---|---|---|
| Developing and Using Models | LS1A: Structure and Function | Systems and System Models |
| Planning and Carrying Out Investigations | LS1A: Structure and Function | Cause and Effect |

**Washington English Language Arts Standards (Common Core State Standards) - Science and Technology Literacy Standards (Grades 9-10):**
RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

## Unit 5: Infectious Disease | Total Learning Hours for Unit: 23

**Unit Summary:**
Students follow the spread of a simulated epidemic as engagement to a thorough examination of the agents of disease. Students use clues from their investigation of Anna Garcia's medical history to deduce that she was suffering from a bacterial infection. Through a series of laboratory investigations, students learn the fundamentals of aseptic technique, complete visual identification of bacterial morphology, use the Gram stain to examine bacterial cell structure, and run metabolic tests to pinpoint the particular bacterium at the heart of the illness. Students explain the functioning of the human immune system in a visual project and explore how this system is designed to protect against invaders.

Lesson 5.1: Infection
1. Infectious diseases are caused by infectious agents and are transmitted in a variety of manners.
2. Aseptic technique ensures that contaminants are not introduced into a specimen and that infectious agents are not spread to people or laboratory

surfaces.
3. Bacteria are characterized by their shape, colony morphology, metabolism, and reaction to the Gram stain.
4. The specific structures of the immune system function to protect the human body against foreign invaders.

**Performance Assessments:**
*Performance assessments may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.*

Lesson 5.1: Infection
*It is expected that students will:*
- Describe the mode of transmission and mode of reproduction of various infectious agents.
- Describe the prevention of and treatment for various infectious agents.
- Identify the basic structures of a bacterial cell.
- Describe how the immune system responds when an antigen enters the body.
- Demonstrate the transmission of a simulated infectious agent.
- Compare and contrast the biology and pathology of various infectious agents.
- Use proper aseptic techniques to isolate bacterial colonies.
- Perform a gross examination of bacterial colonies to differentiate an unknown bacterial sample.
- Use proper Gram staining and microscope techniques to stain, observe, and classify bacteria.
- Chemically examine and identify unknown bacteria.

**Leadership Alignment:**
- Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed within the class for all students.
- The event, activity, or project and the associated 21st Century Skill should be clearly articulated.
  Example: Students will demonstrate the ability to communicate clearly through their group project presentation.

Students work in groups in order to investigate how contagious diseases spread throughout a population. They will need to be flexible and adapt to change as they work effectively in diverse teams. Students will use systems thinking as they investigate how different systems and organs help the human body work to fight infectious diseases.

Students will ask questions and work to solve problems as they conduct the Gram Staining Lab based on their own written procedures.

## *Industry Standards and Competencies*

**National Healthcare Foundation Standards and Accountability Criteria:**
Foundation Standard 1: Academic Foundation
Healthcare professionals will know the academic subject matter required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in a health science program of study.

1.1 Human Structure and Function
1.13 Analyze the basic structure and function of the human body.
1.2 Diseases and Disorders
1.21 Research common diseases and disorders of each body system (prevention, pathology, diagnosis, and treatment).
1.22 Research emerging diseases and disorders.
1.23 Investigate biomedical therapies as they relate to the prevention, pathology, and treatment of disease.

1.3 Medical Mathematics
1.32 Analyze diagrams, charts, graphs, and tables to interpret healthcare results.

Foundation Standard 2: Communications
Healthcare professionals will know the various methods of giving and obtaining information. They will communicate effectively, both orally and in writing.
2.1 Concepts of Effective Communication
2.11 Interpret verbal and nonverbal communication.
2.13 Report subjective and objective information.
2.15 Apply speaking and active listening skills.
2.2 Medical Terminology
2.21 Use roots, prefixes, and suffixes to communicate information.
2.3 Written Communication Skills
2.31 Critique elements of written and electronic communication (spelling, grammar, and formatting).
2.32 Prepare examples of technical, informative, and creative writing.

Foundation Standard 3: Systems
Healthcare professionals will understand how their role fits into their department, their organization and the overall healthcare environment. They will identify how key systems affect services they perform and quality of care.
3.1 Healthcare Delivery Systems
3.13 Assess the impact of emerging issues on healthcare delivery systems.

Foundation Standard 4: Employability Skills
Healthcare professionals will understand how employability skills enhance their employment opportunities and job satisfaction. They will demonstrate key employability skills and will maintain and upgrade skills, as needed.
4.1 Personal Traits of the Healthcare Professional
4.12 Summarize professional standards as they apply to hygiene, dress, language, confidentiality and behavior.
4.3 Career Decision-making
4.31 Discuss levels of education, credentialing requirements, and employment trends in healthcare.
4.32 Compare careers within the health science career pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).

