UbD Template 2.0

Unit 2: Biochemistry

Phenomenon: Jello with canned vs. fresh pineapple

Stage 1 Desired Results

ESTABLISHED GOALS

HS-LS1-6.Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.[Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.]

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

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Develop and Use Models.
- SEP 3 - Plan and Carry Out Investigations
- SEP 4 - Analyze and Interpret Data
- SEP 6 - Construct Explanations

Meaning

UNDERSTANDINGS

Students will understand that…

- LS1.C: Organization for Matter and Energy Flow in Organisms
  - The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into

ESSENTIAL QUESTIONS

Students will keep considering…

- How are organisms structured to ensure efficiency and survival?
- How does the chemical make-up of organisms determine their properties?
- How do matter and energy behave in

the text.	larger molecules (such as proteins or DNA), used for example to form new cells. ○ As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. ● LS1.C: Organization for Matter and Energy Flow in Organisms ○ As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.	living systems?
	Transition	
	Students will know… ● The structure of organic molecules and how it impacts function (CCC: Structure and Function) ● How hydrolysis/dehydration synthesis break down/form molecules ● Energy transformations that occur in chemical reactions and how this relates to a molecular change (CCC: Energy and Matter)	*Students will be skilled at…* ● Describing properties of water ● Building structures of organic molecules ● Demonstrating how hydrolysis/dehydration synthesis break down/form molecules ● Describing/explaining behavior of enzymes in chemical reactions

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Students are assessed on their understanding of core concepts of molecular structure, chemical reactions, amino acid chain determines protein shape, effects of temperature and pH and critical thinking skills including data analysis, data interpretation, hypothesis and reasoning, predictions and communicating findings. Using GIZMO rubrics.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* Analyzing veterinary patient data to determine how various conditions can alter protein molecule structure and function. Students will make a claim about the cause of the patient's symptoms, justify with evidence and provide counterevidence to rule out alternative hypotheses. GIZMO STEM CASE - Enzyme STEM Case Claire, a Great Dane, is experiencing extreme weight loss and lethargy despite maintaining a normal appetite. As a veterinary technician, students must learn about metabolism, digestion, and enzymes to help Claire. They must then examine Claire, run lab tests, and analyze data to determine the cause and treat her weight loss.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* T, M, A Warm-Up / Exit tickets M, A Monitor progress for depth and accuracy T, M, A Kahoot, Peardeck, Edpuzzle Assessments M, A Quizzes on content T, M, A Questions on activities, labs and projects M, A Verbal questions / discussions for comprehension T, M, A Article Analysis /Summaries T, M, A End of unit assessment

Stage 3 – Learning Plan

Code	***Pre-Assessment***	
	• Brainstorming at the start of the unit • Informal assessment of prior knowledge • Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M, A	- **Taking notes** from lecture, class discussion, and videos on each topic (E3)	• Warm-Up / Exit tickets Monitor progress for depth and accuracy Kahoot, Peardeck, Edpuzzle Assessments • Quizzes on content Questions on activities and projects Verbal questions for comprehension • End of unit assessment
T, M, A	- **Working collaboratively** with partners or small groups to complete graphic organizers to compare the structure and function of organic macromolecules (E1, E2, E3, E4)	
T, A	- **Modeling** - model the processes of dehydration synthesis and hydrolysis to show how macromolecules are built and broken down (Ball-and-stick modeling) (E2, E3)	
T, M, A	- **Modeling: POGIL** - Analyze data and interpret models of various environmental factors affecting enzyme function (E2, E3, E4)	
T, M, A	- **Investigating** various factors that affect the reaction rate of enzymes: (Lab: Enzyme Reaction Rate) (E4, E5)	

Unit 3: Cell Structure and Function

Phenomenon: Genetic disease that causes malfunctioning organelles

Stage 1 Desired Results

ESTABLISHED GOALS

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]LS1.A

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in

Transfer

Students will be able to independently use their learning to…

- SEP 1 - Ask Questions and Define Problems
- SEP 2 - Develop and Use Models.
- SEP 7 - Engage in Argument from Evidence
- SEP 8 - Obtain, Evaluate, and Communicate Information.

