Waynesville R-VI

Scope and Sequence 2021-2022

Biology

		1st Semester					2nd Semester			
Days		**12**	**21**	**20**	**17**	**13**	**19**	**24**	**19**	**30**
Month(s)		**8/23-8/31 1/3-1/7**	**9/1-9/30**	**10/1-10/28**	**11/1-11/30**	**12/1-12/17**	**1/10-2/4**	**2/7-3/11**	**3/21-4/14**	**4/18-5/27**
Topics										
Unit 1	Engineering, Technology, and Application of Science	CFA Pre SA Key								
Unit 2	Biochemistry		SA Ans. Key							
Unit 3	Photosynthesis and Cellular Respiration			SA Ans. Key						
Unit 4	Homeostasis				SA Ans. Key					
Unit 5	DNA Structure and Function					SA Ans. Key				
Unit 6	Mitosis & Meiosis						SA Ans. Key			
Unit 7	Heredity							SA Ans. Key		
Unit 8	Biological Evolution								SA Ans. Key	
Unit 9	Ecology									SA Ans. Key

Engineering, Technology, and Application of Science

Grade: 9-12 **Subject:** Biology **Pre:** August 25 **Post:** January 3-7

Standards

Unit Title	Engineering, Technology, and Application of Science		Expectation Unwrapped

Priority Standard	9-12.ETS1.A.2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	• Design a solution to a complex real-world problem based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations.
			• Defining and Delimiting Engineering Problems
			  ○ Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
			  ○ Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.

Supporting Standards	9-12.ETS1.A.1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants	Listed on the item specification linked to the standard's code
	9-12.ETS1.B.2	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	Listed on the item specification linked to the standard's code
	9-12.ETS1.B.1	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.	Listed on the item specification linked to the standard's code

**Click on standard code above to see Item Specifications from DESE and Released Items*

Instructional Ideas/Notes

		Assessed on Post Test	Instructional Ideas/Prerequisite Knowledge
Priority Standard	9-12.ETS1.A.2	Yes	**Assessment Information:** ● August-Unit 1 SLO Pretest ● August 31 Give-Biology Unit 1 Scientific Inquiry CFA Scientific Method ● January Unit 1 SLO Summative (FINAL) **Instructional Notes:** Task 1 Station Identification Cards Task 2 Sample Data used to create graphs Task 3 Station Identification and/or Sample data cards Task 4 Performance Event

Key Vocabulary

observation	hypothesis	prediction	experiment	Control group
constant	Independent variable	Dependent variable	Qualitative data	Quantitative data
conclusion	Data table	Bar graph		

Common Assessments

Unit 1 SLO Pretest	Biology Unit 1 Scientific Inquiry CFA Scientific Method	SLO Formative Optional	Unit 1 SLO Summative

Proficiency Scale

Proficiency Scale: A score of 3.0 correlates with grade-level proficiency on the priority standard.

Score	Learning Goal	Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences or applications that go beyond what was taught. For example, the student may:** ● Design an experiment correctly identifying all components.	● Grape Osmosis Diffusion Lab
3.5 In addition to 3.0 performance, in-depth inferences and applications with partial success.		
Score 3.0	**The student exhibits no major errors or gaps in the learning goal (complex ideas and processes).** **The student will:** ● Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	● Solar Home design
2.5 No major errors or gaps in 2.0 content and partial knowledge of 3.0 content.		
Score 2.0	**The student exhibits no major errors or gaps in the simpler details and processes.** **The student will:** ● Formulate a testable hypothesis but is not in the correct format (I think, in my opinion) ● Identify variables but have not categorized them correctly. ● Identify controls and constraints but have not categorized them correctly. ● Create correct type of graph (bar/line) but mislabels axes, gives a non-descriptive title, has incorrect data plots, key is missing (if applicable) ● Use data to create a data table	● Simpsons Scientific Method Practice problems
1.5 Partial understanding of the 2.0 content with major errors or gaps in 3.0 content.		
Score 1.0	**With help, a partial understanding of the 2.0 content and some of the 3.0 content.**	

