Science
Honors Geophysical Science
Unit 1: Science Methods

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ How can two people in different locations measure a similar item and get consistent results? ▪ What is the purpose of measuring? ▪ How can observations be visually depicted to yield a conclusion? ▪ How do different measurement systems compare? ▪ How can measurements be expressed in different ways? ▪ What information can be gained from measurement analysis?
Essential Knowledge	▪ Scientists use a standard measuring system called SI. ▪ Measuring is a human creation used to describe and compare objects and events. ▪ Graphs are used to effectively display or describe relationships. ▪ Measurements consist of numbers and units. ▪ Research is a vital tool of scientists. ▪ Measurements can be displayed in multiple ways. ▪ Measurements can be compared.
Vocabulary	▪ Terms: o graphs: line, bar, pie o meter, liter, kilogram, Kelvin, second o derived units o density o dependent and independent variables o controls and constants o significant figures o scientific notation o accuracy, precision
Essential Skills	▪ Convert from one SI unit to another SI unit using dimensional analysis. ▪ Express numbers appropriately based on the measurements taken. ▪ Correctly show data on a graph. ▪ Correctly interpret data shown on a graph and predict new outcomes. ▪ Measure items precisely and accurately. ▪ Use a process to experimentally solve problems.
	Science and Technology B. The Skills and Traits of Scientific Inquiry and Technological Design B1. The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and

Science
Honors Geophysical Science
Unit 1: Science Methods

Related Maine Learning Results	communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas.
Related Maine Learning Results	C. The Scientific and Technological Enterprise C1. Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, and that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical arguments and verifiable results.
Sample Lessons And Activities	▪ Graphing Exercise ▪ Measurement Lab ▪ SI Conversion Worksheets ▪ Estimation activities ▪ Research, compare, and contrast two different measurement systems
Sample Classroom Assessment Methods	▪ SI Conversion Quiz ▪ Chapter Test ▪ Lab Reports ▪ Portfolio Project (science content and literacy)
Sample Resources	▪ Publications: o Discover Magazine o Glencoe Physical Science o MARVEL Data bases * o GALE Resource Data bases ** ▪ Audiovisual: o Multiple online interactive sites o Video: The Mechanical Universe o Video: ESPN Sports Figures

Science
Honors Geophysical Science
Unit 2: Motion

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ What are the quantitative and qualitative similarities and differences among speed, velocity and acceleration? ▪ How does the slope of a position/time graph represent the motion of an object? ▪ How does the slope of a position/time graph predict the motion of an object? ▪ What does the slope of a velocity/time curve represent? ▪ What are the ideas of relative motion and frames of reference? ▪ What are gravitational and inertial frames of reference? ▪ How does inertia relate to the change in motion of an object?
Essential Knowledge	▪ Motion is measured relative to gravitational or inertial frames if reference. ▪ Motion is the change of position. ▪ Average speed is the ratio of distance traveled to the time elapsed. ▪ Acceleration is the rate at which velocity changes. ▪ Inertia is the amount an object resists changes to its current motion. ▪ Mass is the measure of the object's inertia.
Vocabulary	▪ Terms: o constant speed, average speed, instantaneous speed, velocity, acceleration, inertia, mass, frame of reference, displacement, gravitational frame of reference, inertial frame of reference.
Essential Skills	▪ Use mathematics to calculate velocity, acceleration, time and distance. ▪ Use mathematics to analyze motion to realize the relationships among distance, velocity and acceleration. ▪ Interpret the slopes on motion graphs.
Related Maine Learning Results	Science and Technology A. Unifying Themes A1. Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system

Science
Honors Geophysical Science
Unit 2: Motion

problem.

b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system.

A2.Models

Students evaluate the effectiveness of a model by comparing its predications to actual observations from the physical setting, the living environment, and the technological world.

B. The Skills and Traits of Scientific Inquiry and Technological Design

B1.The Skills and Traits of Scientific Inquiry

Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis.

a. Identify questions, concepts, and testable hypotheses that guide scientific investigations.
b. Design and safely conduct methodical scientific investigations, including experiments with controls.
c. Use statistics to summarize, describe, analyze, and interpret results.
d. Formulate and revise scientific investigations using logic and evidence.
e. Use a variety of tools and technologies to improve investigations and communications.
f. Recognize and analyze alternative explanations and models using scientific criteria.
g. Communicate and defend scientific ideas.

D. The Physical Setting

D4.Force and Motion

Students understand that the laws of force and motion are the same across the universe.

a. Describe the contribution of Newton to our understanding of force and motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation.
b. Explain and apply the ideas of relative motion and frame of reference.
c. Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies.
d. Describe and apply characteristics of waves, including wavelength, frequency, and amplitude.
e. Describe and apply an understanding of how waves interact with other waves and with materials including reflection, refraction, and absorption.
f. Describe kinetic energy (the energy of motion), potential energy (dependent on relative position), and energy

Science
Honors Geophysical Science
Unit 2: Motion

	contained by a field (including electromagnetic waves) and apply these understandings to energy problems.
Sample Lessons And Activities	▪ Word problem worksheets ▪ Motion Labs, i.e., constant velocity, acceleration ▪ Lectures ▪ Motion demonstrations ▪ Motion Videos
Sample Classroom Assessment Methods	▪ Chapter Tests ▪ Motion Quizzes ▪ Laboratory Reports ▪ Portfolio Project (science content and literacy)
Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases * o GALE Resource Data bases ** ▪ Audiovisual: o Multiple online interactive sites o Video: The Mechanical Universe o Video: ESPN Sports Figures

Science
Honors Geophysical Science
Unit 3: Forces

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ What is a force? ▪ How are balanced and unbalanced forces different? ▪ What causes acceleration? ▪ How are acceleration, mass, and force quantitatively related? ▪ Why are forces increasingly described as interactions? ▪ What conditions are required to attain terminal velocity? ▪ How are momentum and inertia related? ▪ What factors affect the distance a projectile will travel?
Essential Knowledge	▪ $a = F / m$ ▪ Mathematical relationships may be inverse or direct. ▪ Net forces cause acceleration. ▪ Forces exist in pairs. ▪ Weight is the measure of the force of gravity on an object. ▪ Air resistance is dependent upon the characteristics of the air, the object, and the interaction between them. ▪ $p = m v$ ▪ Vertical and horizontal velocities of projectiles are independent. ▪ Force and gravity problems can be mathematically calculated using algebraic formula manipulations.
Vocabulary	▪ Terms: o force, net force, friction, gravity, weight, newtons (N), balanced forces, terminal velocity, air resistance, momentum, projectile, free fall, centripetal force
Essential Skills	▪ Use mathematics to calculate acceleration, force, and mass. o Analyze systems to realize the relationships among force, mass, and acceleration. o Manipulate formulas algebraically to solve problems.
Related Maine Learning Results	Science and Technology A. Unifying Themes A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances.

Science
Honors Geophysical Science
Unit 3: Forces

Related Maine Learning Results	B. The Skills and Traits of Scientific Inquiry and Technological Design B1. The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. D. The Physical Setting D4. Force and Motion Students understand that the laws of force and motion are the same across the universe. a. Describe the contribution of Newton to our understanding of force and motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation. b. Explain and apply the ideas of relative motion and frame of reference. c. Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies. d. Describe and apply characteristics of waves, including wavelength, frequency, and amplitude. e. Describe and apply an understanding of how waves interact with other waves and with materials including reflection, refraction, and absorption. f. Describe kinetic energy (the energy of motion), potential energy (dependent on relative position), and energy contained by a field (including electromagnetic waves) and apply these understandings to energy problems.
Sample Lessons And Activities	▪ Constant Force / Changing Mass Laboratory ▪ Constant Mass / Changing Force Laboratory ▪ Balloon Rockets ▪ Newton's Laws Station Lab

Science
Honors Geophysical Science
Unit 3: Forces

Sample Classroom Assessment Methods	▪ Chapter Tests ▪ Motion Quizzes ▪ Laboratory Reports ▪ Sharing Circles (or rectangles, or other geometries) ▪ Portfolio Project (science content and literacy)
Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases * o GALE Resource Data bases ** ▪ Audiovisual: o Multiple online interactive sites o Video: The Mechanical Universe o Video: ESPN Sports Figures

Science
Honors Geophysical Science
Unit 4: Energy

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ What is energy? ▪ How are work and energy related? ▪ How is energy conserved? ▪ What factors determine the amount of thermal energy in an object?
Essential Knowledge	▪ Energy can be neither created nor destroyed but can be changed from one form to another. ▪ Work is a transfer of energy through motion. ▪ Simple machines transfer energy/work. ▪ Compound machines are two or more simple machines combined. ▪ Efficiency is work out divided by work in. ▪ All objects have thermal energy. ▪ Different objects absorb/release different amounts of energy. ▪ Positive heat values represent heat gained, and negative heat values represent heat lost.
Vocabulary	▪ Terms: ○ energy, work, potential energy, kinetic energy, mechanical energy, thermal energy, heat, temperature, specific heat, machine, mechanical advantage, efficiency
Essential Skills	▪ Use appropriate formulas to calculate work and energy relationships ($W = Fd$; $E_P = mgh$; $E_K = ½mv^2$) ▪ Determine the thermal energy of an object using $E_T = Q = m \Delta T C$ ▪ Determine both positive and negative heat values based upon information provided. ▪ Calculate mechanical advantages of simple machines.
Related Maine Learning Results	Science and Technology B. The Skills and Traits of Scientific Inquiry and Technological Design B1. The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations using logic and

Science
Honors Geophysical Science
Unit 4: Energy

	evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas.
Related Maine Learning Results	D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. a. Describe and analyze the effect of solar radiation, ocean currents, and atmospheric conditions on the Earth's surface and the habitability of Earth. b. Describe Earth's internal energy sources and their role in plate tectonics. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationships between matter and energy. a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions. c. Explain the essential roles of carbon and water in life processes. d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules. f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. g. Describe nuclear reactions, including fusion and fission, and the energy they release.

Science
Honors Geophysical Science
Unit 4: Energy

	h. Describe the radioactive decay and half-life. i. Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems. j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibration) useful energy is often lost through radiation or conduction. k. Apply an understanding of energy transformations to solve problems. l. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions. D. The Physical Setting D4. Force and Motion Students understand that the laws of force and motion are the same across the universe. a. Describe the contribution of Newton to our understanding of force and motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation. b. Explain and apply the ideas of relative motion and frame of reference. c. Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies. d. Describe and apply characteristics of waves, including wavelength, frequency, and amplitude. e. Describe and apply an understanding of how waves interact with other waves and with materials including reflection, refraction, and absorption. f. Describe kinetic energy (the energy of motion), potential energy (dependent on relative position), and energy contained by a field (including electromagnetic waves) and apply these understandings to energy problems.
Sample Lessons And Activities	▪ Coke Can/Calorimeter Laboratory ▪ Work and Power Stair Laboratory ▪ Rubber band (Elastic Potential Energy) Laboratory ▪ Specific Heat / Paraffin Wax Demonstration ▪ Design a Rube-Goldberg machine calculating total mechanical advantage.
Sample Classroom Assessment Methods	▪ Chapter Tests ▪ Energy Quizzes ▪ Laboratory Reports ▪ Laboratory exercises ▪ Portfolio Project (science content and literacy)

Science
Honors Geophysical Science
Unit 4: Energy

Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases * o GALE Resource Data bases ** ▪ Audiovisual: o Multiple online interactive sites o Video: The Mechanical Universe o Video: The Connections Series

Science
Honors Geophysical Science
Unit 5: Nature of Matter

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ What is matter? ▪ What is the kinetic theory of matter? ▪ What are the macroscopic characteristics of each state of matter? ▪ What are the microscopic characteristics of each state of matter? ▪ What constitutes a physical property and physical change?
Essential Knowledge	▪ All matter is made of moving particles. ▪ All matter exists in one of the four states but can change state based on the gain or loss of energy. ▪ Scientific laws and principles govern how matter responds to changes of density, pressure, and temperature.
Vocabulary	▪ Terms: ○ matter, solid, liquid, gas, plasma, crystals, specific heat, heat of fusion, heat of vaporization, thermal expansion
Essential Skills	▪ Calculate the relationships among temperature, pressure and volume. ▪ Use the relationship among force, area, and pressure. ▪ Distinguish among solid, liquid, gas and plasma. ▪ Calculate the thermal energy necessary to change water from a solid to a vapor.
Related Maine Learning Results	Science and Technology A. Unifying Themes A2.Models Students evaluate the effectiveness of a model by comparing its predications to actual observations from the physical setting, the living environment, and the technological world. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results.

Science
Honors Geophysical Science
Unit 5: Nature of Matter

	d. Formulate and revise scientific investigations using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. D. The Physical Setting D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationships between matter and energy. a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions. c. Explain the essential roles of carbon and water in life processes. d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules. f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. g. Describe nuclear reactions, including fusion and fission, and the energy they release. D4.Force and Motion Students understand that the laws of force and motion are the same across the universe. a. Describe the contribution of Newton to our understanding of force and motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation. b. Explain and apply the ideas of relative motion and frame of reference. c. Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies.