Meaning

UNDERSTANDINGS

Students will understand that…

- LS1.A: Structure and Function
  - Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.
- LS1.C: Organization for Matter and Energy Flow in Organisms
  - The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.
  - As a result of these chemical

ESSENTIAL QUESTIONS

Students will keep considering…

- How are organisms structured to ensure efficiency and survival?
- In the hierarchical organization of multicellular organisms, how do complex properties emerge from simpler properties?

photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.[Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.	reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment.	
	Acquisition	
	Students will know… ● The similarities and differences between plant and animal cells. ● The similarities and differences between prokaryotes and eukaryotes. ● The biochemical contribution of different organelle processes to the overall cell function (CCC: Structure and Function) ● The similarities and differences between bacteria and viruses ● The differences between bacterial reproduction and viral replication ● how organisms are structured in a hierarchy of increasingly complex components working together to carry out the functions of life (cells, tissues, organs, organ systems, organisms)	*Students will be skilled at…* ● Comparing and contrasting prokaryotic and eukaryotic cells. ● Explaining how a cell responds to changes in its environment. ● Comparing and contrasting plant and animal cells. ● Explaining the biochemical role of each organelle

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	- Correctly describing the structure of various cell parts and explaining how the particular structure allows for its specific function. - Relating cell functions to the 7 characteristics of life required of all organisms - Accurately comparing cell organelle functions to the proper components of a functioning city. - Accurately depicting cell organelles in a diagram or model	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* Making analogies between cell parts and a city. **Cell City Analogy Project** – students create analogies comparing cell organelles to parts of a city based on structure and function.
		…ER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* T, M, A Warm-Up / Exit tickets M, A Monitor progress for depth and accuracy T, M, A Kahoot, Peardeck, Edpuzzle Assessments M, A Quizzes on content T, M, A Questions on activities, labs and projects M, A Verbal questions / discussions for comprehension T, M, A Article Analysis /Summaries T, M, A End of unit assessment

Stage 3 – Learning Plan

Code		
	Pre-Assessment ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M, A	- **Taking notes** from lecture, class discussion, and videos on each topic (E3)	● Warm-Up / Exit tickets Monitor progress for depth and accuracy Kahoot, Peardeck, Edpuzzle Assessments ● Quizzes on content Questions on activities and projects Verbal questions for comprehension ● End of unit assessment
T, M, A	- **Working collaboratively** with partners or small groups to complete graphic organizers to summarize major concepts (E2, E3, E4)	
M, A	- **Completing Graphic Organizer** - compare the structure and function of prokaryotic vs. eukaryotic cells; plant vs. animal cells (E2, E3)	
M, A	- **Completing card sort and organizer** on biological hierarchy of life (E2, E3)	
M, A	- **Exploring and describing** how an organism's components work together to carry out life functions (E2, E3)	
T, M, A	- **Modeling** - model the structure and function of a cell (E4)	
M, A	- **Completing POGIL** - Eukaryotic cell structures - predicting what would happen if an organelle was missing (E4, E5)	
T, M, A	- **Completing Case Study** - Little Girl Lost (mitochondrial disease) (E4, E5)	

Unit 4: Cell Transport

Phenomenon: Water intoxication (hyponatremia)

Stage 1 Desired Results

ESTABLISHED GOALS

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.[Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.]

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Develop and Use Models.
- SEP 3 - Plan and Carry Out Investigations
- SEP 4 - Analyze and Interpret Data
- SEP 6 - Construct Explanations
- SEP 7 - Engage in Argument from Evidence
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS

Students will understand that…

- LS1.A: Structure and Function
  - Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.
  -

ESSENTIAL QUESTIONS

Students will keep considering…

- How do organisms maintain homeostasis in the face of changing environmental conditions?

