Subject	Biology
Unit	Unit 1: Ecology
Est. Length	About 21 lessons (August - October)
Big Idea	• Organisms are linked to one another in an ecosystem by the flow of energy and the cycling of materials.
Essential Questions	1. What is the impact of the human footprint on Earth? 2. Why do different animals and plants live in the same area? 3. What limits a species from expanding infinitely?
MA State Standards *Power standards in bold	HS-LS1-1. Construct a model of transcription and translation to explain the roles of DNA and RNA that code for proteins that regulate and carry out essential functions of life. Clarification Statements: • Proteins that regulate and carry out essential functions of life include enzymes (which speed up chemical reactions), structural proteins (which provide structure and enable movement), and hormones and receptors (which send and receive signals). • The model should show the double-stranded structure of DNA, including genes as part of DNA's transcribed strand, with complementary bases on the nontranscribed strand. State Assessment Boundaries: • Specific names of proteins or specific steps of transcription and translation are not expected in state assessment.

	• Cell structures included in transcription and translation will be limited to nucleus, nuclear membrane, and ribosomes for state assessment HS-LS2-2. Use mathematical representations to support explanations that biotic and abiotic factors affect biodiversity, including genetic diversity within a population and species diversity within an ecosystem. Clarification Statements: • Examples of biotic factors could include relationships among individuals (feeding relationships, symbiosis, competition) and disease. • Examples of abiotic factors could include climate and weather conditions, natural disasters, and availability of resources. • Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data. HS-LS2-4. Use a mathematical model to describe the transfer of energy from one trophic level to another. Explain how the inefficiency of energy transfer between trophic levels affects the relative number of organisms that can be supported at each trophic level and necessitates a constant input of energy from sunlight or inorganic compounds from the environment. Clarification Statement: • The model should illustrate the “10% rule” of energy transfer and show approximate amounts of available energy at each trophic level in an ecosystem (up to five trophic levels). HS-LS2-5. Use a model that illustrates the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere, and geosphere. Clarification Statements: • The primary forms of carbon include carbon dioxide, hydrocarbons, waste (dead organic matter), and biomass (organic materials of living organisms). • Examples of models could include simulations and mathematical models. State Assessment Boundary: • The specific chemical steps of respiration, decomposition, and combustion are not expected in state assessment. HS-LS2-6. Analyze data to show ecosystems tend to maintain relatively consistent numbers and types of organisms even when small changes in conditions occur but that extreme fluctuations in conditions may result in a new ecosystem. Construct an argument supported by evidence that ecosystems with greater biodiversity tend to have greater resistance to change and resilience. Clarification Statement: • Examples of changes in ecosystem conditions could include modest biological or physical changes, such as

	moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption, fires, the decline or loss of a keystone species, climate changes, ocean acidification, or sea level rise. **HS-LS2-7. Analyze direct and indirect effects of human activities on biodiversity and ecosystem health, specifically habitat fragmentation, introduction of non-native or invasive species, overharvesting, pollution, and climate change. Evaluate and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health.*** Clarification Statement: • Examples of solutions can include captive breeding programs, habitat restoration, pollution mitigation, energy conservation, and ecotourism. HS-LS4-6 Human activity NGSS HS-LS2- 8 NGSS
Common Core State Standards (CCSS)	<u>Reading</u> RST.11-12.1 ● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCSS.ELA-LITERACY.RST.11-12.2 ● Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. RST.11-12.3 ● Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. RST.11-12.7 ● Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. RST.11-12.8 ● Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. <u>Writing</u> CCSS.ELA-LITERACY.WHST.11-12.1 ● Write arguments focused on *discipline-specific content* CCSS.ELA-LITERACY.WHST.11-12.2 ● Write informative/explanatory texts, including the narration of historical events, scientific

	procedures/experiments, or technical processes. CCSS.ELA-LITERACY.WHST.11-12.5 ● Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. CCSS.ELA-LITERACY.WHST.11-12.7 ● Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. CCSS.ELA-LITERACY.WHST.11-12.8 ● Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
Science Practices (SP)	**1. Asking scientific questions & defining engineering problems** 2. Developing & using models 3. Planning & carrying out investigations **4. Analyzing & interpreting data** 5. Using mathematics & computational thinking 6. Constructing scientific explanations & designing engineering solutions **7. Engaging in argument from evidence** 8. Obtaining, evaluating, and communicating information
Assessment Alignment	**Minor Assessments** ● Quiz C1, Quiz C2 **Major Assessments** ● Ecology Unit Exam ● Sustainability Project
Honors Assignments	● Sustainability Project Honors Option ● Unit Test Honors Option
20 Key	Ecology, producers, consumer, decomposers, community, biosphere, mortality, birth rate,

Vocabulary Words	e/immigration, biotic, abiotic, carrying capacity, homeostasis, dispersal, herbivores, carnivores, omnivores,symbiosis, primary consumer, secondary consumer, tertiary consumer, biodiversity, species, innate behavior, dominance hierarchy, sexual selection, tolerance curve

Prior knowledge that students have entering this unit

1. General knowledge about food chains and food webs
2. Basic knowledge about consumption as a means of obtaining energy
3. Basic factors that affect the survival rate of a population (resources, predator-prey, competition, etc)

Where this knowledge goes next

1. The student will demonstrate the ability to analyze the interrelationships and interdependencies among different organisms and explain how these relationships contribute to the stability of the ecosystem
2. The student will demonstrate the ability to describe the flow of matter and energy between living systems and the physical environment.
3. The student will demonstrate the ability to investigate how natural changes in environmental conditions and human activity will affect individual organisms and the dynamics of populations.
4. In the next unit, students will study how small changes in an organism's environment, can result in internal changes in an effort to maintain homeostasis. This parallels the environment/organism interaction that we study during this unit.
5. We will go on to link ecosystems with evolution. Often, if the ecosystem is in dynamic equilibrium that species do not changing that much. However, when periods of great change happen, species must either move (if they can) to other regions like the ones they evolved in or face extinction. Students will explore this idea in unit 3.

Descriptive outline narrative of unit

The unit begins by reviewing basic concepts of consumption as a means for energy. Students follow the flow of both energy and matter through biotic and abiotic factors in an ecosystem. Then, we transition to learning about how different factors of an

ecosystem can affect the increase and decrease of specific populations. Students will discover how these factors may lead to a population reaching its carrying capacity, and use models to analyze the impact of limiting factors in an ecosystem.

Next, we discuss how energy not only flows from one specific organism to another within an ecosystem, but also how each trophic level receives and passes along energy to the next trophic level. In addition to the flow of energy students gain knowledge about other factors that both contribute to and prevent stability within specific ecosystems.