Science
Honors Geophysical Science
Unit 5: Nature of Matter

Related Maine Learning Results	d. Describe and apply characteristics of waves, including wavelength, frequency, and amplitude. e. Describe and apply an understanding of how waves interact with other waves and with materials including reflection, refraction, and absorption. f. Describe kinetic energy (the energy of motion), potential energy (dependent on relative position), and energy contained by a field (including electromagnetic waves) and apply these understandings to energy problems.
Sample Lessons And Activities	▪ Lecture ▪ "Boiling is a Cooling Process Lab" ▪ Heat of fusion and heat of vaporization demonstration ▪ 1, 4 - dichlorobenzene Lab ▪ Soda Can Combined Gas Law demonstration
Sample Classroom Assessment Methods	▪ Matter Quizzes ▪ Chapter Tests ▪ Laboratory Reports ▪ Portfolio Project (science content and literacy)
Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases* o GALE Resource Data bases** ▪ Audiovisual: o Multiple online interactive sites o Video: Connections Series o Video: The World of Chemistry

Science
Honors Geophysical Science
Unit 6: Classification of Matter

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ How do substances and mixtures differ? ▪ What constitutes a chemical property and chemical change? ▪ What is the difference between chemical properties and physical properties? ▪ What is the difference between chemical change and physical change? ▪ How do physical changes obey the Law of Conservation of Matter? ▪ How is the Law of Conservation of Matter observed in chemical changes? ▪ What is solubility and how is it calculated? ▪ What is Archimedes' Principle? ▪ What is Pascal's Principle? ▪ What are the basic gas laws?
Essential Knowledge	▪ Elements and compounds are substances. ▪ Mixtures are either homogeneous or heterogeneous. ▪ Chemical changes result in the formation of new substances. ▪ Physical changes do not result in new substances. ▪ Solubility is a physical property that can be quantified. ▪ Density is a physical property that can be quantified. ▪ Solve problems using Archimedes' Principle. ▪ Solve problems using Pascal's Principle. ▪ Solve problems using the basic gas laws (Boyle's, Charles', Gay-Lussac, and Combined.
Vocabulary	▪ <u>Terms</u>: ○ elements, compounds, solutions, mixture, suspensions, colloid, Tyndall Effect, Archimedes' Principle, Pascal's Principle, Boyle's Law, Charles' Law, Gay-Lussac's Law, and Combined Gas Law.
Essential Skills	▪ Safely use laboratory burner. ▪ Distinguish between chemical and physical properties. ▪ Distinguish between chemical and physical changes. ▪ Classify solutions, suspensions and colloids.

Science
Honors Geophysical Science
Unit 6: Classification of Matter

Related Maine Learning Results	Science and Technology B. The Skills and Traits of Scientific Inquiry and Technological Design B1.The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. D. The Physical Setting D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationships between matter and energy. a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions. c. Explain the essential roles of carbon and water in life processes. d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules. f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. g. Describe nuclear reactions, including fusion and fission, and

Science
Honors Geophysical Science
Unit 6: Classification of Matter

	the energy they release. h. Describe the radioactive decay and half-life. i. Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems. j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibration) useful energy is often lost through radiation or conduction. k. Apply an understanding of energy transformations to solve problems. l. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions.
Sample Lessons And Activities	▪ Lab: Classify Chemical And Physical Changes ▪ Lab: Alchemist Dream (Penny Lab) ▪ Tyndall Effect demonstration ▪ CO_2 Flame Extinguish demonstration
Sample Classroom Assessment Methods	▪ Classification of Matter Quizzes ▪ Chapter Tests ▪ Laboratory Reports ▪ Student Classification Auxiliary Measurements ▪ Portfolio Project (science content and literacy)
Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases* o GALE Resource Data bases** ▪ Audiovisual: o Multiple online interactive sites o Video: Connections Series o Video: The World of Chemistry

Science
Honors Geophysical Science
Unit 7: Atomic Structure

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ What different models of the atom have been developed? ▪ What subatomic particles compose the atom? ▪ What are the relative locations of the subatomic particles in an atom? ▪ What characteristics typify the various subatomic particles? ▪ How do the subatomic particles interact?
Essential Knowledge	▪ Protons determine elemental identity. ▪ The nucleus occupies a very small portion of an atom's volume, but possesses the vast majority of the atom's mass. ▪ Element properties repeat periodically based on the arrangement of their electrons. ▪ Energy levels consist of electrons subdivided into subshells. ▪ Strong and weak nuclear forces hold protons and neutrons together in the nucleus. ▪ As scientists gather new data new models of the atom are developed.
Vocabulary	▪ Terms: o atom, nuclear region (nucleus), electron cloud region, valence, subatomic particle, proton, neutron, electron, quark, atomic number, mass number, atomic weight (average atomic mass), isotope, periodicity, strong nuclear force, weak nuclear force
Essential Skills	▪ Use the Periodic Table to retrieve the Atomic Number, Average Atomic Mass, Chemical Symbol and valence electrons of an element. ▪ Use the Periodic Table to identify the periodic characteristics of elements. ▪ Describe basic characteristics of the subatomic particles. ▪ Describe at least two models of the atom. ▪ Diagram an element's electron configuration based on subshells. ▪ Draw Lewis-dot diagrams based upon an element's location on the periodic table.
Related Maine Learning Results	Science and Technology A. Unifying Themes A2.Models Students evaluate the effectiveness of a model by comparing its

Science
Honors Geophysical Science
Unit 7: Atomic Structure

	predications to actual observations from the physical setting, the living environment, and the technological world. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. C. The Scientific and Technological Enterprise C2.Understandihngs About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. c. Provide examples that illustrate how technological solutions to problems sometimes lead to new problems of new fields of inquiry. C4.History and nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe and provide examples of the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and

Science
Honors Geophysical Science
Unit 7: Atomic Structure

	personal beliefs and ways of viewing the worlds can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationships between matter and energy. a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions. c. Explain the essential roles of carbon and water in life processes. d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules. f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. g. Describe nuclear reactions, including fusion and fission, and the energy they release. h. Describe the radioactive decay and half-life. i. Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems. j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibration) useful energy is often lost through radiation or conduction. k. Apply an understanding of energy transformations to solve problems. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions.
Sample Lessons And Activities	▪ Lecture ▪ Diagramming electron configurations ▪ Grouping misc. items (development of periodic table) ▪ Flame tests

Science
Honors Geophysical Science
Unit 7: Atomic Structure

	▪ Nuclear worksheets ▪ History of the atom
Sample Classroom Assessment Methods	▪ Quizzes ▪ Chapter tests ▪ Laboratory experiments and reports ▪ Formative classroom assessments ▪ Portfolio Project (science content and literacy)
Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases* o GALE Resource Data bases** ▪ Audiovisual: o Multiple online interactive sites o Video: Connections Series o Video: The World of Chemistry

Science
Honors Geophysical Science
Unit 8: Chemical Bonding

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ How do atoms combine? ▪ Under what circumstances do atoms combine? ▪ How is the Law of Conservation of Mass demonstrated when atoms combine? ▪ What determines the polarity of molecules? ▪ How are molecules different from ionic compounds? ▪ What are chemical reactions? ▪ What are the basic chemical reactions? ▪ How can balanced chemical equations be used to predict the outcomes of reactions? ▪ What is Avogadro's Law? ▪ What is molarity? ▪ What is stoichiometry?
Essential Knowledge	▪ Covalent bonds are formed by sharing of electrons. ▪ Ionic bonds are formed by transferring of electrons. ▪ Compounds are formed with outer shell electrons. ▪ Atoms combine in whole number ratios. ▪ Molecular symmetry determines polarity. ▪ Balanced chemical equations are important chemical tools. ▪ Stoichiometry is using balanced equations to determine quantitative results. ▪ There are six basic chemical reactions.
Vocabulary	▪ <u>Terms</u>: o chemical bonding, ionic bond, covalent bond, ion, polar and nonpolar molecule, oxidation number/state, molecules, compound, Avogadro's Law, molarity, stoichiometry.
Essential Skills	▪ Writing chemical formulae with correct subscripts. ▪ Predicting how atoms will combine using the Periodic Table. ▪ Demonstrating the Law of Conservation of Matter by writing chemical formulae and balancing chemical equations. ▪ Using balanced equations to solve word problems, predicting the quantitative outcome of reactions. ▪ Describing how molecules and ionic compounds differ.

Science
Honors Geophysical Science
Unit 8: Chemical Bonding

Related Maine Learning Results	Science and Technology A. Unifying Themes A2.Models Students evaluate the effectiveness of a model by comparing its predications to actual observations from the physical setting, the living environment, and the technological world. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. D. The Physical Setting D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationships between matter and energy. a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions. c. Explain the essential roles of carbon and water in life processes. d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules.

Science
Honors Geophysical Science
Unit 8: Chemical Bonding

	f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. g. Describe nuclear reactions, including fusion and fission, and the energy they release. h. Describe the radioactive decay and half-life. i. Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems. j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibration) useful energy is often lost through radiation or conduction. k. Apply an understanding of energy transformations to solve problems. l. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions.
Sample Lessons And Activities	▪ Lecture ▪ Chemical reactions demonstration ▪ Solubility laboratory exercise ▪ Writing chemical formulae ▪ Balancing chemical equations ▪ Copper extraction laboratory ▪ Solving chemical equation word problems
Sample Classroom Assessment Methods	▪ Quizzes ▪ Chapter tests ▪ Laboratory experiments and reports ▪ Formative classroom assessments ▪ Portfolio Project (science content and literacy)
Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases* o GALE Resource Data bases** ▪ Audiovisual: o Multiple online interactive sites o Video: Connections Series o Video: The World of Chemistry

Science
Honors Geophysical Science
Unit 9: Energy Transfer

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ How is energy transferred? ▪ What are the types of waves and their characteristics? ▪ How do waves interact with matter? ▪ How do we use waves? ▪ What information can waves provide?
Essential Knowledge	▪ Waves transfer energy without transferring matter. ▪ Waves can be categorized by behavior. ▪ Wave properties depend on the wave source and material through which it moves. ▪ Waves can be used to gather information. ▪ Visible light waves can be detected by the human eye. ▪ Different objects absorb/release different amounts of energy to create waves.
Vocabulary	▪ Terms: o kinetic energy, medium, transverse, longitudinal, wavelength, period, frequency, amplitude, wave speed, reflection, refraction, diffraction, intereference, resonance, sound, decibel, Doppler Effect, shock wave, echolocation, ultrasound, electromagnetic, spectrum, pigments, coherent light, color, polarization, color addition, color subtraction
Essential Skills	▪ Identify mechanical and electromagnetic waves and their properties. ▪ Identify how individual waves can be used to gather information, locate objects, form images, and provide medical treatment. ▪ Evaluate diagrams and manipulate equations to determine basic wave properties. ▪ Analyze situations to determine wave behaviors and their effects on matter. ▪ Connect energy input, wave production, and the Law of Conservation of Matter and Energy. ▪ Analyze color and sound systems to determine what is perceived.
	Science and Technology B. The Skills and Traits of Scientific Inquiry and Technological Design B1.The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis.

Science
Honors Geophysical Science
Unit 9: Energy Transfer

Related Maine Learning Results	a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas.
Related Maine Learning Results	D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. a. Describe and analyze the effect of solar radiation, ocean currents, and atmospheric conditions on the Earth's surface and the habitability of Earth. b. Describe Earth's internal energy sources and their role in plate tectonics. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationships between matter and energy. a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions. c. Explain the essential roles of carbon and water in life processes. d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the

Science
Honors Geophysical Science
Unit 9: Energy Transfer

	presence of molecules that encourage interaction with other molecules. f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. g. Describe nuclear reactions, including fusion and fission, and the energy they release. h. Describe the radioactive decay and half-life. i. Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems. j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibration) useful energy is often lost through radiation or conduction. k. Apply an understanding of energy transformations to solve problems. l. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions. D. The Physical Setting D4. Force and Motion Students understand that the laws of force and motion are the same across the universe. a. Describe the contribution of Newton to our understanding of force and motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation. b. Explain and apply the ideas of relative motion and frame of reference. c. Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies. d. Describe and apply characteristics of waves, including wavelength, frequency, and amplitude. e. Describe and apply an understanding of how waves interact with other waves and with materials including reflection, refraction, and absorption. f. Describe kinetic energy (the energy of motion), potential energy (dependent on relative position), and energy contained by a field (including electromagnetic waves) and apply these understandings to energy problems.
Sample Lessons And Activities	▪ Wave Spring Activities ▪ Sound Station Lab ▪ Spectrometer Lab ▪ Spectral tube analysis ▪ Color, filter, laser, and optic fiber demonstrations

Science
Honors Geophysical Science
Unit 9: Energy Transfer

Sample Classroom Assessment Methods	▪ Chapter Tests ▪ Wave Quizzes ▪ Laboratory Reports ▪ Laboratory exercises ▪ Portfolio Project (science content and literacy)
Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases * o GALE Resource Data bases ** ▪ Audiovisual: o Multiple online interactive sites o Video: Connections Series o Video: The World of Chemistry

Science: Environmental Science
Unit 1: Soil

Essential Understandings	▪ The four major components of soil are mineral material, air, water, and organic matter. ▪ There are four factors that influence soil formation; climate, topography, biota, and time. ▪ A soil profile can have up to six primary soil horizons: O, A, E, B, C, and R. ▪ There are seven primary soil properties which influence how a soil may be used for many purposes. They are soil texture, soil structure, soil consistence, soil depth, soil drainage class, soil reaction, and cation exchange capacity. ▪ Soil surveys involve predictions of soil behavior, soil limitations, soil series, and detailed soil maps to affect land use planning in a survey area. ▪ The main function of soils is to support all types of plants.
Essential Questions	▪ How is soil defined and what are the components of soil? ▪ What are the five factors that influence the formation of soil? ▪ How do these factors drive the process of soil profile development? ▪ What is a soil profile and what are the six primary soil horizons that a profile is composed of? ▪ How does the process of erosion impact soil and what can be done to minimize soil losses? ▪ What is a soil survey and how are they used in judging soil profile characteristics? ▪ What are the common soil types and their respective uses as well as some common agricultural methods and pest management practices in Maine?
Essential Knowledge	▪ Soils are essential for plant growth and for all life on earth. ▪ Mineral matter, air, water, and organic matter make up soil. ▪ Different soil types are formed by climate, aspect, vegetation, time, and parent material. ▪ Soil profiles are typically composed of the O, A, E, B, C, R, layers known as horizons. ▪ The properties of soil are determined by texture, structure, consistence, depth, drainage, pH, and cation exchange capacity. ▪ A web soil survey consists of a detailed report on-line of any location in the United States. ▪ Soil judging involves identifying some of the soil properties presented while examining an on-site student dug soil pit.
Vocabulary	▪ Terms: soil: mineral, air, water, organic matter; soil formation: climate, topography, catena, slope aspect, biota, pedoturbation, parent material, glacial till, lodgment till, ablation till, hardpan, outwash(stratified drift), eskers, lacustrine sediments, marine