Foundation Standard 6: Ethics
Healthcare professionals will understand accepted ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment. They will perform quality healthcare delivery.
6.1 Ethical Practice
6.12 Recognize ethical issues and their implications related to healthcare.

Foundation Standard 7: Safety Practices
Healthcare professionals will understand the existing and potential hazards to clients, co-workers, and self. They will prevent injury or illness through safe work practices and follow health and safety policies and procedures.
7.1 Infection Control
7.11 Explain principles of infection control.
7.12 Assess methods of controlling the spread and growth of microorganisms.
7.2 Personal Safety
7.21 Apply personal safety procedures based on Occupational Safety and Health Administration (OSHA) and Centers for Disease Control (CDC) regulations.

7.3 Environmental Safety
7.31 Apply safety techniques in the work environment.
7.4 Common Safety Hazards
7.41 Recognize Safety Data Sheets (SDS).
7.42 Comply with safety signs, symbols, and labels.
7.5 Emergency Procedures and Protocols
7.52 Apply principles of basic emergency response in natural disasters and other emergencies.

Foundation Standard 8: Teamwork
Healthcare professionals will understand the roles and responsibilities of individual members as part of the healthcare team, including their ability to promote the delivery of quality healthcare. They will interact effectively and sensitively with all members of the healthcare team.
8.1 Healthcare Teams
8.11 Understand roles and responsibilities of team members.
8.2 Team Member Participation
8.21 Differentiate creative methods for building positive team relationships.
8.23 Apply effective techniques for managing team conflict.

Foundation Standard 9: Health Maintenance Practices
Healthcare professionals will understand the fundamentals of wellness and the prevention of disease processes. They will practice preventive health behaviors among the clients.
9.1 Healthy Behaviors
9.11 Apply behaviors that promote health and wellness.
9.12 Describe strategies for the prevention of diseases including health screenings and examinations.
9.13 Investigate complementary (alternative) health practices as they relate to wellness and disease prevention.

Foundation Standard 11: Information Technology Applications
Healthcare professionals will use information technology applications required within all career specialties. They will demonstrate use as appropriate to healthcare applications.
11.1 Health Information Literacy and Skills
11.11 Identify methods and types of data collected in healthcare.
11.2 Privacy and Confidentiality of Health Information
11.21 Apply the fundamentals of privacy and confidentiality policies and procedures.
11.3 Basic Computer Literacy Skills
11.31 Apply basic computer concepts and terminology in order to use computers and other mobile devices.
11.32 Demonstrate basic computer operating procedures.
11.33 Demonstrate use of file organization and information storage.
11.34 Use basic word processing, spreadsheet, and database applications.
11.35 Evaluate the validity of web-based resources.
11.36 Demonstrate use of appropriate email and social media usage.

## *Aligned Washington State Standards*

**Washington Science Standards (Next Generation Science Standards):**
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

**Washington English Language Arts Standards (Common Core State Standards) - Science and Technology Literacy Standards (Grades 9-10):**

RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

## Unit 6: Post Mortem | Total Learning Hours for Unit: 11

**Unit Summary:**

In the final unit of the course, students put together all they have learned throughout the course to determine Anna Garcia's cause of death. Students will investigate the structure and function of key human body systems and relate the illnesses in the course to a breakdown in these systems. Students will begin to recognize the coordination and interconnections of the body systems required to maintain homeostasis, a precursor to the theme of the Human Body Systems course.

Lesson 6.1: Analyzing Anna

1. The human body is composed of multiple body systems working together to maintain good health.
2. Scientists need to make sure that what they present is accurate and is communicated in a way that keeps interest and focus.
3. Determining the cause of death involves the investigation of many aspects of the medical condition of a victim, the internal and external examination of the body, and the chemical and microscopic analysis of tissues and body fluids.

**Performance Assessments:**

*Performance assessments may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.*

Lesson 6.1: Analyzing Anna

*It is expected that students will:*

- Explain the functions of different human body systems and list the major organs within each system.
- Describe how multiple body systems are interconnected and how those interconnections and interactions are necessary for life.
- Demonstrate the ways an illness affects the various body systems.

- Deliver a quality visual and oral presentation.
- Analyze autopsy reports and medical history documents to determine cause of death.