Students complete the unit by identifying a specific problem related to sustainability. Students then define a community in need of a particular sustainable technology. Students must research, present, and defend the feasibility of their designs for the class.

Day	Lesson #/name	MA	CCSS	Content Objective	Language Objective	Science practice(s)
1	C1	HS-LS2-6.	RST.11-12.1	SWBAT identify three benefits/disadvantages that can occur through adding a new predator to an ecosystem	(L) With a partner, orally identify 3 benefits that a predator can bring to an ecosystem.	SP6: Constructing explanations
2	C2	N/A	WHST.11-12.1	**SWBAT write an argument that incorporates a claim and evidence from data.**	(W) Using an annotated text and a graphic organizer, write an argument that incorporates three pieces of evidence to support a claim	SP7: Arguments from evidence
3	C3	HS-LS2-2	RST.11-12.8	SWBAT sort organisms into a community and identify producers, consumers, and decomposers.	(S) With a partner, orally compare and contrast the difference between producers, consumers, and decomposers	SP2: Developing and using models
4	C4	HS-LS2-2	RST.11-12.2	SWBAT explain how matter is used to build living organisms.	(W): Write 2-3 sentences that explains how matter is used to build an organism using the provided word bank	SP2: Develop and using models
5	C5	HS-LS2	RST.1	SWBAT identify the four factors that	(S) Using a population graph,	SP2: Develop and using

		-2	1-12.1	determine population size and explain how the environment limits population size.	explain to a partner how the introduction of a new species can affect population sizes in an environment.	models
6	C6	HS-LS2-1	RST.11-12.2	**SWBAT define carrying capacity and explain how changes to population density are related to carrying capacity**.	(S) Construct an oral prediction of how the change in population size can affect the carrying capacity of the population	SP7: Arguments from evidence
7	C7	HS-LS2-1	RST.11-12.8	SWBAT define limiting factors and describe how they affect the carrying capacity of humans	(R): Identify and underline/highlight evidence that suggests humans population growth may lead to humans reaching the carrying capacity on Earth.	SP7: Arguments from evidence
8	C8	HS-LS2-6	WHST.11-12 21	SWBAT use evidence to write an argument that a herbivore, carnivore, or omnivore harms another population in an ecosystem.	(S) Orally compare and contrast the difference between a herbivore, an omnivore, and a carnivore with a partner using a food chain as a reference.	SP7: Arguments from evidence
9	C9	HS-LS2-4	RST.11-12.8	SWBAT draw an energy pyramid and explain why energy is lost at different trophic levels.	(W): Draw an energy pyramid that displays the energy transferred to different trophic levels using terms: producer, primary consumer, secondary consumer, and tertiary consumer	SP7: Arguments from evidence
10	C10	HS-LS2-6	WHST.11-12.2	**SWBAT explain why biodiversity is important and how humans threaten biodiversity.**	(W) Explain how humans threaten biodiversity using a word bank and the following redacted sentence : "Humans threaten biodiversity through_____ which can cause _____. This can lead to _____"	SP7: Arguments from evidence

					Word bank: fossil fuels, nitrogen run off, dead zones, acid rain, increase in water temp	
11	C11	HS-LS2-8	RST.11-12.2	SWBAT describe how social behavior among organisms can help a species survive.	(R) Read annotated article and cite 3 examples of innate behaviors that help a population survive	SP6: Constructing explanations
12	C12	HS-LS2-8		SWBAT draw a tolerance curve with labeled axes to evaluate how an organism's survives in changing environmental conditions.	(S) In small groups, orally interpret how temperature affects the population of fish using an annotated tolerance curve.	SP2: Developing and using models
13	C13	HS-LS4-6	RST.11-12.2	SWBAT explain how human population growth is connected to environmental problems.	(R) Cite 3-4 examples of of negative environmental consequences caused by humans using cause and effect graphic organizer	SP7: Arguments from evidence
14	C14	N/A	WHST.11-12.8	SWBAT cite journal articles and websites accurately using APA format.	(S): Explain to a partner the necessary components of a website citation using the APA format	*Not really using a science practice here???*
15	C15	HS-LS2-7	WHST.11-12.7	SWBAT identify an interesting problem related to sustainability and define a community that would benefit from a new sustainable technology.	(S) As a group, determine a specific community in need of additional sustainable technology	SP1: Asking scientific questions and design engineering problems
16	C16	HS-LS2-7	WHST.11-12.7	SWBAT identify an idea for a sustainable technology and design a survey to assess the feasibility of the technology.	(S) With a group, create sustainable technology solution for identified problem	SP1: Asking scientific questions and design engineering problems
17	C17			SWBAT accurately answer questions about ecology.	(R) Underline/highlight key vocabulary words that assist in answering test questions	*SP for unit test?*
18	C18	HS-LS2	WHST	SWBAT evaluate the feasibility of their	(W) Record 2-3 redesign ideas in a	SP1: Asking scientific

		-7	.11-12 .8	sustainable design idea.	graphic organizer and identify pros and cons of the new design	questions and design engineering problems
19	C19	HS-LS2 -7	WHST .11-12 .7	SWBAT identify research that provides evidence to support their sustainable design and speculate on the impact on the human footprint.	(R) Record applicable research for sustainable design in graphic organizer	SP3: Planning and carrying out investigation
20	C20	HS-LS2 -7	WHST .11-12 .8	SWBAT analyze data from a survey to assess a solution that would lessen the impact of humans on biodiversity.	(L) As a group, agree to implement one piece of feedback into sustainable design	SP4: Analyzing and interpreting data
21	C21			SWBAT: use survey evidence and preliminary feedback to present a solution that would reduce the human footprint.	(S) Using cited resources, describe the function of your sustainability design to class in 4-5 sentences.	SP8: Communicating information