Science: Environmental Science
Unit 1: Soil

	sediments, alluvial, transformation, translocation, soil losses and additions, leaching, erosion (raindrop, sheet, rill, gulley, and stream), microbial decomposition, platy, prismatic, blocky, granular, friable, bedrock, water table, redoximorphic features, anaerobic micro-organisms, biologic zero, pH, acidic, alkaline, cation exchange capacity, sedimentation, topsoil, infiltration capacity, permeability, soil (survey, series, maps), horizons(O,A,E,B,C,R), sand, silt, clay, rock fragment, textural triangle, soil conservation: contour farming, strip farming, terracing, waterways, windbreaks, tillage, fertilizer: (N,P,K), insecticides, herbicides, pesticides, bioaccumulation, biomagnification, integrated pest management. ○
Essential Skills	▪ Carefully read and highlight the provided soil information packet and understand through class presentations the characteristics, formation, and importance of soil. ▪ Dig a prescribed soil pit and complete all parts of the soil management laboratory activity. ▪ Determine pH, nitrogen, phosphorus, and potash levels in collected soil samples. ▪ Evaluate the soil quality in a forest using physical, chemical, and biological tests at different depths. ▪ Review and answer practice assessment questions for textbook chapters 14 and 15 by matching terms and definitions, determining true or false statements, identifying correct multiple choice responses, or writing complete sentences to answer challenging questions.
Related Maine Learning Results	C1 Understandings of Inquiry D2 Earth E1 Biodiversity E2 Ecosystems
Sample Lessons And Activities	▪ Groups of students will dig soil pits (3'x3') on campus and collect/test samples of each soil layer. ▪ Read Chapters 14 and 15 and answer the end of chapter review questions for each. ▪ Complete the Soil Management Lab with soil pit groups. ▪ Read and highlight any unknown information in the Soil Information packet (Maine Envirothon competition). ▪ Working in pairs complete the Soil Quality Lab Experiment for a forest soil type. ▪ Take notes of class demonstration and discussion for judging a soil profile using a score card.
Sample Classroom	▪ Soil Management/Soil Quality Experiment Post-Lab Quizzes ▪ Chapter 14 and Chapter 15 Textbook Quizzes and Tests

Science: Environmental Science
Unit 1: Soil

Assessment Methods	▪ Soils Judging Scorecard ▪ Previous Envirothon Test Questions on Soils
Sample Resources	▪ Publications: Environmental Science: A Study of Interrelationships Eighth Edition by Enger/Smith ▪ Maine Envirothon Soils Information packet ▪ Cornell Soil Health Assessment Training Manual ▪ Munsell Soil Color Book ▪ A Study of Soil Science Second Edition by Dr. Henry D. Foth ▪ Lamotte Soil Handbook ○ ▪ Videos: Dirt: the Video ▪ You Tube: Soil Formation, Soil Types, Soil Structure ○
Technology Link	▪ http://www.brunswick.k12.me.us/curriculum

Science: Environmental Science
Unit 2: Forestry

Essential Understandings	▪ Forests are an important natural resource. ▪ Forest ecosystems provide clean water, oxygen, soil nutrients, carbon storage, temperature regulation and rainfall, and wildlife habitat. ▪ Primary and secondary succession produces a mature forest biome. ▪ Humans can modify a forest in many ways both positively and negatively. ▪ Trees have many functional parts. ▪ The main function of forests is to support living habitats..
Essential Questions	▪ What is a forest and how is forestry related?. ▪ What are the functional parts of a tree? ▪ How is a forest inventory growth plot determined and used? ▪ What are the benefits of a single tree species? ▪ How does a forester measure diameter, height, and volume of a tree? ▪ What is the calculated board footage of a tree and how is it used? ▪ What are the common softwood and hardwood trees in Maine and how can we identify, harvest, and use them? ▪ Is a forest sustainable?
Essential Knowledge	▪ Trees absorb carbon dioxide and give off oxygen through photosynthesis. ▪ Forests provide us with resources to produce more than 5000 different commercial products. ▪ There are two major types of trees commonly known as softwoods and hardwoods with numerous tree species of each type. ▪ Succession produces a mature forest. ▪ The major types of terrestrial climax communities are known as biomes. ▪
Vocabulary	▪ <u>Terms</u>: Forest, forestry, Tree: diameter, height, volume, species identification; coniferous, deciduous, softwood, hardwood, Biltmore stick, diameter tape, clinometer, Garmin etrex gps unit, handheld compass, crown, trunk, roots, medullary rays, root hairs, leaves, pith, heartwood, sapwood (xylem), cambium, inner bark (phloem), outer bark, pioneer community, desert, grassland, boreal forest, tundra, savanna, harvesting; clear-cutting, selective, patch-work clear-cutting, reforestation, forest sustainability. ○
	▪ Carefully read and highlight the provided Forest Station information

Science: Environmental Science
Unit 2: Forestry

Essential Skills	packet and understand through class activities and presentations the ecological, economic, and social importance of trees in Maine. ▪ Set up a prescribed FIG plot and complete all parts of the Forest Inventory Growth laboratory activity. ▪ Determine the type of tree, diameter, and height using a Forest Trees Maine booklet, Biltmore stick, Diameter tape, and Clinometer ▪ Understand the GPS system and then use a GPS unit and a compass to locate and identify directions of latitude and longitude. ▪ Review and answer practice assessment questions for textbook chapters 6 and 12 by matching terms and definitions, determining true or false statements, identifying correct multiple choice responses, or writing complete sentences to answer challenging questions.
Related Maine Learning Results	D2 Earth E1 Biodiversity E2 Ecosystems
Sample Lessons And Activities	▪ Student groups will set up a Forest Inventory Growth (FIG) plot and identify, measure, and estimate the volume of trees using various lab activities. Also not suitable wildlife habitat. ▪ Read Chapters 6 and 12 and answer the end of chapter review questions and practice test questions for each. ▪ Read and complete both parts of the Reading the Rings Activity. ▪ Determine What Leaf Is It by completing the Laboratory Activity in student pairs. ▪ Working in pairs practice with a Biltmore Stick, Diameter Tape, and Clinometer for Calculating Board Footage in a Tree Activity. ▪ Read and highlight before answering review questions on the Forests Are More Than Trees handout packet. ▪ Evaluate the benefit of a tree using the web-site treeenefits.com ▪ Select and research one piece of Maine logging equipment before presenting to the class. ▪ Read Forest Invaders and then work in pairs to determine the best ways to prevent invasive species in the Maine forest.
Sample Classroom Assessment Methods	▪ Maine Deciduous (hardwood) and Coniferous (softwood) Tree Identification Quizzes. ▪ Textbook Chapters 6 and 12 Quizzes and Test. ▪ Previous Envirothon Test Questions for Forestry ▪ Functional Tree Parts Quizzes and Tests
Sample Resources	▪ Publications: Environmental Science: A Study of Interrelationships Eighth Edition by Enger/Smith ▪ Maine Envirothon Forestry Station Packet ▪ Forest Trees of Maine Booklet Centennial Edition 1908-2008 ▪ Trees of the Northeast Leaf Identification Guide

Science: Environmental Science
Unit 2: Forestry

	▪ Tree Finder A Manual for the Identification of Trees By Their Leaves by May Theilgaard Watts 1998 ▪ Tree Growth Study Kit/Tree Ring Dating Simulation Student Activity Kit by Flinn Scientific Inc. ○ ▪ Videos: Maine Forests Forever Greeen DVD ▪ Using the Compass DVD ▪ You Tube: Various Photos of Trees of Maine ○
Technology Link	▪ http://www.brunswick.k12.me.us/curriculum

Science: Environmental Science
Unit 3: Wildlife

Essential Understandings	▪ Wildlife are an important natural resource. ▪ There are many important relationships between habitat and wildlife species in Maine. ▪ Wildlife ecology involves predator-prey relationships, adaptations, population dynamics, carrying capacity, limiting factors, food chains and food webs throughout the world. ▪ There are many issues involving wildlife and society such as endangered and threatened species, land use and habitat loss, introduced and reintroduced species, hunting and trapping, and human health. ▪
Essential Questions	▪ What is a forest and how is forestry related?. ▪ What are the functional parts of a tree? ▪ How is a forest inventory growth plot determined and used? ▪ What are the benefits of a single tree species? ▪ How does a forester measure diameter, height, and volume of a tree? ▪ What is the calculated board footage of a tree and how is it used? ▪ What are the common softwood and hardwood trees in Maine and how can we identify, harvest, and use them? ▪ Is a forest sustainable?
Essential Knowledge	▪ Trees absorb carbon dioxide and give off oxygen through photosynthesis. ▪ Forests provide us with resources to produce more than 5000 different commercial products. ▪ There are two major types of trees commonly known as softwoods and hardwoods with numerous tree species of each type. ▪ Succession produces a mature forest. ▪ The major types of terrestrial climax communities are known as biomes. ▪
Vocabulary	▪ Terms: Ecology, environment, abiotic/biotic factors, range of tolerance, limiting factor, habitat, niche, species, natural selection, evolution, speciation, extinction, coevolution, predation, predator, prey, competition; intraspecific/interspecific, competitive exclusion principle, symbiosis, parasitism, parasite, host, vectors, ectoparasites, endoparasites, commensalism, mutualism, mycorrhizae, community, ecosystem, producers, consumers, primary consumers, herbivores, secondary consumers, carnivores, omnivores, decomposers, keystone species, trophic level, biomass, food chain, detritus, food web, nutrient cycles; carbon, nitrogen, and phosphorus cycle, nitrogen-fixing bacteria, nitrifying bacteria,

Science: Environmental Science
Unit 3: Wildlife

	denitrifying bacteria, wildlife management, cover, habitat management, migratory birds, common species, endangered species, threatened species, poachers, predator-prey relationships, adaptations, carrying capacity, limiting factors, hunting, trapping, Maine (MDIFW): common mammals, amphibians, reptiles, birds, and fish, and Maine Audubon. ○
Essential Skills	▪ Identify common Maine mammal skulls using teeth placement (carnivore/herbivore/omnivore), eye sockets (predator/prey/size), nasal cavity size, and ear pocket placement and size. ▪ Determine how a mammal lives, eats, and protects itself from the size and shape of its feet. ▪ Identify common mammals of Maine from size, shape, and color of pelts, scat, and tracks. ▪ After reading and highlighting the Maine Amphibian and Reptile packet information students will then select a common species of Maine and use the internet to research project information before presenting to some members of the class. ▪ Review and answer practice assessment questions for textbook chapters 5 and 12 by matching terms and definitions, determining true or false statements, identifying correct multiple choice responses, or writing complete sentences to answer challenging questions. ▪ Answer and review previous Envirothon questions for wildlife of Maine. ▪ After reading/highlighting a bird information packet students will identify common birds of Maine using posters, field guides, and songs. ▪ Select an endangered or threatened species in Maine and provide information in the form of a brochure/pamphlet to notify the class and public regarding your concern for this species. ▪ Perform a laboratory activity to determine if our BHS campus is friendly to all wildlife.
Related Maine Learning Results	E1 Biodiversity E2 Ecosystems
Sample Lessons And Activities	▪ Student groups will identify Maine mammal skulls using the Skull-king activity. ▪ Read Chapters 5 and 12 and answer the end of chapter review questions and practice test questions for each. ▪ Read and complete all parts of the Feet-Feet-Feet activity. ▪ Identify Maine mammals using the diagrams and samples of pelts, scat, and tracks. ▪ Draw, color, and label the Ideal Mammal for Maine.

Science: Environmental Science
Unit 3: Wildlife

	▪ Read and Give Me Ten facts about birds from the Bird Information handout packet. ▪ Use binoculars and Birds of North America field guides to identify common birds of Maine from the posters in the classroom. ▪ Select and research one Maine Amphibian or Reptile before presenting to members of the class.
Sample Classroom Assessment Methods	▪ Maine mammal skulls, pelts, scat and tracks quizzes. ▪ Textbook Chapters 5 and 12 Quizzes and Tests. ▪ Previous Maine Envirothon Test Questions on Wildlife ▪ Common Mammals and Birds of Maine quizzes. ▪ Wildlife Unit Test.
Sample Resources	▪ Publications: Environmental Science: A Study of Interrelationships Eighth Edition by Enger/Smith ▪ Maine Envirothon Wildlife Station packet ▪ A Field Guide To The Mammals Of North America by William H. Burt and Richard P. Grossenheider, 3rd Edition in 1976 ▪ Field Guide To The Birds of North America by the National Geographic , 3rd Edition ▪ Maine Amphibians and Reptiles by Malcolm L. Hunter Jr., Aram J.K. Calhoun, and Mark McCollough, UM Press 1999 ▪ Field Guide To Tracks Of North American Wildlife; Nature Study Aids by Myron and Charles Chase, 1969 ▪ Safari In A Box Skulls Guide ▪ Museum Products Replica Scat and Tracks, Mystic, Conn. ▪ Maine Hunting and Trapping, Maine Department of Inland Fisheries and Wildlife 2015-2016 ○ ▪ Videos: ▪ You Tube: Various Videos and Photos of Wildlife in Maine ○
Technology Link	▪ http://www.brunswick.k12.me.us/curriculum

Science: Environmental Science
Unit 4: Aquatics

Essential Understandings	▪ Water is a renewable resource essential for all life on earth. ▪ Water's chemical structures and physical properties make it the most unique substance on earth. ▪ Water's ability to retain heat modifies local climatic conditions in areas near large bodies of water. ▪ Although water covers nearly 70% of the earth's surface, over 97% is saltwater. ▪ Water is naturally cleaned and recycled through a process known as the hydrologic cycle. ▪ The four human uses of water are domestic, agricultural, in-stream, and industrial. ▪ Reduced water quality can seriously threaten land use and in-place water use. ▪ We must keep our local freshwater supply clean and uncontaminated in order to survive on planet earth.
Essential Questions	▪ What are the chemical and physical properties of water and why is it so unique? ▪ How does the hydrologic cycle purify water and replenish the watershed? ▪ What are the four human uses of water and why is it so important? ▪ What lives in freshwater besides fish? ▪ What is a BMI? ▪ How do we protect and manage our water resources? ▪ What are some common threats to our water resources? ▪ Name some benefits of a wetland and describe the changes that could be expected with the destruction of a wetland?
Essential Knowledge	▪ A watershed is a drainage area or basin in which all land and water areas drain or flow toward a central collector river, pond, lake, ocean or lower elevation. ▪ All water systems: groundwater, wetlands, streams, rivers, lakes, ponds, estuaries, marine intertidal zones, and open ocean are all part of a watershed (a large area that transports water) ▪ The chemical and physical properties of surface water will vary continuously and allow for many species of living organisms. ▪ Forested wetlands, bogs, and marshes are the three types of wetlands found in Maine. ▪ The hydrologic cycle cleanses and recycles our water supply naturally. We cannot survive without a clean freshwater supply.
Vocabulary	▪ Terms: watershed, wetland, runoff, groundwater, aquifer, transpiration, dam, reservoir, evaporation, precipitation, freshwater ecosystem, lakes, ponds, streams, rivers, emergent plants,