Biochemistry

Grade: 9-12 **Subject:** Biology **Pre:** Sept. 1 **Post:** Sept. 30

Standards

Unit Title	Biochemistry		Expectation Unwrapped
Priority Standard	9-12.LS1.C.3	Construct and revise an explanation based on evidence that organic macromolecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur and phosphorus to form large carbon-based molecules.	• [Clarification Statement: Large carbon-based molecules included are proteins, carbohydrates, nucleic acids, and lipids. Emphasis is on the inclusion of the element, not the structural organization of the macromolecule and on using evidence from models and simulations to support explanations.] • Constructing Explanations and Designing Solutions ○ Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and on the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Supporting Standards		Recognize and recall academic vocabulary	Listed on the item specification linked to the standard's code
		Construct a model of the lock and key mechanism of enzymes	Listed on the item specification linked to the standard's code
		Predict how denaturing affects the functioning of enzymes	Listed on the item specification linked to the standard's code

**Click on standard code above to see Item Specifications from DESE and Released Items*

Instructional Ideas/Notes

		Assessed on Post Test	Instructional Ideas/Prerequisite Knowledge
Priority Standard	9-12.LS1.C.3	Yes	**Assessment Information:** **Instructional Suggestions:** **Task 1** **Graphic organizer differentiating macromolecules** **Task 2** **Incomplete graphic organizer to be completed by the students differentiating macromolecules.** **Task 3** **Analyze case study to determine any imbalances in homeostasis of organisms.**

Key Vocabulary

atom	element	hydrogen	bond	monomer
polymer	carbohydrate	lipid	fatty acid	protein
amino acid	nucleic acid	ATP	nucleotides	DNA
RNA	molecule	catalyst	enzymes	

Common Assessments

Unit 2 Biochemistry CFA 1 Macro	Unit 2 Biochemistry CFA 2 Enzymes	CFA 2	CFA 3	Post

Proficiency Scale

Proficiency Scale: A score of 3.0 correlates with grade-level proficiency on the priority standard.

Score	Learning Goal	Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences or applications that go beyond what was taught. For example, the student may:** ● Analyze case study to determine any imbalances in organic molecules that could affect the homeostasis of organisms.	Construct a model to explain the relationship among genes, DNA, proteins, and cell function.
3.5 In addition to 3.0 performance, in-depth inferences and applications with partial success.		
Score 3.0	**The student exhibits no major errors or gaps in the learning goal (complex ideas and processes).** **The student will:** ● Construct and revise an explanation based on evidence that organic macromolecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur and phosphorus to form large carbon-based molecules.	The region of DNA indicated in the diagram is called a _____. It contains instructions for _____.

2.5 No major errors or gaps in 2.0 content and partial knowledge of 3.0 content.		
Score 2.0	**The student exhibits no major errors or gaps in the simpler details and processes.** **The student will:** ● Recognize and recall academic vocabulary: organic, enzyme ● Describe basic atomic structure. ● Explain different types of bonds (hydrogen, ionic and covalent) ● Solve equations for building polymers	● **Vocabulary Quiz** ● **Kinesthetic formative** ● **Graphic organizer/Venn Diagram** ● **Exit Ticket**
1.5 Partial understanding of the 2.0 content with major errors or gaps in 3.0 content.		
Score 1.0	**With help, a partial understanding of the 2.0 content and some of the 3.0 content.**	