Subject	Biology
Unit	Unit 2: Anatomy
Est. Length	26 lessons (Oct 30- Jan 16)
Big Idea	All 11 human body systems are interrelated and work together to achieve an ultimate goal of maintaining homeostasis within an organism.
Essential Questions	1. Why do cells with the same DNA have different functions? 2. Why do you sweat? 3. How does comparative anatomy help us learn about ourselves?
MA State Standards *Power standards in bold	HS-LS1-1. Construct a model of transcription and translation to explain the roles of DNA and RNA that code for proteins that regulate and carry out essential functions of life. Clarification Statements: • Proteins that regulate and carry out essential functions of life include enzymes (which speed up chemical reactions), structural proteins (which provide structure and enable movement), and hormones and receptors (which send and receive signals). • The model should show the double-stranded structure of DNA, including genes as part of DNA's transcribed strand, with complementary bases on the nontranscribed strand. State Assessment Boundaries: • Specific names of proteins or specific steps of transcription and translation are not expected in state assessment. • Cell structures included in transcription and translation will be limited to nucleus, nuclear membrane, and ribosomes for state assessment. **HS-LS1-2. Develop and use a model to illustrate the key functions of animal body systems, including (a) food digestion, nutrient uptake, and transport through the body; (b) exchange of oxygen and carbon dioxide; (c) removal of wastes; and (d) regulation of body processes.** Clarification Statement: • Emphasis is on the primary function of the following body systems (and structures): digestive (mouth, stomach, small intestine [villi], large intestine, pancreas), respiratory (lungs [alveoli], diaphragm), circulatory (heart, veins, arteries, capillaries), excretory (kidneys, liver, skin), and nervous (neurons, brain, spinal cord). State Assessment Boundary: • Chemical reactions in cells, details of particular structures (such as the structure of the neuron), or the

	identification of specific proteins in cells are not expected in state assessment. HS-LS1-3. Provide evidence that homeostasis maintains internal body conditions through both body-wide feedback mechanisms and small-scale cellular processes. Clarification Statements: • Feedback mechanisms include the promotion of a stimulus through positive feedback (e.g., injured tissues releasing chemicals in blood that activate platelets to facilitate blood clotting), and the inhibition of stimulus through negative feedback (e.g., insulin reducing high blood glucose to normal levels). • Cellular processes include (a) passive transport and active transport of materials across the cell membrane to maintain specific concentrations of water and other nutrients in the cell and (b) the role of lysosomes in recycling wastes, macromolecules, and cell parts into monomers. State Assessment Boundary: • Interactions at the molecular level (for example, how insulin is produced) are not expected in state assessment.
Common Core State Standards (CCSS)	<u>Reading</u> RST.11-12.1 ● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCSS.ELA-LITERACY.RST.11-12.2 ● Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. RST.11-12.3 ● Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. RST.11-12.7 ● Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. RST.11-12.8 ● Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. <u>Writing</u> CCSS.ELA-LITERACY.WHST.11-12.1 ● Write arguments focused on *discipline-specific content* CCSS.ELA-LITERACY.WHST.11-12.2 ● Write informative/explanatory texts, including the narration of historical events, scientific

	procedures/experiments, or technical processes. CCSS.ELA-LITERACY.WHST.11-12.5 ● Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. CCSS.ELA-LITERACY.WHST.11-12.7 ● Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. CCSS.ELA-LITERACY.WHST.11-12.8 ● Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
Science Practices (SP)	**1. Asking scientific questions & defining engineering problems** 2. Developing & using models 3. Planning & carrying out investigations **4. Analyzing & interpreting data** 5. Using mathematics & computational thinking 6. Constructing scientific explanations & designing engineering solutions **7. Engaging in argument from evidence** 8. Obtaining, evaluating, and communicating information
Assessment Alignment	**Mastery Assessments** **Quizzes** ● Quizzes: A1, A2, A3 ● Homeostasis lab **Tests** ● A4 Writing Assessment ● Anatomy unit test ● Fetal pig portfolio (RT Artifact) ● Dissection reflection letter (RT Artifact Letter)

Honors Assignments	Honors Option of Dissection Letter Honors Option for Homeostasis Lab Honors Page on Anatomy Exam Honors Option - Parking Lot Questions
20 Key Vocabulary Words	Central dogma, DNA, RNA, protein, Nerve, muscle, heart, differentiation, specialization, Esophagus, stomach, small intestine, pancreas, peristalsis, microvilli, mechanical digestion, chemical digestion, Artery, vein, atrium, ventricle, aorta, blood, plasma, lung, trachea, alveoli, bronchioles, lymphocytes, pathogens, helper T cells kidneys, nephrons, hormones, glands, comparative anatomy

Prior knowledge that students have entering this unit

1. Students learned basic function of each body system in MS science
2. Students learned that organs within an organ system work together in MS science
3. Students learned about cell organelle function including DNA
4. Students learned the flow of air and food through respiratory and digestive systems

Where this knowledge goes next

1. Students will learn how organ systems function together to make the body work
2. Students will predict complications of specific organ failure
3. Students will memorize the flow of blood through heart, gases through respiratory tract, and food through digestion
4. Students will learn that organ systems work to maintain the body's homeostasis
5. Students will demonstrate the processes of transcription and translation within a cell

Descriptive outline narrative of unit

Anatomy and physiology is a course that will enable students to develop an understanding of the relationships between the structures and functions of the human body. Students will also learn the mechanisms for maintaining homeostasis within the human body.
First we will learn about the central dogma of molecular biology by outlining the two-step process, transcription and translation, by which the information in genes flows into proteins: DNA → RNA → protein. Next we will learn the basic structure and function of many of the body's organ systems: digestive, respiratory, immune, circulatory, endocrine, nervous, excretory. After learning about the function of the body's organ systems, we will observe and dissect these organs using fetal pigs. Students will be tasked to discover how organ systems function, together. Finally, students will reflect on the concept of comparative anatomy, outlining why we use fetal pig dissection to learn about ourselves.

Day	Lesson #/name	MA	CCSS	Content Objective	Language Objective	Science practice(s)
1	A1	HS-L S1-1	RST.11-12.1	SWBAT explain how DNA sequences are used to make proteins.	(W) SWBAT describe in 2-3 sentences the relationship between DNA, codons, and proteins	SP7: Engaging in argument from evidence
2	A2	HS-L S1-1	RST.11-12.1	SWBAT identify and describe the function of specialized cells in nerves, muscles, and the blood.	(W) SWBAT use a word bank to label neuron, muscle cells, and blood cells	SP8: Obtaining, evaluating, and communicating information
3	A3	HS-L S-1	RST.11-12.1	SWBAT use DNA & protein information to determine the function of an unknown cell.	(S) SWBAT use a partner and DNA/Protein organizer to determine cell function	SP6: Constructing scientific explanations & designing engineering solutions
4	A4	HS-L S1-2	RST.11-12.1	**SWBAT identify organs of the digestive system and explain how food is broken down.**	**(W) SWBAT trace the path of food from the mouth to the rectum in writing**	SP7: Engaging in argument from evidence
5	A5	HS-L S1-2	RST.11-12.8	SWBAT explain how dietary choices can lead to human diseases, including atherosclerosis.	(L) SWBAT use video to provide evidence that dietary choices have led to health problems	SP7: Engaging in argument from evidence