Science: Environmental Science
Unit 4: Aquatics

	submerged plants, littoral zone, limnetic zone, oligotrophic lakes, eutrophic lakes, biochemical oxygen demand, periphyton, swamps, marshes, potable water, hydrologic cycle, evapotranspiration, unconfined aquifer, water table, vadose zone, confined aquifer, aquiclude, aquitard, artesian well, porosity, domestic water, irrigation, industrial water uses, in-stream water use, eutrophication, pollution: point source/nonpoint source, fecal coliform bacteria, thermal pollution, storm-water runoff, water diversion, primary sewage treatment, secondary sewage treatment, trickling filter system, sewage sludge, activated-sludge sewage treatment, chlorination, tertiary sewage treatment, salinization, and groundwater mining. ○
Essential Skills	▪ Draw and label the BHS water cycle using the terms and definitions correctly from The Water Cycle and Water Resources activity worksheet. ▪ Review and answer practice assessment questions for textbook chapters 6 and 16 by matching terms and definitions, determining true or false statements, identifying correct multiple choice responses, or writing complete sentences to answer challenging questions before answering them on a unit test. ▪ Answer and then review the previous regional Maine Envirothon test question answers regarding the Aquatics unit before doing them correctly on a test. ▪ Identify common benthic macro-invertebrates in both the BHS ponds and boundary stream to complete the lab activity and worksheets. ▪ Complete the How to Read a Topographic Map and Delineate a Watershed activity and then perform each skill on a test.
Related Maine Learning Results	E1 Biodiversity E2 Ecosystems
Sample Lessons And Activities	Draw and label the BHS Water Cycle using the Water Cycle and Water Resources activity worksheet. ▪ Read Chapters 6 and 16 and answer the assigned end of chapter review questions and practice test questions for each. ▪ Read and complete the Defining A Watershed activity. ▪ Individual students will be asked to take a written true/false question pre-test regarding the properties of water. ▪ Students will watch the “Water’s Physical Properties” and “Water’s Structure” videos and complete the accompanying worksheets before answering written post-test questions. ▪ All students will be given chapter 6 and 16 notes on the properties of water prior to witnessing a power-point presentation and then

Science: Environmental Science
Unit 4: Aquatics

	given follow-up questions to be completed. ▪ Identify "Major River Divides" of Maine by completing an assigned worksheet. ▪ Read and "Give Me Ten" facts on the basic BMI morphology packet. ▪ Identify common benthic macro-invertebrates in the BHS pond and stream using a lab sheet and dichotomous key. ▪ Groups of two students will read and learn "How To Read A Topographic Map And Delineate A Watershed" by doing the activity packet. ▪ Select and research one Maine freshwater fish and complete the project worksheet, poster, and presentation to their class. ▪ Read and then answer Limnology packet questions before reviewing answers in class. ▪ If time allows…students will be asked to complete a local positive impact project on a topic of their choice by doing a hands on activity and a two-page typed report.
Sample Classroom Assessment Methods	▪ Answer post-test questions from observing the physical and chemical structures demonstrations and water videos. ▪ Textbook Chapters 6 and 16 Quizzes and Tests. ▪ Previous Maine Envirothon Test Questions on Aquatics. ▪ Benthic macro-invertebrates lab quiz. ▪ Aquatics Unit Test.
Sample Resources	▪ Publications: Environmental Science: A Study of Interrelationships Eighth Edition by Enger/Smith ▪ Maine Envirothon Aquatics Station packet ▪ Peterson Field Guides Freshwater Fishes by Lawrence M. Page and Brooks M. Burr , 1991 ▪ Pond Life edited by Zim, Golden Nature Series ▪ "Water on the Web" www.waterontheweb.org/index.html ▪ Textbook of Limnology by Gerald Cole ▪ Videos: Merrymeeting Bay: The Rising Tide of Stewardship ▪ Water's Structure ▪ Water's Physical Properties ▪ Freshwater Ecosystems ○
Technology Link	▪ http://www.brunswick.k12.me.us/curriculum

Science
Honors: Human Anatomy and Physiology
Unit 1: The Reproductive System

Essential Understandings	▪ The reproductive system ensures continuity of the species by producing offspring. ▪ Male and female gonads produce both gametes and hormones. ▪ Fertilization and embryo development occur in the female reproductive tract. ▪ Labor is initiated by hormones and has three stages.
Essential Questions	▪ What are the organs of the male and female reproductive organs and what are their functions? ▪ How are sperm cells made in the male reproductive system? ▪ How are egg cells made in the female reproductive system? ▪ What are the phases and controls of the menstrual cycle? ▪ How and where does fertilization occur? ▪ What occurs during the first eight weeks of embryo development? ▪ How does an embryo differ from a fetus? ▪ How is labor initiated and what are the three stages of labor? ▪ What agents can interfere with normal fetal development? ▪ How do the male and female reproductive systems change as people age?
Essential Knowledge	▪ The male reproductive organs produce sperm cells that are made during spermatogenesis. ▪ The female reproductive organs produce egg cells that are made during oogenesis. ▪ The menstrual cycle is made of the menstrual phase, the proliferative phase, and the secretory phase and is influenced by lutenizing hormone, follicle stimulating hormone, estrogen and progesterone. ▪ Fertilization occurs in the fallopian tubes and cells division and tissue development lays the groundwork for all of the organ systems in the first eight weeks. ▪ At the beginning of the ninth week the embryo is referred to as a fetus and from that point on growth and organ specialization occurs. ▪ Labor is initiated by hormones and the three phases of labor are the dilation stage, the expulsion stage, and the placental stage. ▪ Menopause occurs in women when a whole year passes without menstruation.
Vocabulary	Gonads or primary sex organs Gametes Accessory reproductive organs Sperm Ova Testes Tunica albuginea Seminiferous tubules

Science
Honors: Human Anatomy and Physiology
Unit 1: The Reproductive System

	Interstitial cells Testosterone Duct System: Epididymis Ductus Deferens or vas deferens Spermatic cord Ampulla Ejaculatory duct Ejaculation Urethra Prostatic urethra Membranous urethra Spongy (penile) urethra Seminal vesicles Prostate Cystitis Prostatitis Prostatic cancer Bulbourethral glands Semen Male infertility Semen analysis Scrotum Penis Shaft Glans penis Prepuce Foreskin Erectile tissue Erection Spermatogenesis Spermatogonia Follicle-stimulating hormone (FSH) Primary spermatocyte Meiosis Spermatids Spermiogenesis Acrosome Testosterone Luteinizing hormone (LH) Secondary sex characteristics Sexual infantilism Sterility Ovaries Ovarian follicles

Science
Honors: Human Anatomy and Physiology
Unit 1: The Reproductive System

	Oocyte Follicle cells Vesicular or Graafian follicle Ovulation Corpus luteum Suspensory ligaments Ovarian ligaments Broad ligament Uterine or fallopian tubes Fimbriae Gonorrhea Pelvic inflammatory disease (PID) Uterus Round and uterosacral ligaments Body Fundus Cervix Endometrium Implantation Cancer of the cervix Myometrium Perimetrium Vagina Hymen External genitalia Vulva Mons pubis Labia majora Labia minora Vestibule Greater vestibular glands Clitoris Perineum Oogenesis Oogonia Primary oocytes Ovarian cycle Secondary oocyte Polar body Ovum Uterine or menstrual cycle Menstrual phase Proliferative phase Secretory phase Estrogens

Science
Honors: Human Anatomy and Physiology
Unit 1: The Reproductive System

	Progesterone Mammary glands Areola Nipple Alveolar glands Lactating Lactiferous ducts Breast cancer Mammography Fertilization Zygote Cleavage Embryo Blastocyst Chorionic vesicle Human chorionic gonadotropin (hCG) Trophoblast Inner cell mass Ectoderm Endoderm Mesoderm Chorionic villi Placenta Amnion Umbilical cord Fetus Pregnancy Relaxin Abortion Parturition Labor Oxytocin Braxton Hicks contractions False labor Prostaglandins Stages of Labor: Dilation stage Expulsion stage Dystocia Cesarean section or C-section Placental stage Afterbirth Puberty Menarche Menopause

Science
Honors: Human Anatomy and Physiology
Unit 1: The Reproductive System

Essential Skills	▪ Label diagrams of both the male and female reproductive systems. ▪ Label diagrams of cell development during spermatogenesis and oogenesis. ▪ Diagram the fluctuation of hormones during the menstrual cycle. ▪ Describe embryo development through the three germ layers. ▪ Describe the three phases of labor.
Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs.

Science
Honors: Human Anatomy and Physiology
Unit 1: The Reproductive System

	a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C1.Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results. C2.Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3.Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical

Science
Honors: Human Anatomy and Physiology
Unit 1: The Reproductive System

	episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life. E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change.

Science
Honors: Human Anatomy and Physiology
Unit 1: The Reproductive System

	a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species. c. Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations. E5.Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution.

Science
Honors: Human Anatomy and Physiology
Unit 1: The Reproductive System

	a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons and Activities	▪ Locate and name structures of both the male and female reproductive systems on a model and diagram ▪ Look at starfish embryology microscope slides ▪ View male and female reproductive systems during rat and fetal pig dissections. ▪ Read articles related to disorders caused by homeostatic imbalance in the male and female reproductive systems.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Essentials of Human Anatomy and Physiology, 9th edition by Elaine N. Marieb o Anatomy and Physiology Coloring Workbook: A Complete Study Guide by Elaine N. Marieb o Essentials of Human Anatomy and Physiology Laboratory Manual by Elaine N. Marieb ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine o Nova: Life's Greatest Miracle ▪ Other Resources Lab Supplies

Science
Honors: Human Anatomy and Physiology
Unit 2: The Urinary System

Essential Understandings	▪ The urinary system rids the body of nitrogenous wastes while regulating water, electrolyte, and acid-base balance of the blood.
Essential Questions	▪ What are the major structures of the urinary system? ▪ What is the functional unit of the kidney? ▪ What is the composition of normal urine? ▪ What is the role of antidiuretic hormone (ADH) in the regulation of water balance by the kidney? ▪ How do the kidneys help to maintain the acid-base balance of the blood?
Essential Knowledge	▪ The structures of the urinary system are the kidneys, ureters, urinary bladder, and urethra. ▪ The nephron is the structural and functional unit of the kidney. ▪ Urine contains nitrogenous wastes and unneeded substances. ▪ Antidiuretic hormone helps to maintain blood volume by causing water to be recollected at the kidneys and returned to the blood stream. ▪ The kidneys help to maintain the pH of blood by regulating the levels of hydrogen ions (H^+) in the blood.
Vocabulary	Urea kidney renal artery renal vein renal medulla renal cortex ureter urinary bladder nephron glomerulus Bowman's capsule filtration filtrate reabsorption secretion loop of Henle urine urethra dialysis
Essential Skills	▪ Diagram and label organs of the urinary system. ▪ Describe how blood is filtered by the nephrons. ▪ Explain how urine is produced and how water balance is maintained by the urinary system. ▪ Describe how the pH of the blood is maintained.

Science
Honors: Human Anatomy and Physiology
Unit 2: The Urinary System

Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process.

Science
Honors: Human Anatomy and Physiology
Unit 2: The Urinary System

	e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C1.Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results. C2.Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3.Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society.

Science
Honors: Human Anatomy and Physiology
Unit 2: The Urinary System

	c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life. E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual

Science
Honors: Human Anatomy and Physiology
Unit 2: The Urinary System

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Science
Honors: Human Anatomy and Physiology
Unit 2: The Urinary System

	advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons and Activities	▪ Locate and name organs of the urinary system on a model and diagram. ▪ Microscope labs comparing tissue from a healthy kidney and a kidney with cancer ▪ Model urinalysis lab ▪ View urinary organs during rat and fetal pig dissections. ▪ Read articles related to disorders caused by homeostatic imbalance in the urinary system.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Essentials of Human Anatomy and Physiology, 9th edition by Elaine N. Marieb o Anatomy and Physiology Coloring Workbook: A Complete Study Guide by Elaine N. Marieb o Essentials of Human Anatomy and Physiology Laboratory Manual by Elaine N. Marieb ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources Lab Supplies

Science
Honors: Human Anatomy and Physiology
Unit 3: The Endocrine System

Essential Understandings	▪ The endocrine system maintains homeostasis by releasing chemicals called hormones, and it controls prolonged or continuous processes such as growth and development, reproduction, and metabolism. ▪ Negative feedback regulates many of the hormones in the body. ▪ The endocrine system is made of multiple endocrine organs distributed throughout the body. ▪ Hypersecretion or hyposecretion of hormones leads to homeostatic imbalance.
Essential Questions	▪ How do hormones bring about their effects in the body? ▪ What is negative feedback and what is its role in regulating blood levels of various hormones? ▪ What are the major endocrine glands and tissues? ▪ What hormones are produced by each endocrine gland and what is the function of each hormone? ▪ What is the functional relationship between the hypothalamus and the pituitary gland? ▪ What are the major pathological consequences of hypersecretion and hyposecretion of the hormones produced by the endocrine system? ▪ How does aging effect the endocrine system and body homeostasis?
Essential Knowledge	▪ Hormones are chemicals that travel through the bloodstream and bind to specific chemical receptors on target cells. ▪ Heating and cooling systems controlled by thermostats are examples of mechanical feedback systems. The hormones of the endocrine system are biological examples of the same process. ▪ The pituitary gland secretes nine hormones that directly regulate many body functions and controls the actions of several other endocrine glands. For this reason it is often referred to as the master gland. ▪ The hypothalamus controls the secretions of the pituitary gland. ▪ The pineal gland releases melatonin which regulates sleep-wake cycles. ▪ The thyroid gland has the major role in regulating the body's metabolism. ▪ The thyroid gland and parathyroid glands work together to maintain homeostasis in blood calcium levels. ▪ The adrenal glands help the body prepare for and deal with stress. ▪ Insulin and glucagon released from the pancreas help to keep the level of glucose in the blood stable. ▪ The gonads serve two important functions: the production of gametes and the secretion of sex hormones. ▪ Many disorders are the result of hypersecretion or hyposecretion of

Science
Honors: Human Anatomy and Physiology
Unit 3: The Endocrine System

	hormones released by the endocrine glands.
Vocabulary	Hormone target cell gland exocrine gland endocrine gland steroid hormones nonsteroid hormones prostaglandins feedback mechanism thyroid-releasing hormone (TRH) thyroid-stimulating hormone (TSH) antidiuretic hormone (ADH) calcitonin parathyroid hormone (PTH) pituitary gland antidiuretic hormone (ADH) oxytocin follicle-stimulating hormone (FSH) luteinizing hormone (LH) thyroid-stimulating hormone (TSH) adreno-corticotropic hormone (ACTH) growth hormone (GH) prolactin melanocyte-stimulating hormone (MSH) hypothalamus pineal gland melatonin thyroid thyroxine hyperthyroidism hypothyroidism goiter cretinism parathyroid glands parathyroid hormone (PTH) thymus thymosin adrenal glands epinephrine (adrenaline) norepinephrine (noradrenaline) “fight or flight” response pancreas islets of Langerhans insulin

Science
Honors: Human Anatomy and Physiology
Unit 3: The Endocrine System

	glucagon diabetes mellitus gonad ovary eggs estrogen progesterone testes sperm testosterone
Essential Skills	▪ Locate and label endocrine glands in the human body. ▪ Name the hormones made by each endocrine gland and describe the effect of each hormone on the body. ▪ Be able to explain the disorders caused in the body by the hypersecretion or hyposecretion of hormones.
Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence.