**Leadership Alignment:**

- Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed within the class for all students.
- The event, activity, or project and the associated 21st Century Skill should be clearly articulated.
  Example: Students will demonstrate the ability to communicate clearly through their group project presentation.

Students will be responsible to others for collaborative work as they create an end-of-course presentation using all information received throughout the course in order to evaluate and come to a conclusion as to how Anna Garcia passed away. They will access and evaluate information effectively while creating their final presentation. Students must be able to manage their goals and time, and they will need to decide which of the types of media projects they will create.

## *Industry Standards and Competencies*

**National Healthcare Foundation Standards and Accountability Criteria:**

Foundation Standard 1: Academic Foundation

Healthcare professionals will know the academic subject matter required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in a health science program of study.

1.1 Human Structure and Function

1.11 Classify the basic structural and functional organization of the human body (tissue, organ, and system).

1.13 Analyze the basic structure and function of the human body.

1.2 Diseases and Disorders

1.21 Research common diseases and disorders of each body system (prevention, pathology, diagnosis, and treatment).

Foundation Standard 2: Communications

Healthcare professionals will know the various methods of giving and obtaining information. They will communicate effectively, both orally and in writing.

2.1 Concepts of Effective Communication

2.11 Interpret verbal and nonverbal communication.

2.13 Report subjective and objective information.

2.14 Interpret the elements of communication using a basic sender-receiver-feedback model.

2.15 Apply speaking and active listening skills.

2.2 Medical Terminology

2.21 Use roots, prefixes, and suffixes to communicate information.

2.3 Written Communication Skills

2.31 Critique elements of written and electronic communication (spelling, grammar, and formatting).

2.32 Prepare examples of technical, informative, and creative writing.

Foundation Standard 8: Teamwork

Healthcare professionals will understand the roles and responsibilities of individual members as part of the healthcare team, including their ability to promote the delivery of quality healthcare. They will interact effectively and sensitively with all members of the healthcare team.

8.2 Team Member Participation

8.21 Differentiate creative methods for building positive team relationships.

8.22 Analyze attributes and attitudes of an effective leader.

8.23 Apply effective techniques for managing team conflict.

Foundation Standard 9: Health Maintenance Practices
Healthcare professionals will understand the fundamentals of wellness and the prevention of disease processes. They will practice preventive health behaviors among the clients.

9.1 Healthy Behaviors

9.11 Apply behaviors that promote health and wellness.

9.12 Describe strategies for the prevention of diseases including health screenings and examinations.

Foundation Standard 11: Information Technology Applications
Healthcare professionals will use information technology applications required within all career specialties. They will demonstrate use as appropriate to healthcare applications.

11.3 Basic Computer Literacy Skills

11.31 Apply basic computer concepts and terminology in order to use computers and other mobile devices.

11.32 Demonstrate basic computer operating procedures.

11.33 Demonstrate use of file organization and information storage.

11.34 Use basic word processing, spreadsheet, and database applications.

11.35 Evaluate the validity of web-based resources.

## *Aligned Washington State Standards*

**Washington Science Standards (Next Generation Science Standards):**

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

**Washington English Language Arts Standards (Common Core State Standards) - Science and Technology Literacy Standards (Grades 9-10):**

RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

## 21st Century Skills

Students will demonstrate in this course:

### LEARNING & INNOVATION

**Creativity and Innovation**
☒Think Creatively
☒Work Creatively with Others
☒Implement Innovations

**Critical Thinking and Problem Solving**
☒Reason Effectively
☒Use Systems Thinking
☒Make Judgments and Decisions
☒Solve Problems

**Communication and Collaboration**
☒Communicate Clearly
☒Collaborate with Others

### INFORMATION, MEDIA & TECHNOLOGY SKILLS

**Information Literacy**
☒Access and Evaluate Information
☒Use and Manage Information

**Media Literacy**
☒Analyze Media
☒Create Media Products

**Information, Communications and Technology (ICT Literacy)**
☒Apply Technology Effectively

### LIFE & CAREER SKILLS

**Flexibility and Adaptability**
☒Adapt to Change
☒Be Flexible

**Initiative and Self-Direction**
☒Manage Goals and Time
☒Work Independently
☒Be Self-Directed Learners

**Social and Cross-Cultural**
☒Interact Effectively with Others
☒Work Effectively in Diverse Teams

**Productivity and Accountability**
☒Manage Projects
☒Produce Results

**Leadership and Responsibility**
☒Guide and Lead Others
☒Be Responsible to Others