6	A6	HS-LS1-2	RST.11-12.2	**SWBAT name and describe the function of the chambers in the heart and the aorta.**	**(W) SWBAT draw the flow of blood through each of the four heart chambers**	SP8: Obtaining, evaluating, and communicating information
7	A7	HS-LS1-2	RST.11-12.2	SWBAT describe how the immune system functions to defend the body against foreign invaders.	(S) SWBAT identify the components of the specific immune defense system and describe their functions	SP8: Obtaining, evaluating, and communicating information
8	A8	HS-LS1-2	RST.11-12.8	SWBAT explain how gas and liquid waste are removed from the body.	(S) SWBAT explain to a partner how carbon dioxide is removed from the body	SP7: Engaging in argument from evidence
9	A9	HS-LS1-3	RST.11-12.7	**SWBAT plan an investigation that describes how feedback mechanisms maintain homeostasis (Investigation 16.1).**	**(W) SWBAT ask a scientific question regarding the body maintaining homeostasis**	SP1: Asking scientific questions & defining engineering problems
10	A10	HS-LS1-3	RST.11-12.3	SWBAT conduct an investigation about homeostasis and use evidence from their data to explain how feedback mechanisms maintain homeostasis.	(W) SWBAT use evidence from an investigation about homeostasis to answer scientific question	SP3: Planning & carrying out investigations SP4: Analyzing & interpreting data
11	A11	HS-LS1-2	RST.11-12.1	SWBAT describe the function of each muscle type, and describe how muscle contraction occurs in the body	(W) SWBAT describe and label the steps of muscle contraction using a word bank	SP8: Obtaining, evaluating, and communicating information
12	A12	HS-LS1-2	RST.11-12.2	**SWBAT draw and label a neuron.**	**(W) SWBAT use a word bank to draw and label a neuron**	SP2: Develop and using models
13	A13	HS-LS1-3	RST.11-12.8	SWBAT explain how hormones provide feedback to the body to maintain homeostasis.	(W) SWBAT use an image of calcium regulation to explain what happens when calcium level are low	SP7: Engaging in argument from evidence
14	A14	HS-LS1-2	RST.11-12.7	SWBAT explain how stress and drug use affects the nervous system.	(S) SWBAT describe the body's fight or flight response	SP7: Engaging in argument from evidence

15	A15	HS-LS1-2	WHST.11-12.8	SWBAT present information about the function of one lobe of the brain.	(S) SWBAT to identify and communicate the function details of one lobe of the brain	SP8: Obtaining, evaluating, and communicating information
16	A16	HS-LS1-2	RST.11-12.7.	SWBAT identify and label the integumentary system in a fetal pig.	(W) Identify and label the skin, forelimbs, and hindlimb of the fetal pig.	SP2: Develop and using models
17	A17	HS-LS1-2	RST.11-12.7	SWBAT identify the sex of a fetal pig and expose organs in the abdominal and chest cavities.	(W) Identify and label the genital pilla or the scrotal sac of the fetal pig	SP2: Develop and using models
18	A18	HS-LS1-2	RST.11-12.7	SWBAT identify and draw the liver, stomach, and intestines.	(W) Identify and label 5 major organs of the digestive system of the fetal pig: esophagus, stomach, large intestine, small intestine, liver	SP2: Develop and using models
19	A19	HS-LS1-2	RST.11-12.7	SWBAT demonstrate mastery on anatomy unit test	SWBAT demonstrate mastery on anatomy unit test	
20	A20	HS-LS1-2	RST.11-12.7	SWBAT identify and draw the kidneys, bladder, and reproductive system of their fetal pig.	(W) SWBAT identify and label the kidneys, renal veins, and renal arteries and bladder of the fetal pig	SP2: Develop and using models
21	A21	HS-LS1-2	RST.11-12.7	SWBAT identify and draw the lungs, aorta, and four chambers of the fetal pig heart.	(W) Identify and label the lobes of the lung and four chambers of the heart of the fetal pig	SP2: Develop and using models
22	A22	HS-LS1-2	RST.11-12.7	SWBAT identify and draw the brain and spinal cord of the fetal pig.	(W) SWBAT identify and label the brain and spinal cord of the fetal pig	SP2: Develop and using models
23	A23	HS-LS1-2	RST.11-12.7	SWBAT begin rough draft of their fetal pig reflection paper	(W) SWBAT explain why the fetal pig dissection is used as as a method of comparative	SP2: Develop and using models

					anatomy	
24	A24	HS-L S1-2	WHST. 11-12.2	SWBAT begin final draft of their fetal pig reflection paper	(W) SWBAT summarize fetal pig dissection observations made for the digestive, excretory, circulatory, and nervous systems	SP6: Constructing explanations
25	A25	HS-L S1-2	WHST. 11-12.5	SWBAT edit and add content to their fetal pig reflection paper.	(W) SWBAT describe the function of one organ in the fetal pig	SP6: Constructing explanations
26	A26	HS-L S1-2	WHST. 11-12.5	SWBAT edit and add content to their fetal pig reflection paper.	(W) SWBAT justify using the fetal pig in order to learn about human digestive systems	SP6: Constructing explanations

Subject	Biology
Unit	Unit 3: Evolution
Est. Length	27 lessons (Jan 24 - Mar 26)
Big Idea	The process of evolution drives the diversity and unity of life.
Essential Questions	1. What scientific evidence supports evolution? 2. How do species increase in number? 3. How does natural selection lead to the adaptation of a population to an environment?
MA State Standards *Power standards in bold	**HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence, including molecular, anatomical, and developmental similarities inherited from a common ancestor (homologies), seen through fossils and laboratory and field observations**. Clarification Statement: • Examples of evidence can include the work of Margulis on endosymbiosis, examination of genomes, and analyses of vestigial or skeletal structures. HS-LS4-2. Construct an explanation based on evidence that Darwin's theory of evolution by natural selection occurs in a population when the following conditions are met: (a) more offspring are produced than can be supported by the environment, (b) there is heritable variation among individuals, and (c) some of these variations lead to differential fitness among individuals as some individuals are better able to compete for limited resources than others. Clarification Statement: • Emphasis is on the overall result of an increase in the proportion of those individuals with advantageous heritable traits that are better able to survive and reproduce in the environment. (HS-LS4-3 merged with HS-LS4-2) HS-LS4-4. Research and communicate information about key features of viruses and bacteria to explain their ability to adapt and reproduce in a wide variety of environments. Clarification Statement: • Key features include high rate of mutations and the speed of reproduction which produces many generations with high variability in a short time, allowing for rapid adaptation. State Assessment Boundary: • Specific types of viral reproduction (e.g., lytic and lysogenic) are not expected in state assessment.