Science
Honors: Human Anatomy and Physiology
Unit 3: The Endocrine System

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Science
Honors: Human Anatomy and Physiology
Unit 3: The Endocrine System

	b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life. E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of

Science
Honors: Human Anatomy and Physiology
Unit 3: The Endocrine System

	species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving

Science
Honors: Human Anatomy and Physiology
Unit 3: The Endocrine System

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Sample Lessons and Activities	▪ Locate and name endocrine glands on a model and diagram. ▪ View on line video of the effect of insulin on a goldfish. ▪ Microscope labs looking at endocrine gland tissue slides. ▪ View endocrine glands during a rat and fetal pig dissection. ▪ Read articles related to disorders caused by homeostatic imbalance in various endocrine glands.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Essentials of Human Anatomy and Physiology, 9th edition by Elaine N. Marieb o Anatomy and Physiology Coloring Workbook: A Complete Study Guide by Elaine N. Marieb o Essentials of Human Anatomy and Physiology Laboratory Manual by Elaine N. Marieb ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources Lab Supplies

Science
Honors: Human Anatomy and Physiology
Unit 4: The Respiratory System

Essential Understandings	▪ The respiratory system supplies oxygen to the blood while removing carbon dioxide. ▪ The respiratory passageway extends from the nasal cavity to the alveoli of the lungs. ▪ Respiratory muscles cause volume changes that lead to air flow into and out of the lungs (breathing). ▪ The brain is involved in control of respiration. ▪ Tobacco smoke and air pollution can lead to a number of respiratory problems.
Essential Questions	▪ How are oxygen and carbon dioxide exchanged between the blood and the tissues? ▪ What anatomical structures does air pass through as it travels from the nasal cavity to the alveoli? ▪ How do respiratory muscles control the change in volume of the lungs during inhalation and exhalation? ▪ How is the brain involved in respiration? ▪ What disorders are caused by smoking and air pollution?
Essential Knowledge	▪ At the alveoli, oxygen diffuses from the air into the blood and carbon dioxide diffuses out of the blood into the air. ▪ At the tissues, oxygen diffuses out of the blood and into the cells and carbon dioxide diffuses out of the cells into the blood. ▪ Air travels through the nose pharynx, larynx, trachea, bronchi, to reach the alveoli in the lungs. ▪ The diaphragm and intercostal muscles control the size of the thoracic cavity. ▪ The medulla oblongata monitors the amount of carbon dioxide in the blood. ▪ Tobacco smoke and air pollution can lead to lung cancer, emphysema, and chronic bronchitis.
Vocabulary	pharynx epiglottis trachea or windpipe cilia mucus larynx vocal cords bronchi: plural (bronchus: singular) bronchioles alveoli: plural (alveolus: singular) gas exchange: O_2 and CO_2 breathing inhalation exhalation diaphragm

Science
Honors: Human Anatomy and Physiology
Unit 4: The Respiratory System

	nicotine carbon monoxide tar bronchitis emphysema lung cancer
Essential Skills	▪ Label a diagram showing the major structure of the respiratory system and be able to recognize those structures on a model. ▪ Explain how gas exchange occurs in the lungs and at the tissues. ▪ Use a model to demonstrate how pressure allows for inhalation and exhalation of gases. ▪ Describe two diseases or disorders caused by smoking and air pollution.
Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications.

Science
Honors: Human Anatomy and Physiology
Unit 4: The Respiratory System

	f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C1.Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results. C2.Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3.Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality

Science
Honors: Human Anatomy and Physiology
Unit 4: The Respiratory System

	of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life. E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural

Science
Honors: Human Anatomy and Physiology
Unit 4: The Respiratory System

	and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species. c. Explain how the instructions in DNA that lead to cell

Science
Honors: Human Anatomy and Physiology
Unit 4: The Respiratory System

	differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations. E5.Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution. a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons and Activities	▪ Locate and name respiratory system organs on a model and diagram. ▪ Examine lungs, heart, trachea, and bronchi in a sheep pluck dissection ▪ Complete an activity testing lung capacity ▪ Model the action of lungs using a lung model ▪ Compare healthy lung tissue with the lung tissue from a smoker using microscope slides ▪ View respiratory system organs during rat and fetal pig dissections. ▪ Read articles related to disorders caused by homeostatic imbalance in the respiratory system.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Essentials of Human Anatomy and Physiology, 9th edition by Elaine N. Marieb o Anatomy and Physiology Coloring Workbook: A Complete Study Guide by Elaine N. Marieb o Essentials of Human Anatomy and Physiology Laboratory Manual by Elaine N. Marieb ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources Lab Supplies

Science
Honors: Human Anatomy and Physiology
Unit 5: The Digestive System

Essential Understandings	▪ The digestive system breaks down ingested food into particles small enough to be absorbed into the blood. ▪ Both mechanical and chemical digestion are used to break down food. ▪ Each organ in the digestive system has a specific role to play in the breakdown of food. ▪ Accessory structures aid in the digestion of food.
Essential Questions	▪ How is food broken down in the body? ▪ Where do mechanical and chemical digestion take place in the digestive system? ▪ What role does each organ and accessory organ play in the breakdown of food? ▪ How do digestive enzymes aid in the break down of food? ▪ Where are most of the nutrients absorbed into the blood stream?
Essential Knowledge	▪ The digestive system includes the mouth, pharynx, esophagus, stomach, small intestine, and large intestine. ▪ Several major accessory structures, including the teeth, salivary glands, the pancreas, and the liver, add secretions to the digestive system. ▪ Peristalsis moves food through the digestive system. ▪ Digestive enzymes like amylase and pepsin are used to break down carbohydrates and proteins. ▪ Most nutrients are absorbed in the small intestine. ▪ Most water is absorbed in the large intestine. ▪ Disorders of the digestive system affect the body's ability to absorb nutrients and water balance.
Vocabulary	mouth teeth saliva salivary amylase mechanical digestion chemical digestion bolus esophagus peristalsis cardiac sphincter stomach peptic ulcer chyme pepsin pyloric valve small intestine duodenum jejunum

Science
Honors: Human Anatomy and Physiology
Unit 5: The Digestive System

	ileum pancreas amylase trypsin lipase sodium bicarbonate liver bile gallbladder villus microvilli large intestine diarrhea rectum
Essential Skills	▪ Recognize and label organs and accessory organs of the digestive system. ▪ Describe the movement of food and water through the digestive system. ▪ Explain how enzymes are used to break down food.
Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls.

Science
Honors: Human Anatomy and Physiology
Unit 5: The Digestive System

	c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C1.Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results. C2.Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and

Science
Honors: Human Anatomy and Physiology
Unit 5: The Digestive System

	technological design. C3.Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life. E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that

Science
Honors: Human Anatomy and Physiology
Unit 5: The Digestive System

	some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems

Science
Honors: Human Anatomy and Physiology
Unit 5: The Digestive System

	for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species. c. Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations. E5.Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution. a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons and Activities	▪ Locate and name digestive organs on a model and diagram. ▪ Complete a lab testing the function of the enzymes pepsin and amylase in digestion ▪ Microscope labs looking at tissue from digestive system organs ▪ Compare liver tissue from a normal liver and a liver effected by cirrhosis using microscope slides ▪ View digestive system organs during rat and fetal pig dissections. ▪ Read articles related to disorders caused by homeostatic imbalance in various digestive system organs.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Essentials of Human Anatomy and Physiology, 9th edition by Elaine N. Marieb o Anatomy and Physiology Coloring Workbook: A Complete Study Guide by Elaine N. Marieb o Essentials of Human Anatomy and Physiology Laboratory Manual by Elaine N. Marieb ▪ Videos:

Science
Honors: Human Anatomy and Physiology
Unit 5: The Digestive System

	○ National Geographic: Inside the Living Body ○ National Geographic: The Incredible Human Machine ▪ Other Resources Lab Supplies

Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

Essential Understandings	▪ The heart pumps blood. ▪ Blood vessels provide the conduits within which blood circulates to all body tissues. ▪ The heart contains nerve tissue that regulates the pace of the heart. ▪ Blood pressure measures the pressure the blood exerts against the inner walls of the blood vessels. ▪ Diet and lifestyle can effect cardiovascular health.
Essential Questions	▪ Where is the heart located and what are the major anatomical areas of the heart? ▪ How does blood travel through the body? ▪ What regulates the pace of the heart? ▪ How are arteries, veins, and capillaries similar and different? ▪ How does arterial circulation of the brain, hepatic portal circulation, and fetal circulation differ from regular circulation? ▪ How is blood pressure measured? ▪ How do diet and lifestyle effect cardiovascular health?
Essential Knowledge	▪ The heart is located in the thoracic cavity between the lungs. ▪ Blood travels through the heart and body using both pulmonary and systemic circuits. ▪ Valves in the heart prevent the backflow of blood. ▪ The sinoatrial node or pacemaker sets the pace for the heart. ▪ Arteries have a thicker wall and tend to carry blood away from the heart while veins have a thinner wall and carry blood back to the heart. ▪ The Circle of Willis helps to protect delicate brain tissue, the hepatic portal circulation helps aid digestion, and fetal circulation protects the baby because the lungs and digestive system are not yet working. ▪ Two measurements are made for blood pressure, systolic pressure and diastolic pressure. ▪ A diet high in saturated fat and poor exercise habits can lead to cardiovascular disease like high blood pressure, and atherosclerosis.

Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

Vocabulary	Mediastinum Apex Base Pericardium Fibrous pericardium Serous pericardium Parietal layer Visceral layer or epicardium Pericarditis Myocardium Endocardium Atria Ventricles Interventricular septum or interatrial septum Superior venae cavae Inferior venae cavae Pulmonary trunk Pulmonary arteries Pulmonary veins Pulmonary circulation Aorta Systemic circulation Atrioventricular or AV valves Bicuspid or mitral valve Tricuspid valve Chordae tendineae Semilunar valves Pulmonary valve Aortic valve Endocarditis Cardiac Circulation Coronary arteries Coronary sulcus or atrioventricular groove Anterior interventricular artery Circumflex artery Posterior interventricular artery Marginal artery Cardiac veins Coronary sinus Angina pectoris Infarct Myocardial infarction Intrinsic conduction system Nodal system Sinoatrial (SA) node

Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

	Atrioventricular (AV) node Atrioventricular (AV) bundle (bundle of His) Bundle branches Purkinje fibers Pacemaker Heart block Ischemia Fibrillation Tachycardia Bradycardia Systole diastole Cardiac cycle Mid-to-late diastole Ventricular systole Early diastole Heart sounds “lub” “dub” murmurs Cardiac output (CO) Heart rate (HR) Stroke volume (SV) Regulation of Stroke Volume Starling’s law of the heart Venous return Muscular pump Congestive heart failure (CHF) Pulmonary edema Vascular system Arteries Arterioles Capillary beds Venules Veins Tunics Microcirculation Vascular shunt Terminal arteriole Postcapillary venule Precapillary sphincter Varicose veins Thrombophlebitis Pulmonary embolism Aorta Ascending aorta

Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

	Aortic arch Thoracic aorta Abdominal aorta Right (R.) coronary arteries Left (L.) coronary arteries Brachiocephalic trunk R. common carotid artery R. subclavian artery L. common carotid artery Brachial artery Radial artery Ulnar artery Intercostals arteries Bronchial arteries Esophageal arteries Phrenic arteries Celiac trunk L. gastric artery Splenic artery Common hepatic artery Superior mesenteric artery Renal arteries Gonadal arteries Ovarian arteries Testicular arteries Inferior mesenteric artery Femoral artery Popliteal artery Anterior tibial artery Posterior tibial artery Dorsalis pedis artery Superior vena cava Inferior vena cava Radial veins Ulnar veins Brachial vein Axillary vein Cephalic vein Subclavian vein External jugular vein Vertebral vein Internal jugular vein Brachiocephalic veins Anterior tibial vein Posterior tibial vein

Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

	Fibular vein Popliteal vein Femoral vein External iliac vein Great saphenous veins Common iliac (R. and L.) vein R. gonadal vein L. gonadal vein Renal veins Hepatic portal vein Hepatic (R. and L.) veins Cerebral arterial circle or circle of Willis Umbilical vein Umbilical arteries Ductus venosus Foramen ovale Ductus arteriosus Ligamentum arteriosum Hepatic portal circulation Pulse Pressure points Blood pressure Systolic pressure Diastolic pressure Hypotension Orthostatic hypotension Circulatory shock Hypertension or high blood pressure Congenital heart defects Coronary artery disease Atherosclerosis Arteriosclerosis
Essential Skills	Recognize and identify different regions of the heart. Be able to describe the pathway blood takes through the heart and body. Be able to compare and contrast arteries, veins, and capillaries. Be able to interpret a blood pressure reading. Recognize the effect of lifestyle on the cardiovascular system.
Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's

Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

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Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

	C1.Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results. C2.Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3.Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2.Earth

Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

	Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life. E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic

Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

	functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species. c. Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations. E5.Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution. a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons	▪ Locate and name structures on human heart models ▪ Do a sheep heart dissection

Science
Honors: Human Anatomy and Physiology
Unit 6: The Cardiovascular System

and Activities	▪ Observe blood vessel microscope slides ▪ Learn to take blood pressure using a sphygmomanometer ▪ View cardiovascular system during rat and fetal pig dissections. ▪ Read articles related to disorders caused by homeostatic imbalance of the cardiovascular system
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets Labs
Sample Resources	▪ Publications: o Essentials of Human Anatomy and Physiology, 9th edition by Elaine N. Marieb o Anatomy and Physiology Coloring Workbook: A Complete Study Guide by Elaine N. Marieb o Essentials of Human Anatomy and Physiology Laboratory Manual by Elaine N. Marieb ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources Lab Supplies

Science
Honors: Human Anatomy and Physiology
Unit 7: Blood

Essential Understandings	▪ Blood serves as a vehicle for distributing body heat and for transporting nutrients, respiratory gases, and other substances throughout the body ▪ Blood contains plasma and several formed elements that have various functions in the body. ▪ Blood has the ability to clot. ▪ Blood is categorized into ABO and Rh groups to aid the process of transfusions. ▪ Blood disorders can occur in individuals in every age group.
Essential Questions	▪ What is the composition of blood plasma and how does it function in the body? ▪ What is the function of red blood cells, white blood cells, and platelets in the blood? ▪ How does blood clot? ▪ How are ABO and Rh blood groups determined and how is blood typing used to for the purposes of performing blood transfusions? ▪ What blood disorders can occur?
Essential Knowledge	▪ Blood plasma is 90% water and over 100 different substances are dissolved in it. ▪ Red blood cells contain hemoglobin that carries oxygen. ▪ Disorders of the RBCs include anemia, sickle cell anemia, and polycythemia. ▪ White blood cells are the army of the immune system and they include neutrophils, eosinophils, basophils, lymphocytes, and monocytes. ▪ WBC disorders include leukemia and leukopenia. ▪ Hemostasis is regulated by a variety of blood proteins and enzymes in the blood. ▪ Hemolysis can occur if a recipient gets an incorrect blood transfusion.
Vocabulary	Plasma proteins Albumin Acidosis Alkalosis Erythrocytes or red blood cells (RBCs) Hematocrit Hemoglobin Anemia Sickle cell anemia (SCA) Sickle cell trait (SCT) Polycythemia Leukocytes or white blood cells (WBCs) Buffy coat Diapedesis

Science
Honors: Human Anatomy and Physiology
Unit 7: Blood

	Positive chemotaxis Ameboid motion Leukocytosis Leucopenia Leukemia Granulocytes Neutrophils Eosinophils Basophils Histamine Agranulocytes Lymphocytes Monocytes Platelets Megakaryocytes Hematopoiesis Myeloid tissue Hemocytoblast Lymphoid stem cell Myeloid stem cell Reticulocyte Erythropoietin Colony stimulating factors (CSFs) Interleukins Thrombopoietin Hemostasis Vascular spasms Platlet plug formation Coagulation/blood clotting Tissue factor (TF) PF Prothrombin activator Prothrombin Thrombin Fibrinogen Fibrin Serum Thrombus Embolus Thrombocytopenia Petechiae Hemophilia Antigen Antibodies/agglutinins Agglutination

Science
Honors: Human Anatomy and Physiology
Unit 7: Blood

	ABO blood groups Rh blood groups Hemolysis RhoGAM Hemolytic disease of the newborn Physiologic jaundice
Essential Skills	▪ Describe the physical characteristics of blood plasma ▪ Describe the characteristics of red blood cells and disorders associated with them. ▪ Recognize the five types of white blood cells and disorder associated with white blood cells. ▪ Explain how blood clots. ▪ Explain who ABO and Rh factors are used to determine blood transfusions.
Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve

Science
Honors: Human Anatomy and Physiology
Unit 7: Blood

	investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C1.Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results. C2.Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3.Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. b. Explain how ethical, societal, political, economic, and

Science
Honors: Human Anatomy and Physiology
Unit 7: Blood

	cultural factors influence personal health, safety, and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life. E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species.

Science
Honors: Human Anatomy and Physiology
Unit 7: Blood

	c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species.

Science
Honors: Human Anatomy and Physiology
Unit 7: Blood

	c. Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations. E5.Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution. a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons and Activities	▪ Microscope labs looking at human blood samples including diseased blood. ▪ Using models to explain ABO and Rh blood types. ▪ Do ABO and Rh blood typing lab. ▪ View blood vessels during rat and fetal pig dissections. ▪ Read articles related to disorders caused by homeostatic imbalance of the blood.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets Labs
Sample Resources	▪ Publications: o Essentials of Human Anatomy and Physiology, 9th edition by Elaine N. Marieb o Anatomy and Physiology Coloring Workbook: A Complete Study Guide by Elaine N. Marieb o Essentials of Human Anatomy and Physiology Laboratory Manual by Elaine N. Marieb ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources Lab Supplies

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

Essential Understandings	▪ The nervous system maintains body homeostasis with electrical signals; provides for sensation, higher mental functioning, and emotional response; and activates muscles and glands. ▪ There are two divisions of the nervous system: the central nervous system and the peripheral nervous system. ▪ Neurons have a general structure that can be classified based on their structure and function. ▪ A series of events lead to the generation of a nerve impulse and its conduction from one neuron to another. ▪ Major regions of the brain can to diagramed and labeled. ▪ The brain has protective structures. ▪ Reflexes pass through the spinal cord. ▪ Cranial and spinal nerves are part of the peripheral nervous system. ▪ The effects of the sympathetic and parasympathetic nervous system differ. ▪ Several factors can have harmful effects on brain development. ▪ There are five types of sensory receptors.
Essential Questions	▪ How do the roles of the central nervous system and peripheral nervous system differ? ▪ What is the general structure on a neuron and what are the names of the important anatomical regions? ▪ How is an action potential initiated and how is a nerve impulse generated? ▪ What are the major regions of the brain and what are their functions? ▪ What are the protective structures of the brain? ▪ How do reflexes differ from normal nervous system response? ▪ What are the functions of the major spinal and cranial nerves? ▪ How do the sympathetic and peripheral nervous system differ in their effect on organs in the body? ▪ What factors impact brain development? ▪ How do the sensory organs differ in structure and function?
Essential Knowledge	▪ The CNS is made of the brain and spinal cord while the PNS is made of the spinal and cranial nerves. ▪ Neurons conduct impulses while neuroglia cells help to support the neurons. ▪ The parts of a neuron are the axon, cell body, dendrites, myelin sheath, and nodes of Ranvier. ▪ There are three types of neuron: sensory neurons, interneurons, and motor neurons. ▪ An action potential is an “all-or-none response”. ▪ The generation of a nerve impulse involves a change in charge across the cell membrane that must then be reversed.

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

	▪ There are four major regions of the brain – the cerebrum, the cerebellum, the brain stem, and the diencephalon region and each region has a different role to play in the body. ▪ The meninges and the blood brain barrier help to protect the brain. ▪ Neurons are connected by synapses that allow for passage of an impulse. ▪ The spinal nerves and the cranial nerves send nerves to different locations in the body. ▪ The sympathetic nervous system generates a "fight or flight" response while the parasympathetic nervous system generates a "rest and digest" response. ▪ A lack of oxygen can lead to the death of neurons and exposure to drugs, alcohol, and radiation can be damaging to fetal tissue. ▪ The senses rely on pain receptors, thermoreceptors, mechanoreceptors, chemoreceptors, and photoreceptors to help us perceive the world around us.
Vocabulary	Central nervous system (CNS) Peripheral nervous system (PNS) Sensory or afferent division Somatic sensory fibers Visceral sensory fibers or visceral afferents Motor or efferent division Somatic nervous system or voluntary nervous system Autonomic nervous system (ANS) or involuntary nervous system Sympathetic Parasympathetic Supporting cells or neuroglia Glia Astrocytes Microglia Ependymal cells Oligodendrocytes – myelin sheath Schwann cells Satellite cells Neurons or nerve cells Cell body Nissl substance Neurofibrils Processes or fibers Dendrites Axons Axon hillock Collateral branch Axon terminals Neurotransmitters

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

	Synaptic cleft Synapse Myelin Myelin sheaths Neurilemma Nodes of Ranvier Multiple sclerosis (MS) Nuclei Ganglia Tracts Nerves White matter Gray matter Sensory or afferent neurons Receptors Cutaneous sense organs Proprioceptors Motor or efferent neurons Interneurons or association neurons Multipolar neuron Bipolar neuron Unipolar neuron Nerve impulses Irritability Conductivity Polarized Depolarized Graded potential Action potential or nerve impulse All-or-nothing response Repolarization Salutatory conduction Impulse Electrochemical event Reflexes Reflex arcs Somatic reflexes Autonomic reflexes Neural tube Ventricles Cerebral hemispheres Cerebrum Gyri (gyrus = singular) Sulci (sulcus = singular) Fissures

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

	Lobes Cerebral cortex Primary somatic sensory area Parietal lobe Central sulcus Sensory homunculus Occipital lobe Temporal lobe Primary motor area Frontal lobe Corticospinal or pyramidal tract Motor homunculus Broca's area Speech area Gray matter Cerebral white matter Corpus callosum Basal nuclei or basal ganglia Huntington's disease or Huntington's chorea Parkinson's disease Diencephalons or interbrain Thalamus Hypothalamus Limbic system Pituitary gland Mammillary bodies Epithalamus Pineal body Choroid plexus Brain stem Midbrain Cerebral aqueduct Cerebral peduncles Corpora quadrigemina Pons Medulla oblongata Fouth ventricle Reticular formation Reticular activating system (RAS) Cerebellum Ataxia Meninges Dura mater Falx cerebri Tentorium cerebelli

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

	Arachnoid mater Subarachnoid space Pia mater Arachnoid villi Meningitis Encephalitis Cerebrospinal fluid (CSF) Hydrocephalus Blood-Brain Barrier Concussion Contusion Intracranial hemorrhage Cerebral edema Cerebrovascular accidents (CVAs) Hemiplegia Aphasias Transient ischemic attack (TIA) Spinal cord Cauda equina Dorsal or posterior horns Ventral or anterior horns Central canal Dorsal root Dorsal root ganglion Ventral root Spinal nerves Flaccid paralysis Dorsal, lateral, and ventral columns Spastic paralysis Peripheral nervous system (PNS) Nerve Endoneurium Perineurium Fascicles Epineurium Mixed nerves Sensory or afferent nerves Motor or efferent nerves Cranial nerves I. Olfactory II. Optic III. Oculomotor IV. Trochlear V. Trigeminal VI. Abducens

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

	VII. Facial VIII. Vestibulocochlear IX. Glossopharyngeal X. Vagus XI. Accessory XII. Hypoglossal Spinal nerves Dorsal and ventral rami Plexuses Cervical Phrenic Brachial Lumbar Femoral Sacral Sciatic Autonomic nervous system (ANS) Involuntary nervous system Preganglionic axon Postganglionic axon Sympathetic division Parasympathetic division Sympathetic division Parasympathetic division Cerebral palsy Anencephaly Spina bifida Orthostatic hypotension Arteriosclerosis Senility sensory receptor pain receptor thermoreceptor mechanoreceptor chemoreceptor photoreceptor The Senses The Eye cornea aqueous humor iris vitreous humor pupil lens retina

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

	rod cone fovea optic nerve The Ear auditory canal tympanum hammer anvil stirrup oval window semicircular canal cochlea cochlear nerve eustachian tube Taste and Smell taste bud olfactory bulb
Essential Skills	▪ Recognize the differences between parts of the Central and Peripheral Nervous Systems. ▪ Diagram and label a model of a neuron. ▪ Describe an action potential and nerve impulse. ▪ Name and describe the major sections of the brain. ▪ Label a diagram of the spinal and cranial nerves. ▪ Label of a diagram of an ear and eye.
Related Maine Learning Results	<u>Science</u> A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and

Science
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Unit 8: The Nervous System

	communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C1.Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results. C2.Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems.

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

	a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3.Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life. E. The Living Environment

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

	E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

	maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species. c. Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations. E5.Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution. a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons and Activities	▪ View human brain models ▪ Do a sheep brain dissection ▪ Do a cow eye dissection ▪ Make a model neuron with pipe cleaners ▪ Model an action potential ▪ Reflex and Response Lab ▪ Taste lab using *Gymnema sylvestre* ▪ Test the effect of alcohol on *C. elegans* ▪ View nervous tissue during a rat and fetal pig dissection. ▪ Read articles related to disorders caused by homeostatic imbalance in the nervous system. ▪ Have the school Substance Abuse Counselor meet with the class to discuss the effects of drugs and alcohol on the nervous system
Sample Classroom	▪ Quiz ▪ Chapter Test

Science
Honors: Human Anatomy and Physiology
Unit 8: The Nervous System

Assessment Methods	▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: ○ Essentials of Human Anatomy and Physiology, 9th edition by Elaine N. Marieb ○ Anatomy and Physiology Coloring Workbook: A Complete Study Guide by Elaine N. Marieb ○ Essentials of Human Anatomy and Physiology Laboratory Manual by Elaine N. Marieb ▪ Videos: ○ National Geographic: Inside the Living Body ○ National Geographic: The Incredible Human Machine ▪ Other Resources Lab Supplies

Science: Human Anatomy
Unit 1: The Skeletal System

Essential Understandings	▪ Bones provide invaluable structure and support for the body. ▪ There are a variety of bone shapes. ▪ Joints connect bones. ▪ The skeletal system is divided into 2 main subdivisions. ▪ There are several specific ways a bone can be broken.
Essential Questions	▪ What are the bones of the axial and appendicular skeleton? ▪ What are the different parts of a long and short bone? ▪ How do bones develop from embryo to adulthood? ▪ What are the different types of joints found in the human body? ▪ What are the different types of breaks a bone can undergo?
Essential Knowledge	▪ There are clearly defined parts of a long and short bone. ▪ Bone begins as cartilage in utero and continues to change throughout life. ▪ There are 6 specified types of broken bones each causing different types of trauma. ▪ The Axial skeleton is composed of the bones of the skull, ribs, and spine. ▪ The Appendicular skeleton includes the bones of the arms, legs, and pelvis. ▪ There are 6 types of joints found in the human body.
Vocabulary	▪ <u>Terms</u>: o Appendicular, Axial, Cranium, Fontanel, Pelvic girdle, Sinus, Thorax, Vertebra, Long bone, Short bone, Epiphysis, Diaphysis, Periosteum, Compact Bone, Spongy Bone, Marrow, Osteoblast, Osteocytes, Ossification, Osteoclasts, Epiphyseal Plate, Greenstick Fracture, Fissured Fracture, Comminuted Fracture, Transverse Fracture, Oblique Fracture, Spiral Fracture, Hyoid, Clavicle, Scapula, Sternum, Humerus, Ribs, Radius, Ulna, Femur, Patella, Tibia, Fibula, Tarsals, Metatarsals, Phalanges, Carpals, Metacarpals, Coccyx, Sinus, Cervical Vertebrae, Thoracic Vertebrae, Lumbar Vertebrae, Synovial joint, Fibrous joint Cartilaginous joint, Ball and Socket Joint, Condylar Joint, Plane Joint, Hinge Joint, Pivot Joint, Saddle Joint, Bursa, Sprain, Arthritis, Osteoporosis
Essential Skills	▪ Recognize and name all the major bones of the Axial and Appendicular Skeleton. ▪ Relate development of the skeletal system to health problems found throughout life. ▪ Draw each type of joint. ▪ Label a diagram of a long bone.