	Acquisition	
	Students will know… ● How the structure of the cell membrane allows cells to maintain homeostasis. (CCC: Stability and Change) ● the types of passive and active cell transport ● the difference between hypertonic, isotonic, and hypotonic solutions ● how solute concentration impacts to direction of osmosis and diffusion ● how plant and animal cells respond to changing environmental concentrations	*Students will be skilled at…* ● Comparing passive and active transport methods ● Modeling a cell membrane structure and function ● Predicting the impact of the environmental concentration on cell homeostasis

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Constructed response rubric to assess for claim accuracy, appropriate use of evidence, and reasoning that connects to content accurately, based on GIZMO rubric.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* the effect solute concentration has on cell transport mechanisms and therefore cellular function and its ability to maintain homeostasis **GIZMO STEM CASE: Osmosis** - Students analyze and interpret data on sodium and pressure levels in the brain, neuron firing rate and free water movement. Students will compare these to normal levels, forming a diagnosis on whether cerebral edema or epilepsy is the cause of the seizures. After being presented with 3 saline treatment options students hypothesize which will be the most effective. Students then observe how the treatment affects the data and are given explanations of the effect of the treatment on the data and can try a different treatment. Lastly, students summarize the case including initial patient data, diagnosis based on testing and treatment plan.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* T, M, A Warm-Up / Exit tickets M, A Monitor progress for depth and accuracy T, M, A Kahoot, Peardeck, Edpuzzle Assessments M, A Quizzes on content T, M, A Questions on activities, labs and projects M, A Verbal questions / discussions for comprehension T, M, A Article Analysis /Summaries T, M, A End of unit assessment

Stage 3 – Learning Plan

Code		
	Pre-Assessment ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M, A	- **Taking notes** from lecture, class discussion, and videos on each topic (E3)	● Warm-Up / Exit tickets Monitor progress for depth and accuracy ● Kahoot, Peardeck, Edpuzzle Assessments
T, M, A	- **Working collaboratively** with partners or small groups to complete graphic organizers to summarize major concepts (E1, E2, E3, E4)	Quizzes on content Questions on activities and projects ● Exit tickets ● Verbal questions for comprehension ● End of unit assessment
M, A	- **Developing and using models** of diffusion, osmosis, and active transport (cell membrane structure POGIL, membrane diagrams, egg demo)(E1, E2, E3, E4)	
T, M, A	- **Performing Osmosis / Diffusion Lab** - investigate the effect of concentration on the direction of osmosis and diffusion across a simulated cell membrane (E2)	
T, M, A	- **Synthesizing and evaluating information** (Osmosis Gizmo STEM Case Study) (E5)	

Unit 5: Cell Division

Phenomenon: Cancer

Stage 1 - Desired Results

ESTABLISHED GOALS

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. [Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.]

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations

Transfer

Students will be able to independently use their learning to…

- SEP1 - Ask Questions and Define Problems
- SEP 2 - Develop and Use Models
- SEP 6 - Construct Explanations

Meaning

UNDERSTANDINGS

Students will understand that…

- LS1.B: Growth and Development of Organisms In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of

ESSENTIAL QUESTIONS

Students will keep considering…

- How are organisms structured to ensure efficiency and survival? (LS1.A)
- How do organisms grow and develop? (LS1.B)

caused by environmental factors. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.] RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).	systems of tissues and organs that work together to meet the needs of the whole organism. ● LS1.A: Structure and Function ○ All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.) ● LS3.A: Inheritance of Traits ○ Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. ● LS3.B: Variation of Traits ○ In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation.	

	Acquisition	
	Students will know… ● the structure of a chromosome ● How mitosis produces cells for growth and development. ● How cell division and differentiation lead to tissue, organ, and organ systems in multicellular organisms. (CCC: Cause and Effect) ● Meiosis contributes to genetic variation in offspring. ● the possible errors that can occur during meiosis that contribute to chromosomal mutations	*Students will be skilled at…* ● Explaining the role of mitosis in growth and development of an organism. ● Creating a model to demonstrate mitosis. ● Explaining the benefits of cell division by meiosis. ● Creating a model to demonstrate the importance of mitosis and meiosis for sexually reproducing organmisms.