	HS-LS4-5. Evaluate models that demonstrate how changes in an environment may result in the evolution of a population of a given species, the emergence of new species over generations, or the extinction of other species due to the processes of genetic drift, gene flow, mutation, and natural selection.
Common Core State Standards (CCSS)	<u>Reading</u> RST.11-12.1 ● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCSS.ELA-LITERACY.RST.11-12.2 ● Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. RST.11-12.3 ● Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. RST.11-12.7 ● Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. RST.11-12.8 ● Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. <u>Writing</u> CCSS.ELA-LITERACY.WHST.11-12.1 ● Write arguments focused on *discipline-specific content* CCSS.ELA-LITERACY.WHST.11-12.2 ● Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. CCSS.ELA-LITERACY.WHST.11-12.5 ● Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. CCSS.ELA-LITERACY.WHST.11-12.7 ● Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources

	on the subject, demonstrating understanding of the subject under investigation. CCSS.ELA-LITERACY.WHST.11-12.8 ● Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
Science Practices (SP)	**1. Asking scientific questions & defining engineering problems** 2. Developing & using models 3. Planning & carrying out investigations **4. Analyzing & interpreting data** 5. Using mathematics & computational thinking 6. Constructing scientific explanations & designing engineering solutions **7. Engaging in argument from evidence** 8. Obtaining, evaluating, and communicating information
Assessment Alignment	**Minor Assessments** ● Quiz V1, V2, V3, ● Plant Adaptation Project **Major Assessments** ● Evolution unit test ● Phylogeny Webquest
Honors Assignments	● Phylogeny Project Honors Addition ● Evolution unit Test Honors page ● Honors question wall
20 Key Vocabulary Words	Gene pool, genetic, genetic drift, sexual selection, isolation, Binomial nomenclature, taxonomy, homology, KPCOFGS, Autotroph, heterotroph, prokaryote, plant, animal, fungi, Adaptation, environment, species

Prior knowledge that students have entering this unit
1. Students learned the flow of information in the central dogma 2. Students have seen basic concepts of natural selection and explored topics in sexual selection

3. Students have been introduced to the basic concept of how natural selection can lead to speciation (MS science)

Where this knowledge goes next

1. Students will next study biochemistry
2. The emphasis on molecular evidence for evolution and core processes will be revisited as students learn mechanisms of energy capture and storage
3. Evolution is a major theme of genetics and systems biology to compare phenotypes between organisms and examine why some genotypes have survived over time.

Descriptive outline narrative of unit

1. Students begin the year with a reintroduction to evolution beginning with the origin of life and shared molecular characteristics through common ancestry. Students will then explore how natural selection acts on the genetic makeup of organisms, leading to adaptations.
2. Next, students will explore speciation. Students will study mechanisms of speciation including types of isolation: gepgraphic, behavioral, temporal
3. Students will then learn about cladograms and phylogenetic trees with an emphasis on how to interpret a cladogram or phylogenetic tree based on data from a table of shared traits in animals.
4. Students will, then, research specific plant adaptations and follow-up research with exploration/dissection of angiosperm reproductive structures.
5. Students will use structural knowledge of angiosperms to explore co-evolution between angiosperms and pollinators
6. Next, students will explore evolution through the lens of antibiotic resistance
7. Students learn the Hardy-Weinberg equation and how to solve for allele and genotype frequencies

Day	Lesson #/name	MA	CCSS	Content Objective	Language Objective	Science practice(s)
1	V1	HS-LS4-1	RST.11-12.1	SWBAT use the theory of	(W): Using a word bank,	SP6: Constructing Explanations

				endosymbiosis as evidence that organisms evolved from a common ancestor.	describe 1 piece of evidence that supports the theory of endosymbiosis.	
2	V2	HS-LS4-1	RST.11-12.1	SWBAT identify evidence for evolution as molecular, structural, or developmental.	(R): Interpret a diagram and classify it as a demonstration of molecular, structural, or developmental evidence for evolution.	SP6: Constructing and explanation SP4: Analyze and interpret data
3	V3	HS-LS4-1	RST.11-12.1	SWBAT identify and explain the mechanisms that can change gene frequencies over time.	(W): Identify examples of mechanisms of speciation as: mutation, natural selection, or gene flow.	SP7: Engaging in argument from evidence
4	V4	HS-LS4-1	RST.11-12.1	**SWBAT identify and describe mechanisms that lead to natural selection.**	(S): With a partner identify which species is most “fit” for a specific environment based on characteristics.	SP8: Obtaining, evaluating, and communicating information
6	V6	HS-LS4-1	RST.11-12.1	SWBAT describe how genes isolated for melanin serve as molecular evidence for evolution.	(W): Write a 3 - 5 sentence paragraph that explains why Scandinavians typically have lighter skin and Africans typically have darker skin.	SP8: Obtaining, evaluating, and communicating information
7	V7	HS-LS4-1	RST.11-12.2	SWBAT describe how exposure to UV light has driven the evolution of both light and dark skin tones. ***	(L): Based on TedEx video, describe how fair skin serves as an evolutionary advantage in northern latitudes.	SP8: Obtaining, evaluating, and communicating information
8	V8	HS-LS4-2	WHST.11-12.2	SWBAT use cell structure to classify organisms into one of five kingdoms.	(S) In small groups, agree on the appropriate kingdom classification of an organism.	SP6: Constructing explanations
9	V9	HS-LS4-2	RST.11-12.1	**SWBAT use binomial nomenclature to identify relationships between species.**	(W): Given a list of scientific names, identify which organisms are most closely related.	SP8: Obtaining, evaluating, and communicating information

10	V10	HS-L S4-2	WHST. 11-12.1	**SWBAT use phylogenetic trees to determine evolutionary relationships between species**	(S): Explain to a partner why evidence from a figure can be used to show that evolutionary change is occurring.	SP4: Analyze/Interpret Data
11	V11	HS-L S4-2	WHST. 11-12.2	SWBAT use phylogenetic trees to explain misconceptions about evolutionary relationships. ***	(S): Explain to a partner why evidence from a figure can be used to show that evolutionary change is occurring.	SP4: Analyze/Interpret Data
12	V12	HS-L S4-4	RST.11-12.2	SWBAT classify organisms into one of eight animal phyla (Classification Book Project Day I).	(W): identify 2-3 characteristics of eight given animal phyla	SP6: Constructing Explanations
13	V13	HS-L S4-4	RST.11-12.8	SWBAT classify animals into kingdoms and phyla based on physical characteristics (Classification Book Project Day II).	(S): With a partner, evaluate the classification of animals into specific kingdoms and phyla based on physical characteristics.	SP8: Obtaining, eval, and communicating info
14	V14	HS-L S4-4	WHST. 11-12.8	SWBAT classify animals into phyla and classes based on physical characteristics (Classification Book Project Day III)	(S):With a partner, evaluate the classification of animals into specific kingdoms, phyla, and classes based on physical characteristics.	SP8: Obtaining, eval, and communicating info
15	V15	HS-L S4-4	WHST. 11-12.8	SWBAT generate examples of animals in given phyla and classes and justify their classification (Classification Book Project Day IV)	(W): Use an organizer of phyla/class characteristics in order to correctly identify the taxonomy of animals.	SP2: Developing & using models
16	V16	HS-L S4-4	RST.11-12.8	SWBAT explain how gymnosperms and angiosperms reproduce.	(R): Analyze and interpret the life cycle of the angiosperm image to identify the male and female reproductive parts.	SP8: Obtaining, evaluating, and communicating information SP4: Analyze/Interpret Data