Science: Human Anatomy
Unit 1: The Skeletal System

Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution.

Science: Human Anatomy
Unit 1: The Skeletal System

	f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C1. Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results.

Science: Human Anatomy
Unit 1: The Skeletal System

Related Maine Learning Results	C2. Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3. Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4. History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2. Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. D3. Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life.

Science: Human Anatomy
Unit 1: The Skeletal System

Related Maine Learning Results	E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that

Science: Human Anatomy
Unit 1: The Skeletal System

	maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species. c. Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations.

Science: Human Anatomy
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Sample Lessons and Activities	▪ Create a 3D model of a skeleton ▪ Look at X-rays and determine type of broken bone ▪ Use a skeletal model to identify major bones ▪ Lab dissecting bone ▪ Lab Identifying types of joints in body
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine o Biology the Dynamics of Life – Glencoe Internet Resources o Modern Biology-Holt, Rinehart, and Winston ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources o Lab Supplies

Science: Human Anatomy
Unit 2: The Nervous System

Essential Understandings	▪ The Nervous system controls all voluntary and involuntary actions of the body. ▪ Neurons are the main functional units of the nervous system. ▪ The functions of the eye and ear are connected to the nervous system. ▪ Reflexes are controlled by the spinal cord.
Essential Questions	▪ How does information pass from neuron to neuron? ▪ What generates an action potential? ▪ What types of cells compose the nervous system? ▪ How are specific organs controlled by the nervous system? ▪ What is the "all-or-none" response and how does it relate to impulse conduction? ▪ What is a reflex arc? ▪ What are the major sections of the brain? ▪ How are the central and peripheral systems the same or different?
Essential Knowledge	▪ Neurons have a specific structure that dictates function. ▪ The parts of a neuron are the axon, cell body, dendrites, myelin sheath, and nodes of Ranvier. ▪ There are three types of neuron: sensory neurons, interneurons, and motor neurons. ▪ Neurons are connected by synapses that allow for passage of an impulse. ▪ Action potentials are not graded and if a neuron responds, it responds completely. ▪ Reflexes are controlled by a reflex arc. ▪ The cerebrum is divided into halves each with their own functions. ▪ The major lobes of the brain are the frontal lobe, the temporal lobe, the parietal lobe, and the occipital lobe. ▪ The CNS controls the functions of the eyes and ears.
Vocabulary	▪ <u>Terms</u>: o Action Potential, Axon, Dendrite, Central Nervous System, Membrane Potential, Myelin, Nerve, Peripheral Nervous System, Neuron, Reflex Arc, Synapse, Cerebellum, Cerebrum, Hypothalamus, Meninges, Thalamus, Ganglion, Retina, Refraction, Pupil, Cochlea, Impulse, Neuroglia, Neurotransmitters, Sensory Receptors, Effectors, Schwann Cells, Nodes of Ranvier, Motor Neurons, Interneurons, Resting Potential, Action Potential, Frontal Lobe, Parietal Lobe, Temporal Lobe, Occipital Lobe, Medulla Oblongata
Essential Skills	▪ Name and describe the major sections of the brain. ▪ Describe a reflex arc. ▪ Label a diagram of the inner ear and eye. ▪ Label a diagram of a neuron. ▪ Recognize the differences between parts of the Central and

Science: Human Anatomy
Unit 2: The Nervous System

	Peripheral Nervous Systems.

Science: Human Anatomy
Unit 2: The Nervous System

Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution.

Science: Human Anatomy
Unit 2: The Nervous System

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Science: Human Anatomy
Unit 2: The Nervous System

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Science: Human Anatomy
Unit 2: The Nervous System

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Science: Human Anatomy
Unit 2: The Nervous System

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Science: Human Anatomy
Unit 2: The Nervous System

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Science: Human Anatomy
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Sample Lessons and Activities	▪ Test your reflexes lab ▪ Taste, Sight, and Hearing lab ▪ Build a 3D model of a neuron ▪ Sheep brain dissection ▪ Cow eye dissection ▪ Rat dissection
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine o Biology the Dynamics of Life – Glencoe Internet Resources o Modern Biology-Holt, Rinehart, and Winston ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine o PBS Home Video: The Secret Life of the Teenage Brain ▪ Other Resources o Lab Supplies

Science: Human Anatomy
Unit 3: The Muscular System

Essential Understandings	▪ There are multiple types of muscle cells. ▪ Muscle fiber contraction results from the sliding movement of actin and myosin filaments. ▪ Muscles have specific origins and insertions that allow for all movements of the body.
Essential Questions	▪ What are the major muscles of the arms, legs, torso, and head? ▪ How is movement created in the body? ▪ What is the process of muscles obtaining the energy they need? ▪ What are the different parts of a skeletal muscle?
Essential Knowledge	▪ There are three types of muscle: skeletal, cardiac, and smooth. ▪ The proteins Actin and Myosin cause striations in skeletal muscles called sarcomeres. ▪ Motor neurons control muscle contractions. ▪ Energy is needed for muscle contraction and obtained through aerobic and anaerobic respiration. ▪ Repair of muscle fibers increases muscle mass. ▪ Smooth muscles line many internal organs and are controlled involuntarily. ▪ There are major groupings of muscles in the arms, legs, torso, and head.
Vocabulary	▪ <u>Terms</u>: ○ Motor unit, Myofibril, Myofilament, Neuromuscular Junction, Sarcolemma, Sarcomere, T tubules, Tetanus, Fascia, Aponeuroses, Myosin, Actin, Neurotransmitter, Synapse, Motor End Plate, Synaptic Cleft, Sliding Filament Model, Acetylcholine, Acetylcholinesterase, Lactic Acid, Aerobic Respiration, Anaerobic Respiration, ATP, Threshold Stimulus, Tone, Muscular Dystrophy, Insertion, Origin
Essential Skills	▪ Identify the major muscles of the Arm, Leg, Torso, and Head. ▪ List the series of steps in muscle contraction and explain how they move body parts. ▪ List the generalized functions of each major type of muscle. ▪ Describe the sliding filament theory. ▪ Draw a neuromuscular junction. ▪ Explain the difference between aerobic respiration and anaerobic respiration.

Science: Human Anatomy
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Science: Human Anatomy
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Science: Human Anatomy
Unit 3: The Muscular System

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Science: Human Anatomy
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Sample Lessons and Activities	▪ Observe different muscle types under a microscope ▪ Chicken leg dissection ▪ Build a 3D model of the sliding filament theory ▪ Act out aerobic vs anaerobic respiration
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine o Biology the Dynamics of Life – Glencoe Internet Resources o Modern Biology-Holt, Rinehart, and Winston ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources o Lab Supplies

Science: Human Anatomy
Unit 4: Integumenary System

Essential Understandings	▪ The skin has multiple discernable layers. ▪ The skin helps regulate body temperature. ▪ Glands within the skin help other organs and with multiple functions around the body. ▪ There is a specific process that the body undergoes to heal wounds.
Essential Questions	▪ What are the layers of the skin? ▪ How does the skin help maintain homeostasis? ▪ How is skin color determined? ▪ What glands are found within the layers of the skin? ▪ How do cuts heal?
Essential Knowledge	▪ Skin is the largest organ of the body. ▪ The skin is divided into the epidermis, dermis, and sub-cutaneous layers. ▪ Hair grows from within the dermal and epidermal layers. ▪ Each layer of the skin has specific defining characteristics. ▪ The skin regulates heat loss. ▪ Sweat glands and sebaceous glands performs multiple functions. ▪ Common afflictions of the skin include acne, eczema, cysts, and fungal infections. ▪ Skin color is determined by melanin amounts.
Vocabulary	▪ <u>Terms</u>: o Dermis, epidermis, subcutaneous, hair follicle, keratin, melanin, sweat gland, clot, fibroblast
Essential Skills	▪ Recognize that the skin plays a multitude of important role throughout the body. ▪ Be able to diagram the three layers of the skin. ▪ Summarize what determines skin color. ▪ Draw the growth of a hair follicle.

Science: Human Anatomy
Unit 4: Integumenary System

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Science: Human Anatomy
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Science: Human Anatomy
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Science: Human Anatomy
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Sample Lessons and Activities	▪ Engage in a debate over which is more debilitating for a teenager: acne or eczema ▪ Create a 3D model of the layers of the skin. ▪ Draw the process of wound healing. ▪ Observe pigment granules in differently colored skin in prepared slides.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine o Biology the Dynamics of Life – Glencoe Internet Resources o Modern Biology-Holt, Rinehart, and Winston ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources o Lab Supplies

Science: Human Anatomy
Unit 5: The Digestive System

Essential Understandings	▪ Nutrients are absorbed from food. ▪ Secretions from along the digestive tract break down food into usable parts for the body. ▪ Digestion is involuntary. ▪ Each organ of the digestive system has a specific role in the breakdown of food.
Essential Questions	▪ How is food broken down in the body? ▪ What is the path food takes through the body? ▪ How are nutrients absorbed for use? ▪ What are the major organs of the digestive system and how are their functions interrelated?
Essential Knowledge	▪ Peristalsis moves food through the digestive tract. ▪ Food is broken down in a series of mechanical and chemical ways throughout the digestive process. ▪ The major organs of the digestive tract include: Mouth (and all associated parts), Esophagus, Stomach, Pancreas, Liver, Small Intestines, and Large Intestines. ▪ Most nutrients are absorbed after passing through the stomach into the intestines. ▪ Disorders of the Digestive System affect the body's ability to retain nutrients and water.
Vocabulary	▪ <u>Terms</u>: o Alimentary Canal, Mouth, Teeth, Tongue, Saliva, Bile, Mastication, Esophagus, Peristalsis, Chyme, Bolus, Stomach, Duodenum, Jejunum, Ileum, Colon, Liver, Pancreas, Gallbladder, Insulin, Chemical Digestion, Mechanical Digestion, Small Intestine, Large Intestine, Anus, Absorption
Essential Skills	▪ Document the passage of food through the body. ▪ Describe the function and purpose of all major digestive organs. ▪ Draw and label all the organs of the digestive tract. ▪ Explain how various hormones and secretions affect the body's ability to absorb nutrients.

Science: Human Anatomy
Unit 5: The Digestive System

Related Maine Learning Results	Science A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution.

Science: Human Anatomy
Unit 5: The Digestive System

	f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C1. Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results.

Science: Human Anatomy
Unit 5: The Digestive System

Related Maine Learning Results	C2. Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3. Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4. History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2. Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3. Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter

Science: Human Anatomy
Unit 5: The Digestive System

	and energy. h. Describe radioactive decay and half-life.

Science: Human Anatomy
Unit 5: The Digestive System

Related Maine Learning Results	E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that

Science: Human Anatomy
Unit 5: The Digestive System

	maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species. c. Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations.

Science: Human Anatomy
Unit 5: The Digestive System

Related Maine Learning Results	E5.Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution. a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons and Activities	▪ Create a board game that details food's journey through the digestive system ▪ Rat Dissection ▪ Vocab flashcards for all digestive organs ▪ Creative Writing detailing way that nutrients are absorbed
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine o Biology the Dynamics of Life – Glencoe Internet Resources o Modern Biology-Holt, Rinehart, and Winston ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources o Lab Supplies

Science: Human Anatomy
Unit 6: Circulatory System

Essential Understandings	▪ Blood carries all the necessary nutrients and gases for the human body. ▪ The structure of the heart allows for blood to be pumped to all parts of the body. ▪ There are three types of blood vessels. ▪ The heart is the central organ of the Circulatory System
Essential Questions	▪ What allows blood to carry Oxygen and other nutrients? ▪ How does blood circulate around the body? ▪ How does the heart work in conjunction with the lungs? ▪ What is blood pressure?
Essential Knowledge	▪ Hemoglobin allows red blood cells to carry oxygen. ▪ Blood cells come from bone marrow. ▪ The shape of a red blood cell is important for blood flow and the carrying of nutrients. ▪ There are three types of plasma proteins: albumins, globulins, and fibrinogens. ▪ Platelets aid in blood clotting and wound healing. ▪ Blockage of a blood vessel can lead to serious complications. ▪ The valves of the heart allow blood to flow directionally through sections of the heart. ▪ The major blood vessels of the body are arteries, veins, and capillaries. ▪ Blood pressure refers to the stress of the blood pushing outwards on vessels as it flows through the body. ▪ Electrical impulses trigger cardiac rhythms.
Vocabulary	▪ <u>Terms</u>: o Hemoglobin, Leuocyte, Plasma, Platelet, Arteriole, Artery, Atrium, Capillary, Endocardium, Epicardium, Myocardium, Pericardium, Vein, Ventricle, Diastole, Systole, Stroke, Cardiac Arrest, Albumin, Globulin, Fibrinogen, Coagulation, Fibrin, Septum, Tricuspid Valve, Pulmonary Valve, Aorta, Vena Cava, Aortic Valve, ECG
Essential Skills	▪ Label all the parts of a human heart and track blood flow. ▪ Discuss the flow of blood through the body and the body's mechanisms for ensuring all organs get appropriate nutrients. ▪ Recognize the connection between the heart and lungs. ▪ Describe how a wound heals. ▪ Read a person's blood pressure. ▪ Describe some of the proteins found in blood.