Stage 2 – Evidence

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Accuracy in diagramming each component and process and correctly labeling the following terms: haploid, diploid, gametes, mitosis, meiosis, fertilization, growth/development.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms, as well as the role of meiosis in creating new offspring. Students will create posters modeling how the processes are interdependent on each other and will demonstrate the importance of changing from haploid to diploid and vice versa in the maintenance of a single organism and the continuation of the species.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* T, M, A Warm-Up / Exit tickets M, A Monitor progress for depth and accuracy T, M, A Kahoot, Peardeck, Edpuzzle Assessments M, A Quizzes on content T, M, A Questions on activities, labs and projects M, A Verbal questions / discussions for comprehension T, M, A Article Analysis /Summaries T, M, A End of unit assessment

Stage 3 – Learning Plan

Code		
	Pre-Assessment ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M, A	- **Taking notes** from lecture, class discussion, and videos on each topic (E3)	● Warm-Up / Exit tickets ● Monitor progress for depth and accuracy ● Kahoot, Peardeck, Edpuzzle Assessments ● Quizzes on content ● Questions on activities and projects ● Verbal questions for comprehension ● End of unit assessment
T, M, A	- **Working collaboratively** with partners or small groups to complete graphic organizers to summarize major concepts and compare the process of mitosis and meiosis (E1, E2, E3, E4)	
T, M, A	- **Modeling** - model the process of cell mitosis/meiosis, focusing on chromosome movement (E3)	

M, A M, A	- **Collaborating on POGIL** - Steps of mitosis/meiosis, what can happen when mistakes occur (nondisjunction) (E2, E3, E4) - **Constructing a Karyotype** to determine chromosomal abnormalities resulting from nondisjunction (E1, E2, E3)	

Unit 6: Genetics

Phenomenon: Genetic disease (could be same disease phenomenon from cells unit)

Stage 1 Desired Results

ESTABLISHED GOALS

HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]

HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through

Transfer

Students will be able to independently use their learning to…

- SEP 1 - Ask Questions and Define Problems
- SEP 2 - Develop and Use Models
- SEP 4 - Analyze and Interpret Data
- SEP 5 - Use Mathematics and Computational Thinking
- SEP 6 - Construct Explanations
- SEP 7 - Engage in Argument from Evidence
- SEP 8 - Obtain, Evaluate, and Communicate Information.

Meaning

UNDERSTANDINGS

Students will understand that…

- LS1.A: Structure and Function
  - All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.
- LS3.A: Inheritance of Traits
  - Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The

ESSENTIAL QUESTIONS

Students will keep considering…

- What processes are responsible for life's unity and diversity? (LS3.A) (LS3.B)
- How do science and technology affect the quality of our lives?

meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.] RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.	instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. ● LS3.B: Variation of Traits ○ In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. ○ Environmental factors can also cause mutations in genes, and viable mutations are inherited. Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.	

	Acquisition	
	Students will know… ● Mendel's Law of Dominance ● The difference between genotype and phenotype ● How to predict the probability of genetic crosses (CCC: Patterns) ● Nonmendelian patterns of inheritance such as incomplete and sex-linked traits ● How to use pedigrees to understand patterns of inheritance both Mendelian and non-Mendelian	*Students will be skilled at…* ● Using Punnett Squares to predict the genotypic and phenotypic probabilities of offspring of a genetic cross ● Analyzing a pedigree to determine the pattern of inheritance

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Students are assessed on their understanding of core concepts of inheritance patterns and genetics as well as critical thinking skills including data analysis, data interpretation, constructing explanations from evidence and with reasoning, and communicating findings. Specific skills assessed are: the use of punnett squares to predict genotypic and phenotypic outcomes and analysis of pedigrees	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* Predicting, analyzing and communicating information about a genetic inheritance pattern. **Case Study: It's All Greek to Me** - Students will synthesize what they have learned about genetics to evaluate the inheritance pattern of Nikoleta's genetic disorder in the case study. Then, students will need to counsel Nikoleta's parents by making and defending a claim as to whether or not the parents should consider having more children.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* T, M, A Warm-Up / Exit tickets M, A Monitor progress for depth and accuracy T, M, A Kahoot, Peardeck, Edpuzzle Assessments M, A Quizzes on content T, M, A Questions on activities, labs and projects M, A Verbal questions / discussions for comprehension T, M, A Article Analysis /Summaries T, M, A End of unit assessment