17	V17	HS-LS4-5	RST.11-12.1	SWBAT draw, label and describe the function of the reproductive structures of angiosperms.	(W): Using a word bank, identify four reproductive structures of an angiosperm	SP2: Developing and using models
18	V18	HS-LS4-2	RST.11-12.7	SWBAT describe how species interaction can lead to co-evolution of angiosperms and pollinators.	(L): Watch a video and summarize how two species co-evolve in response to each other.	SP8: Obtaining, evaluating, and communicating information
19	V19	HS-LS4-3	RST.11-12.8	SWBAT describe how evolution influences antibiotic resistance.	R): Given data, create a graph that can be used to support evolution of bacterial species.	SP8: Obtaining, evaluating, and communicating information
20	V20	HS-LS4-3	RST.11-12.8	**SWBAT calculate the genotype and phenotype frequency in a population.**	(W): Identify the recessive allele frequency in a word problem in order to determine homozygous recessive genotype frequency.	SP5: Using mathematics
21	V21	HS-LS4-5	RST.11-12.7	SWBAT use genotype frequencies and H-W equilibrium to explain why a trait evolves over time.	(W): Given a HW word problem, identify the trait that is positively selected for.*	SP5: Using mathematics
22	V22			Exam Review		
23	V23			Evolution Exam		

Subject	Biology
Unit	Unit 4: Biochemistry
Est. Length	15 lessons (April -Mid May)
Big Idea	Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.
Essential Questions	1. How to plants transform light into stored chemical energy? 2. How do animals transform sugar into new compounds? 3. How does carbon cycle throughout an ecosystem?
MA State Standards *Power standards in bold	HS-LS1-5. Use a model to illustrate how photosynthesis uses light energy to transform water and carbon dioxide into oxygen and chemical energy stored in the bonds of sugars and other carbohydrates. Clarification Statements: • Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. • Examples of models could include diagrams, chemical equations, and conceptual models. State Assessment Boundary: • Specific biochemical steps of light reactions or the Calvin Cycle, or chemical structures of molecules are not expected in state assessment **HS-LS1-6. Construct an explanation based on evidence that organic molecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur, and phosphorus to form monomers that can further combine to form large carbon-based macromolecules.** Clarification Statements: • Monomers include amino acids, mono- and disaccharides, nucleotides, and fatty acids. • Organic macromolecules include proteins, carbohydrates (polysaccharides), nucleic acids, and lipids. State Assessment Boundary: • Details of specific chemical reactions or identification of specific macromolecule structures are not expected in state assessment. HS-LS1-7. Use a model to illustrate that aerobic cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and new bonds form, resulting in new compounds and a net

	transfer of energy. Clarification Statements: • Emphasis is on the conceptual understanding of the inputs and outputs of the process of aerobic cellular respiration. • Examples of models could include diagrams, chemical equations, and conceptual models. • The model should include the role of ATP for energy transfer in this process. • Food molecules include sugars (carbohydrates), fats (lipids), and proteins. State Assessment Boundary: • Identification of the steps or specific processes involved in cellular respiration is not expected in state assessment. HS-LS2-3 merged with HS-LS2-4 and HS-LS2-5 HS-LS2-4. Use a mathematical model to describe the transfer of energy from one trophic level to another. Explain how the inefficiency of energy transfer between trophic levels affects the relative number of organisms that can be supported at each trophic level and necessitates a constant input of energy from sunlight or inorganic compounds from the environment. Clarification Statement: • The model should illustrate the "10% rule" of energy transfer and show approximate amounts of available energy at each trophic level in an ecosystem (up to five trophic levels). HS-LS2-5. Use a model that illustrates the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere, and geosphere. Clarification Statements: • The primary forms of carbon include carbon dioxide, hydrocarbons, waste (dead organic matter), and biomass (organic materials of living organisms). • Examples of models could include simulations and mathematical models. State Assessment Boundary: • The specific chemical steps of respiration, decomposition, and combustion are not expected in state assessment.
Common Core State Standards (CCSS)	<u>Reading</u> RST.11-12.1 ● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCSS.ELA-LITERACY.RST.11-12.2 ● Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. RST.11-12.3

	● Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. RST.11-12.7 ● Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. RST.11-12.8 ● Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. <u>Writing</u> CCSS.ELA-LITERACY.WHST.11-12.1 ● Write arguments focused on *discipline-specific content* CCSS.ELA-LITERACY.WHST.11-12.2 ● Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. CCSS.ELA-LITERACY.WHST.11-12.5 ● Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. CCSS.ELA-LITERACY.WHST.11-12.7 ● Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. CCSS.ELA-LITERACY.WHST.11-12.8 ● Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
Science Practices (SP)	**1. Asking scientific questions & defining engineering problems** 2. Developing & using models 3. Planning & carrying out investigations **4. Analyzing & interpreting data** 5. Using mathematics & computational thinking 6. Constructing scientific explanations & designing engineering solutions

	7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information
Assessment Alignment	**Minor assessments** ● B1, B2, Electron Transport Chain Storyboard, B3 **Major assessments** ● Biochemistry unit test ● Fermentation lab
Honors Assignments	● Fermentation Lab Honors ● Biochem Test Honors
20 Key Vocabulary Words	Energy, photosynthesis, chlorophyll, cellular respiration, ATP, carbohydrate, lipid, amino acid, protein, nucleic acid, chloroplast, light reactions, thylakoid, photosystem, electron carrier, cellular respiration, glucose, glycolysis, pyruvate, NADH

Prior knowledge that students have entering this unit

1. Students have a general understanding of the purpose of photosynthesis and cellular respiration
2. Students know that energy is necessary for life
3. Students know that certain biomolecules are nutrients for the body (i.e., proteins)

Where this knowledge goes next

1. In the next unit, students will be asked to interpret complex diagrams of cell processes (including mitosis and meiosis) after receiving practice during the Biochemistry unit