Science: Human Anatomy
Unit 6: Circulatory System

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Science: Human Anatomy
Unit 6: Circulatory System

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Science: Human Anatomy
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Science: Human Anatomy
Unit 6: Circulatory System

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Science: Human Anatomy
Unit 6: Circulatory System

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Sample Lessons and Activities	▪ Draw and label a human heart ▪ Cow heart dissection ▪ Rat dissection ▪ Blood typing lab ▪ Observe blood cells under microscope ▪ Blood pressure lab
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine o Biology the Dynamics of Life – Glencoe Internet Resources o Modern Biology-Holt, Rinehart, and Winston ▪ Videos: o National Geographic: Inside the Living Body o National Geographic: The Incredible Human Machine ▪ Other Resources o Lab Supplies

Science: Marine Science
Unit 1: Maine Marine Ecosystems

Essential Understandings	▪ Maine has a rich and important historical association with commercial fishing. ▪ Numerous marine organisms offer sustainable fishing populations off the Coast of Maine. ▪ The fish stocks in the Gulf of Maine are being depleted. ▪ Pollution and other human interferences are greatly affecting Maine marine resources. ▪ Certain organisms have evolved to survive the harsh conditions of a rocky shore. ▪ Maine's rocky shore is unique. ▪ Maine's climate and terrestrial enterprises affect the productivity level of the coastal marine ecosystems. ▪ There are numerous career opportunities connected with Marine resources.
Essential Questions	▪ What is the history of fish stocks in Maine? ▪ What marine organisms offer sustainable fishing populations off the coast of Maine? ▪ How has fishing affected fish stocks both in the past and at present? ▪ What options remain to restore fish stocks? ▪ What is the correlation between Maine's climate and the productivity level of Maine's ecosystem? ▪ How do people fish commercially in the Gulf of Maine? ▪ What steps can be taken to further protect the Gulf of Maine from pollution? ▪ Who benefits from Maine's fisheries? ▪ What makes Maine's rocky shore a unique ecosystem? ▪ What specific adaptations have organisms evolved to survive the harsh conditions of the rocky shore?
Essential Knowledge	▪ Maine's marine resources affect trade markets around the world. ▪ Maine's marine organisms affect food webs around the world. ▪ Fish populations can be categorized in a variety of ways. ▪ Discoveries and changes in 20th century science have led to the expansion of fisheries in Maine and unstable fish populations. ▪ There are arguments for and against expanding fishing regulations off the Coast of Maine. ▪ Ocean resources can be either physical or biological. ▪ Maine's marine ecosystems provide numerous limiting factors affecting diverse populations. ▪ There are 5 standard types of commercial fishing. ▪ All fishing endeavors impact the Maine Coast and ocean environments. ▪ Pollution is a major threat to the Coast of Maine in a variety of ways. ▪ The tidal cycle greatly affects the rocky shore and the organisms that live there.

Science: Marine Science
Unit 1: Maine Marine Ecosystems

	▪ Organisms of the Maine's rocky shores have developed specific adaptations to help them survive harsh conditions.
Vocabulary	▪ Terms: ○ Ecosystem, fish stocks, rocky shores, tidal systems, pollution, physical resource, biological resource, regulation, adaptation, population, commercial, gulf, alternative energy, limiting factor
Essential Skills	▪ Discuss and analyze the contributions of marine organisms to the world food webs. ▪ Categorize Maine's fish populations. ▪ Justify how technology has affected fisheries in Maine both for better and worse. ▪ Interpret and expand arguments for and against changing fishing regulations. ▪ Discriminate between different ocean resources. ▪ Identify at least 5 limiting factors of Maine's Marine ecosystem. ▪ Summarize the five standard types of commercial fishing. ▪ Describe how various methods of fish harvesting impact the Maine Coast and ocean environments. ▪ Identify and illustrate at least 10 sources of pollution in the Gulf of Maine. ▪ List career opportunities related to Maine's Oceans. ▪ Diagram the relationship between organisms living on the rocky shore and the tidal cycle. ▪ Distinguish specific adaptations related to species survival on Maine's rocky shore.

Science: Marine Science
Unit 1: Maine Marine Ecosystems

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Science: Marine Science
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Science: Marine Science
Unit 1: Maine Marine Ecosystems

	molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predications about chemical reactions. c. Explain the essential roles of carbon and water in life processes. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules). f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions.

Science: Marine Science
Unit 1: Maine Marine Ecosystems

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Science: Marine Science
Unit 1: Maine Marine Ecosystems

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Sample Lessons and Activities	▪ Historical research ▪ Diagram/illustration of rocky shore ▪ Organism dissection ▪ Shore clean up ▪ Debate on fishing regulations ▪ Interview with a lobsterman
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs ▪ Debates ▪ Dissections ▪ Interviews
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine o Biology the Dynamics of Life – Glencoe Internet Resources o An introduction to Marine Life 6th Ed. By James Sumich ▪ Other Resources o Lab Supplies

Science: Marine Science
Unit 2: Survey of Marine Life

Essential Understandings	▪ Marine organisms have adaptations to help them survive. ▪ Characteristics of water affect life in the oceans. ▪ Photic zones of the oceans exhibit markedly different types of life. ▪ Marine life can be characterized and identified in many different ways. ▪ Marine mammal evolution mimics evolution of terrestrial mammals.
Essential Questions	▪ What specific adaptations have different marine organisms established to help their survival? ▪ What challenges do marine ecosystem present to the organisms that live in them? ▪ How do buoyancy, resistance, and movement of water affect marine life? ▪ What is the evolutionary history of marine mammals? ▪ How are diverse phytoplankton identified and categorized? ▪ What makes coral reefs such an integral and important marine ecosystem? ▪ How can the loss of one marine ecosystem affect others? ▪ How are marine algae identified? ▪ How are different fish species categorized? ▪ How do adaptations change according to the depth organisms inhabit? ▪ How do some marine organisms utilize sound? ▪ What role do marine organisms play in the world's food webs? ▪ How are different phyla of marine organisms evolutionarily related?
Essential Knowledge	▪ The adaptations of different marine organisms are diverse but allow for reproductive success in a variety of ecosystems. ▪ A marine organism's ability to change their buoyancy is integral to their survival. ▪ Currents and other movements of water greatly affect marine life. ▪ Changes in the relative numbers of marine organisms in a given population can affect food webs across the globe. ▪ Marine mammals evolved from terrestrial mammals. ▪ Phytoplankton can be identified and characterized. ▪ Different photic zones and coral reefs are home to key species of marine organisms that affect other marine ecosystems around the world. ▪ Marine algae can be identified and characterized. ▪ Fish are categorized according to their evolutionary history. ▪ Specific adaptations, including a swim bladder and dorsal lines, allow fish to inhabit many different marine environments. ▪ Changes in marine ecosystems can have a dramatic affect on the organisms that live there.
	▪ Terms: o Evolution, swim bladder, kingdom, phylum, class, order, family, genus, species, adaptation, coral, buoyancy,

Science: Marine Science
Unit 2: Survey of Marine Life

Vocabulary	resistance, current, food web, cartilaginous
Essential Skills	▪ Describe how marine organisms take advantage of sound and its behavior in water. ▪ Explain how buoyancy, resistance, and movement of water affect marine life. ▪ Compare and contrast various marine invertebrate organisms. ▪ View, draw, design, and modify various marine invertebrate and vertebrate adaptations. ▪ Describe predator/prey relationships in the ocean. ▪ Identify given marine mammal species. ▪ Distinguish and describe how marine mammals have evolved. ▪ Organize the evolutionary history of major fish groups. ▪ Explain how a fish can change their buoyancy using a swim bladder. ▪ Hypothesize how evolution will affect future marine organisms. ▪ Compare and contrast bony and cartilaginous fish.

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Science: Marine Science
Unit 2: Survey of Marine Life

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Science: Marine Science
Unit 2: Survey of Marine Life

Related Maine Learning Results	C2. Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3. Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4. History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2. Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. a. Describe and analyze the effect of solar radiation, ocean currents, and atmospheric conditions on the Earth's surface and the habitability of Earth. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. D3. Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter

Science: Marine Science
Unit 2: Survey of Marine Life

	and energy. b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predications about chemical reactions. c. Explain the essential roles of carbon and water in life processes. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules). f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions.

Science: Marine Science
Unit 2: Survey of Marine Life

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Unit 2: Survey of Marine Life

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Sample Lessons and Activities	▪ Whale watch ▪ Coral reef diorama ▪ Fish ID ▪ Make your own fish market activity ▪ Design a fish ▪ Phytoplankton ID ▪ Marine Algae ID ▪ Marine food webs ▪ Interview a whaler ▪ Debate on current fishing/whaling restrictions ▪ Fish dissection
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs ▪ Debates ▪ Dissections ▪ Organism IDs
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine o Biology the Dynamics of Life – Glencoe Internet Resources o An introduction to Marine Life 6th Ed. By James Sumich ▪ Other Resources o Lab Supplies

Science: Marine Science
Unit 3: Oceans

Essential Understandings	▪ There are many aspects of the oceans still not understood by scientists. ▪ Salt concentrations are not the same across oceans. ▪ Oceans affect weather patterns. ▪ Water has key characteristics that make it essential for life. ▪ Weather patterns have changed over time. ▪ Light saturation is lower as the ocean gets deeper.
Essential Questions	▪ How do levels of organics affect the dissolved salt concentrations in the ocean? ▪ What effect does erosion have on terrestrial and marine ecosystems? ▪ How does salinity affect oceanic populations? ▪ What role do oceans play in weather patterns? ▪ What key characteristics of water allow it to be so important for life? ▪ What does a water molecule look like and how is it structured? ▪ How have weather patterns changed over the years? ▪ What causes waves?
Essential Knowledge	▪ Light scatters or is absorbed in the ocean to create photic zones. ▪ Ions affect the way materials are dissolved in water. ▪ Water's shape and structure allow it to interact with ions and be integral for life. ▪ The ocean has a profound effect on weather patterns. ▪ Erosion plays an important part in habitat loss and nutrient recycling in the oceans.
Vocabulary	▪ Terms: ○ erosion, photic zones, tsunamis, ion, charges, light absorption, salinity, refraction
Essential Skills	▪ Describe how photic zones in the ocean are created. ▪ Draw and describe a water molecule. ▪ Explain how water molecules interact with each other and ions. ▪ Interpret the ocean's effect on various weather patterns. ▪ Select and analyze in detail ways that erosion can negatively affect an ecosystem or population. ▪ Predict future effects of severe weather patterns on the world's ecosystems. ▪ Describe one solution to erosion. ▪ Explain how ocean climates affect terrestrial populations.

Science: Marine Science
Unit 3: Oceans

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Science: Marine Science
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Science: Marine Science
Unit 3: Oceans

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Science: Marine Science
Unit 3: Oceans

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Sample Lessons and Activities	▪ Create a model to show erosion on the Maine Coast. ▪ Draw the photic zones of the ocean and explain properties of each that make them hospitable and not hospitable to life. ▪ Build a model of a water molecule. ▪ Research current methods to stop erosion and severe weather patterns.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs ▪ Class discussions ▪ Think/Pair/Share
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Science: Marine Science
Unit 4: Climate Change

Essential Understandings	▪ There are many aspects of the oceans still not understood by scientists. ▪ The heat capacity of water affects the Earth's climate. ▪ The Earth's climate is changing. ▪ An increase in relative temperatures profoundly affects numerous systems on Earth. ▪ There are several models to explain rising temperatures. ▪ Availability of energy limits the distribution of organisms in an ecosystem. ▪ Scientists use the scientific method to explain and analyze data. ▪ The goal of science is to use explanations to make predictions. ▪ In biological systems, competition is integral for survival. ▪ If current trends in weather patters and temperature shifts continue, the coast of Maine will be permanently altered.
Essential Questions	▪ What parts of the ocean do we know a lot about? What parts are still to be explored? ▪ How has the Earth changed over time? ▪ How does heat capacity of water affect the Earth's climate? ▪ How does temperature affect the density and salinity of ocean water? ▪ What evidence suggests climate change? ▪ How can scientists accurately analyze current models to explain rising temperatures? ▪ How are changes to oceanic water characterizations cyclic? ▪ How will rising temperatures affect the Coast of Maine?
Essential Knowledge	▪ The Earth has been changing for billions of years, but never at its current rate. ▪ Several models exist to explain climate change, but some have more merit than others. ▪ Current weather cycles and temperate changes indicate major shifts in oceanic patterns. ▪ Parts of the deepest oceans have yet to be explored by man. ▪ Chemical energy is obtained and transported in various ways in an ecosystem. ▪ Matter and energy are recycled and recombined in oceanic ecosystems. ▪ Science and technology affect human health on a global scale. ▪ The Coast of Maine is especially susceptible to climatic changes and will be forever changed if current climate trends continue.
Vocabulary	▪ <u>Terms</u>: ○ Climate, weather patterns, heat capacity, invasive species, extinction, pH, salinity, scientific method, energy cycling, tropic levels, hypothesis, inference, observation, biologic relationships, renewable resources, theory, oceanic layering
	▪ Recognize that fossil records provide a scientific explanation for

Science: Marine Science
Unit 4: Climate Change

Essential Skills	variation in the species and common ancestors. ▪ Differentiate layering in the ocean according to density. ▪ Analyze and infer the effects of changes within the correlation between climate regions and relative productivity levels of divergent marine ecosystems. ▪ Discriminate explanations for climate change. ▪ Diagram long-term effects on oceanic climates and marine populations if warming trends continue. ▪ Compare and contrast various endeavors to halt or slow climate change. ▪ Identify how Maine is being affected by climate change. ▪ Evaluate current research being done on climate change. ▪ Relate changing climate patterns with natural disasters.

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Science: Marine Science
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Sample Lessons and Activities	▪ Create an advertisement for climate change. ▪ Compile a list of 10 species affected by climate change and explain how they will be affected. ▪ Create a timeline of major oceanic discoveries including possible future events. ▪ Analyze current journal articles focusing on climate change and engage in a debate using primary sources as reference. ▪ Create a video of a weatherman describing the weather in future 100 year increments.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs ▪ Debates ▪ Analysis of video research ▪ Think/Pair/Share
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