Stage 3 – Learning Plan

Code		
	Pre-Assessment ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M, A	- **Taking notes** from lecture, class discussion, and videos on each topic (E3)	Warm Up / Exit tickets ● Monitor progress for depth and accuracy Kahoot, Peardeck, Edpuzzle Assessments Quizzes on content
T, M, A	- **Working collaboratively** with partners or small groups to complete graphic organizers to summarize major concepts (E1, E2, E3, E4)	● Questions on activities and projects ● Verbal questions for comprehension ● End of unit assessment
M, A	- **Predicting and analyzing** genotypic and phenotypic outcomes using punnett squares and pedigrees (E1, E2, E3)	
M, A	- **Collaborating on POGIL** - Predicting inheritance patterns by analyzing a pedigree (E2, E3)	
T, M, A	- **Analyzing Data** - Lactose Intolerance Pedigree Case Study (E4, E5)	
T, M, A	- **Synthesizing Information from Case Study** - It's All greek to Me (E1, E4, E5)	

Unit 7: DNA and Protein Synthesis

Phenomenon: How do variations in traits arise?
Lactose-Intolerance / Sickle Cell Anemia

Stage 1 Desired Results

ESTABLISHED GOALS

HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]

HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1)

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Develop and Use Models.
- SEP 3 - Plan and Carry Out an Investigation
- SEP 4 - Analyze and Interpret Data
- SEP 6 - Construct Explanations
- SEP 7 - Engage in Argument from Evidence
- SEP 8 - Obtain, Evaluate, and Communicate Information.

Meaning

UNDERSTANDINGS

Students will understand that…

- LS1.A: Structure and Function
  - All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.
- LS3.A: Inheritance of Traits
  - Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The

ESSENTIAL QUESTIONS

Students will keep considering…

- How are organisms structured to ensure efficiency and survival? (LS1.A)
- How do science and technology affect the quality of our lives?

new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.] WHST.9-10.1 Write arguments focused on discipline-specific content.	instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. ● LS3.B: Variation of Traits ○ In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. ○ Environmental factors can also cause mutations in genes, and viable mutations are inherited. Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.	
	Acquisition	
	Students will know…	*Students will be skilled at…* ● Describing the structure of DNA and RNA

	• How an organism transfers the information contained in DNA to the proteins (CCC: Cause and Effect) • That proteins determine the structure and function of all organisms (CCC: Structure and Function) • The process of transcription and translation • The effect of genetic mutations on protein structure (CCC: Structure and Function) • How DNA can be manipulated (engineered) to alter traits	• Explaining how DNA replicates itself • Describing the general role of DNA and RNA in protein synthesis • Identifying types of genetic mutations • Outlining the steps to create a transgenic organism • Supporting claims using evidence

Stage 2 – Evidence

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Students are assessed on their understanding of core concepts of DNA, genes, protein synthesis and mutation. and critical thinking skills including data analysis, data interpretation, hypothesis and reasoning, predictions and communicating findings.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* the relationship between the genetic code and a protein's structure and function and how different types of mutations will affect the protein **GIZMO STEM CASE - Protein Synthesis STEM Case** Lucy is a baby girl whose ADA enzymes are not working properly and suffers from ADA SCID (Adenosine deaminase severe combined immunodeficiency), an autoimmune disease. Students act as a pediatrician and learn about protein synthesis to find the cause of the disease and treatment for Lucy. Students will make a claim about the type of mutation, justify with evidence and provide counterevidence to rule out alternative hypotheses.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* T, M, A Warm-Up / Exit tickets M, A Monitor progress for depth and accuracy T, M, A Kahoot, Peardeck, Edpuzzle Assessments M, A Quizzes on content T, M, A Questions on activities, labs and projects M, A Verbal questions / discussions for comprehension T, M, A Article Analysis /Summaries T, M, A End of unit assessment