Descriptive outline narrative of unit

1. Students will begin with the introduction of ATP as energy currency for the cell
2. Then, they will move forward with the importance of major biomolecules : carbs, protein, lipids, and nucleic acids
3. Student will continue learning the specifics of each step of cellular respiration that results in the production of ATP : Glycolysis, Krebs Cycle, Electron Transport Chain
4. Then, students will learn how respiration occurs when no oxygen is present
5. Finally, Students will investigate the light and dark reactions of photosynthesis

Day	Lesson #/name	MA	CCSS	Content Objective	Language Objective	Science practice(s)
1	B1	HS-LS1-6	RST.11-12.1	SWBAT explain how plants and animals obtain energy using light and ATP.	(W): Draw a concept map connecting photosynthesis and cellular respiration	SP4: Analyzing & interpreting data
2	B2	HS-LS1-6	WHST.11-12.2	**SWBAT identify and define the role of carbohydrates, lipids, proteins, and nucleic acids in living organisms.**	(W): Label each image as a carb, protein, lipid, or nucleic acid	SP4: Analyzing & interpreting data
3	B3	HS-LS1-6	RST.11-12.7	SWBAT use evidence from images of glycolysis to explain how sugars become pyruvates.	(W): Using an image of glycolysis, summarize how major molecules work together to break down glucose	SP4: Analyzing & interpreting data
4	B4	HS-LS1-6	WHST.11-12.2	SWBAT use evidence from images of the Krebs cycle to explain how pyruvates make NADH and FADH2.	(R): Analyze and interpret an image of the Krebs cycle in order to determine how NADH, FADH2 and CO2 are formed	SP4: Analyzing & interpreting data
5	B5	HS-LS1-5	RST.11-12.2	SWBAT use evidence from images of the ETC to explain how electron carriers are used to make ATP.	(R): Label the parts of the electron transport chain using an image and a word bank	SP4: Analyzing & interpreting data

6	B6	HS-LS2-5	RST.11-12.2	SWBAT explain the electron transport chain in 5 steps or left	(W): Label an image of the ETC using the following terms: H+, protein, electron, NADH, FADH2, ATP synthase, ATP, & oxygen.	SP2: Developing & using models
7	B7	HS-LS2-5	RST.11-12.2	SWBAT draw an image relating to each step of the electron transport chain.	(W): Draw at least 3 images that show how the ETC functions to create ATP.	SP2: Developing & using models
8	B8	HS-LS1-5	RST.11-12.2	SWBAT describe how the Calvin cycle produces carbohydrates in chloroplasts.	(S): Using a partner, provide an explanation of how glucose is formed during the Calvin cycle.	SP6: Constructing scientific explanations
9	B9	HS-LS1-5	RST.11-12.1	SWBAT describe how the products of the light reaction are used in the Calvin cycle.	(W): Use a word bank to make a summary drawing of the light and dark rxns of photosynthesis.	SP2: Developing & using models
10	B10	HS-LS1-5	RST.11-12.1	SWBAT write an explanation of how photosynthesis and cellular respiration contribute to the carbon cycle.	(W): Draw a concept map that connects photosynthesis and cellular respiration as apart of the carbon cycle.	SP6: Constructing scientific explanations
11	B11	HS-LS1-5	WHST.11-12.1	SWBAT explain how carbon molecules are converted into energy in anaerobic conditions.	(L): Using a video clip, note instances in which aerobic respiration occurs vs anaerobic respiration	SP6: Constructing scientific explanations
12	B12	HS-LS2-3	WHST.11-12.1	SWBAT describe the fermentation pathways and give examples of microorganisms that use these pathways.	(W): Identify the products of alcohol and lactic acid fermentation.	SP6: Constructing scientific explanations
13	B13	HS-LS2-3	RST.11-12.3	SWBAT graph data to show the relationship between CO_2 production and sugars during respiration.	(W) Draw a graph that demonstrates the relationship between sugar and CO_2	SP3: Planning & carrying out investigations

					production.	
14	B14	HS-LS2-5	RST.11-12.7	SWBAT use class data to determine which sugars are fermented among dextrose, sucrose, and saccharin.	(R): Interpret graphed data to determine which sugars ferment.	SP3: Planning & carrying out investigations
15	B15	HS-LS2-4	RST.11-12.7	SWBAT determine experimental design errors in yeast fermentation lab.	(S): Work with a partner to identify one aspect of an experiment that can be improved.	SP6: Constructing scientific explanations

Subject	Biology
Unit	Unit 5: Genetics
Est. Length	15 lessons (Mid May- June)
Big Idea	Living systems store, retrieve, transmit, and respond to information essential to life processes.
Essential Questions	1. Why are cells specialized after they divide in the body? 2. Why is there so much genetic variation in the human population? 3. How are genetic traits passed from parents to offspring?
MA State Standards *Power standards in bold	**HS-LS3-1. Develop and use a model to show how DNA in the form of chromosomes is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction.** Clarification Statement: • The model should demonstrate that an individual's characteristics (phenotype) result, in part, from interactions among the various proteins expressed by one's genes (genotype). State Assessment Boundary: • Identification of specific phases of meiosis or the biochemical mechanisms involved are not expected in state assessment. HS-LS3-2. Make and defend a claim based on evidence that genetic variations (alleles) may result from (a) new genetic combinations via the processes of crossing over and random segregation of chromosomes during meiosis, (b) mutations that occur during replication, and/or (c) mutations caused by environmental factors. Recognize that mutations that occur in gametes can be passed to offspring. Clarification Statement: • Examples of evidence of genetic variation can include the work of McClintock in crossing over of maize chromosomes and the development of cancer due to DNA replication errors and UV ray exposure. State Assessment Boundary: • Specific phases of meiosis or identification of specific types of mutations are not expected in state assessment. HS-LS3-3. Apply concepts of probability to represent possible genotype and phenotype combinations in offspring caused by different types of Mendelian inheritance patterns. Clarification Statements: • Representations can include Punnett squares, diagrams, pedigree charts, and simulations.

	• Inheritance patterns include dominant-recessive, codominance, incomplete dominance, and sex-linked. HS-LS3-4(MA). Use scientific information to illustrate that many traits of individuals, and the presence of specific alleles in a population, are due to interactions of genetic factors and environmental factors. Clarification Statements: • Examples of genetic factors include the presence of multiple alleles for one gene and multiple genes influencing a trait. • An example of the role of the environment in expressed traits in an individual can include the likelihood of developing inherited diseases (e.g., heart disease, cancer) in relation to exposure to environmental toxins and lifestyle; an example in populations can include the maintenance of the allele for sickle-cell anemia in high frequency in malaria-affected regions because it confers partial resistance to malaria. State Assessment Boundary: • Hardy-Weinberg calculations are not expected in state assessment
Common Core State Standards (CCSS)	<u>Reading</u> RST.11-12.1 ● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCSS.ELA-LITERACY.RST.11-12.2 ● Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. RST.11-12.3 ● Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. RST.11-12.7 ● Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. RST.11-12.8 ● Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. <u>Writing</u> CCSS.ELA-LITERACY.WHST.11-12.1 ● Write arguments focused on *discipline-specific content* CCSS.ELA-LITERACY.WHST.11-12.2 ● Write informative/explanatory texts, including the narration of historical events, scientific

	procedures/experiments, or technical processes. CCSS.ELA-LITERACY.WHST.11-12.5 ● Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. CCSS.ELA-LITERACY.WHST.11-12.7 ● Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. CCSS.ELA-LITERACY.WHST.11-12.8 ● Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
Science Practices (SP)	**1. Asking scientific questions & defining engineering problems** 2. Developing & using models 3. Planning & carrying out investigations **4. Analyzing & interpreting data** 5. Using mathematics & computational thinking 6. Constructing scientific explanations & designing engineering solutions **7. Engaging in argument from evidence** 8. Obtaining, evaluating, and communicating information
Assessment Alignment	**Minor Assessments** ● Quiz G1, G2, **Major Assessments:** **SNP Investigation to uncover genetic predispositions** **Driving Question: How can genetic information improve one's life?** ● 1. Analyze genetic data connecting genotypes to phenotypes 2. Demonstrate understanding of genetic predispositions and expression to traits. 3. Use research based evidence to counsel another human based on analyzing specific predispositions/disorders/tendencies

Honors Assignments	SNP Investigation Honors Option
20 Key Vocabulary Words	Genotype, Phenotype, Punnett Square, Dominant, Recessive, Homozygous, heterozygous, Non-Mendelian traits, allele, chromosome, dihybrid cross, gene, nucleus, replication, mutation, silent, missense, nonsense, variability, sexual, asexual, transcription, translation

Prior knowledge that students have entering this unit
1. Students understand the concept of dominant and recessive traits 2. Students know how to solve single traits Punnett square problems 3. Students know that a mutation is a change in the DNA sequence, and that some mutations can lead to harmful diseases

Where this knowledge goes next
N/A

Descriptive outline narrative of unit
1. The unit will begin with a review of cell organelle function. 2. Students review functions, locations, and structure of key cell organelles. 3. Student will also review methods of reproduction (sexual vs asexual) and differentiate betweeen the function of mitosis and meiosis. 4. Punnett Squares: Students will be able to ask questions, make and defend a claim, and use concepts of probability to explain the genetic variation in a population. 5. SNP investigation: Students will learn to explain the mechanisms of genetic inheritance and describe the environmental and genetic causes of gene mutation and the alteration of gene expression.

Day	Lesson #/name	MA	CCSS	Content Objective	Language Objective	Science practice(s)
1	G1	HS-LS 3-2	RST.11-12.1	SWBAT name and explain the function of organelles in the cytoplasm.	(W): Label the organelles on an image of a eukaryotic cell, and describe 2-3 functions	SP2: Developing & using models
2	G2	HS-LS 3-2	RST.11-12.2	SWBAT explain how cells use passive and active transport to move substances.	(S): Describe to a partner the difference between passive and active transport.	SP6: Constructing scientific explanations
3	G3	HS-LS 1-4	RST.11-12.2	**SWBAT name and explain the PMAT stages of mitosis.**	(R) : Use an image to identify the steps of mitosis and provide evidence for your answers	SP6: Constructing scientific explanations
4	G4	HS-LS 1-4	RST.11-12.1	SWBAT make and use a model to simulate mitosis and cell differentiation.	(R) : Analyze and interpret a classmates model of mitosis.	SP2: Developing & using models
5	G5	HS-LS 1-4	WHST. 11-12.1	SWBAT compare and contrast asexual and sexual reproduction.	(W): Compare and contrast sexual vs asexual reproduction using a Venn diagram	SP4: Analyzing & interpreting data
6	G6	HS-LS 3-1	WHST. 11-12.1	SWBAT explain how gametes are formed via meiosis.	(W): Given an image of cells in various stages of meiosis, identify PMAT II.	SP6: Constructing scientific explanations
7	G7	HS-LS 3-1	WHST. 11-12.1	SWBAT explain that chromosomes are long DNA molecules that contain many genes.	(W): Explain the connection between DNA, chromosomes, and genes.	SP6: Constructing scientific explanations
8	G8	HS-LS 1-1	WHST. 11-12.1	SWBAT explain how transcription and translation result in protein synthesis.	(S): Describe to a partner the products of transcription and the products of translation.	SP4: Analyzing & interpreting data
9	G9	HS-LS 1-1	RST.11-12.2	SWBAT diagram how DNA is replicated.	(W): Using a word bank, label a diagram of DNA replication.	SP2: Developing & using models

10	G10	HS-LS 3-2	WHST. 11-12.	SWBAT predict how silent, missense, and nonsense mutations affect amino acid sequences in proteins.	(R): Given two hypothetical DNA strands, identify the type of mutation that has occurred.	SP6: Constructing scientific explanations
11	G11	HS-LS 3-3	RST.11-12.8	SWBAT use Punnett squares to predict the outcome of dihybrid crosses.	(R) : Analyze and interpret the information provided in a completed dihybrid cross.	SP2: Developing & using models
12	G12	HS-LS 3-3	WHST. 11-12.7	SWBAT analyze genetic data connecting genotypes to phenotypes.	(R): Identify SNP's that lead to certain genetic predispositions.	SP4: Analyzing & interpreting data
13	G13	HS-LS 3-3	WHST. 11-12.7	SWBAT use research based evidence to counsel another human based on analyzing specific predispositions/disorders/tendencies	(S): Investigate and report important habits to acquire when one has a certain genetic predisposition.	SP6: Constructing scientific explanations
14	G14	HS-LS 3-4	RST.11-12.8	Use the Hardy Weinberg equation to calculate allelic and genotypic frequencies in a population.	(W): Calculate the genotype frequencies of a population given the recessive allele frequency	SP5: Using mathematics
15	G15	HS-LS 3-3	RST.11-12.8	SWBAT predict the outcome of non-Mendelian genetic crosses using Punnett squares.	(W): Predict the probability that offspring will be colorblind using a completed Punnett Square	SP2: Developing & using models
16	G16	HS-LS 3-3	RST.11-12.8	SWBAT draw a child that results from statistical variations in inheritance.	(W): Identify the phenotypes that result from Mendelian and non-Mendelian genetic crosses	SP2: Developing & using models