Stage 3 – Learning Plan

Code	***Pre-Assessment***	
	● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M, A	- **Taking notes** from lecture, class discussion, and videos on each topic (E3)	● Warm-Up / Exit tickets Monitor progress for depth and accuracy Kahoot, Peardeck, Edpuzzle Assessments ● Quizzes on content Questions on activities and projects Verbal questions for comprehension ● End of unit assessment
T, M, A	- **Working collaboratively** with partners or small groups to build DNA model, complete graphic organizers to summarize major concepts (E1, E2, E3, E4)	
T, M, A	- **Modeling** protein synthesis (Mystery Monster Activity) (E3)	
T, M, A	- **Simulating** Protein Synthesis/Mutation (Gizmo STEM Cell) (E4, E5)	
T, M, A	- **Modeling lab** - gene manipulation (E5)	

Unit 8: Evolution

Phenomenon: Darwin's Finches
Why do deadly diseases exist?

Stage 1 Desired Results

ESTABLISHED GOALS

HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]

HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Develop and Use Models.
- SEP 4 - Analyze and Interpret Data
- SEP 5 - Use Mathematics and Computational Thinking
- SEP 6 - Construct Explanations
- SEP 7 - Engage in Argument from Evidence
- SEP 8 - Obtain, Evaluate, and Communicate Information.

Meaning

UNDERSTANDINGS
Students will understand that…

LS3.B: Variation of Traits Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus, the variation and distribution of traits observed depends on both genetic and environmental factors.

LS4.A: Evidence of Common Ancestry and Diversity Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of

ESSENTIAL QUESTIONS
Students will keep considering…

- What is the role of genes in the evolution of all populations? (LS4.B)
- What evidence shows that different species are related? (LS4.A)
- What is the driving force of evolution? (LS4.B)
- How do humans impact biodiversity? (LS4.D)

[Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on the number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.] HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. [Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.] HS-LS4-5. Evaluate the evidence	descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. LS4.B: Natural Selection Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information — that is, trait variation — that leads to differences in performance among individuals. The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. LS4.C: Adaptation Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. LS4.C: Adaptation Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. Adaptation	

supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. [Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.] RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.	also means that the distribution of traits in a population can change when conditions change. LS4.C: Adaptation Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline — and sometimes the extinction — of some species. Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. LS4.D: Biodiversity and Humans Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.	
	Acquisition	
	Students will know… ● The role genetic mutation plays in natural selection and evolution (CCC: Cause and Effect) ● Darwin's basic principles of natural selection	*Students will be skilled at…* ● Explaining how genetic mutation and natural selection play a role in evolution ● Explaining how evolution provides a scientific explanation for fossil records

	● How evolution provides a scientific explanation for fossil records ● How adaptations increase chances for survival ● Evolution at the allele level (CCC: Scale, Proportion, and Quantity) ● Evidence of evolution (fossils, homologous structures, embryology, molecular sequences)	● Describing how adaptations increase chances for survival ● Identifying homologous / analogous /vestigial structures and explaining the significance of each in relation to evolution

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Constructed response rubric to assess for claim accuracy, appropriate evidence, and reasoning that connects to content accurately	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* the process of natural selection a the driving force behind life's diversity **Bite Scis Case Study - From Gene to Disease: Sickle Cell Anemia** - Students will analyze data about sickle cell anemia and the incidence of malaria. They will first determine the genetic causes and inheritance pattern of sickle cell anemia then compare the incidence of sickle cell anemia in Africa with the incidence of malaria. Students interpret data to explain why natural selection has favored the prevalence of sickle cell anemia in some locations over others.
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T, M, A	- **Working collaboratively** with partners or small groups to complete graphic organizers to summarize major concepts (E1, E2, E3, E4)	
T, M, A	- **Modeling** - simulate natural selection in a population (peppered moth, rock pocket mice, tuskless elephants) (E2, E4)	
T, M, A	- **Investigating and Applying** the principles of natural selection to the population of Galapagos finches to explain the patterns observed in beak size over several generations (bird beak lab and video) (E2, E3)	
M, A	- **Explaining and Summarizing** the various pieces of evidence of evolution (E2, E3)	