Photosynthesis and Cellular Respiration

Grade: 9-12 **Subject:** Biology **Pre:** Oct. 1 **Post:** Oct. 28

Standards

Unit Title	Photosynthesis and Cellular Respiration		Expectation Unwrapped
Priority Standard	9-12.LS1.C.1	Use a model to demonstrate 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 photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] • Developing and Using Models ○ Use a model based on evidence to illustrate the relationships between systems or between components of a system.
	9-12.LS1.C.2	Use a model to demonstrate that cellular respiration is a chemical process whereby the bonds of 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.] • Developing and Using Models ○ Use a model based on evidence to illustrate the relationships between systems or between components of a system.
	9-12.LS2.B.1	Construct and revise an explanation based on evidence that the processes of photosynthesis, chemosynthesis, and aerobic and anaerobic respiration are responsible for the cycling of matter and flow of energy through ecosystems and that environmental conditions restrict which reactions can occur.	• [Clarification Statement: Examples of environmental conditions can include the availability of sunlight or oxygen.] • Constructing Explanations and Designing Solutions ○ Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Supporting Standards		Recognize and recall academic vocabulary	Listed on the item specification linked to the standard's code
		Identify reactants and products in photosynthesis	Listed on the item specification linked to the standard's code
		Identify factors that affect photosynthesis	Listed on the item specification linked to the standard's code

**Click on standard code above to see Item Specifications from DESE and Released Items*

Instructional Ideas/Notes

		Assessed on Post Test	Instructional Ideas/Prerequisite Knowledge
Priority Standard	9-12.LS1.C.3	Yes	**Assessment Information:** **Instructional Suggestions:** Task 1 Students will create a foldable to show stored and released in energy for photosynthesis and cellular respiration. Task 2 Create a venn diagram or t chart to compare and contrast photosynthesis and cellular respiration Task 3 Analyze graphs to determine the effects of limiting factors on Photosynthesis and Cellular respiration Task 4 Exit ticket over the interrelationship between cellular respiration and photosynthesis. Task 5 Analyze experimental data to determine patterns, relationships and credibility of student explanation for the increase/decrease of photosynthesis and cellular respiration rates.
	9-12.LS1.C.2	Yes	
	9-12.LS2.B.1	Yes	

Key Vocabulary

ATP/ADP	photosynthesis	chlorophyll	thylakoid	light-dependent reactions
light-independent reactions	electron transport chain	calvin cycle cellular respiration	aerobic	glycolysis
anaerobic	krebs cycle fermentation	lactic acid		

Common Assessments

Proficiency Scale

Proficiency Scale: A score of 3.0 correlates with grade-level proficiency on the priority standard.

Score	Learning Goal	Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences or applications that go beyond what was taught. For example, the student may:** ● Analyze experimental data to determine patterns, relationships and credibility of student explanation for the increase/decrease of photosynthesis and cellular respiration rates.	Analyze what would happen to both plants and animals if the chloroplast disappeared from eukaryotic cells?
3.5 In addition to 3.0 performance, in-depth inferences and applications with partial success.		
Score 3.0	**The student exhibits no major errors or gaps in the learning goal (complex ideas and processes).** **The student will:** ● Use a model to demonstrate how photosynthesis transforms light energy into stored chemical energy. ● Use a model to demonstrate that cellular respiration is a chemical process whereby the bonds of molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy ● Construct and revise an explanation based on evidence that the processes of photosynthesis, chemosynthesis, and aerobic and anaerobic respiration are responsible for the cycling of matter and flow of energy through ecosystems and that environmental conditions restrict which reactions can occur	● Create a Venn Diagram or T-table ● Create a foldable to show stored and released energy ● Formative Assessment ● Analyze graphs to determine effects of limiting factors on photosynthesis AND cellular respiration.
2.5 No major errors or gaps in 2.0 content and partial knowledge of 3.0 content.		
Score 2.0	**The student exhibits no major errors or gaps in the simpler details and processes.** **The student will:** ● recognize and recall academic vocabulary photosynthesis, cellular respiration, reactants, products, ATP ● Identify reactants and products in photosynthesis and cellular respiration (CO_2, H_2O, glucose, O_2, ATP.) ● Identify factors that affect photosynthesis and cellular respiration(light, temperature, reactant availability.)	Write the chemical equation for photosynthesis and identify the products and reactants. Write the chemical equation for cellular respiration and identify the products and reactants.

1.5 Partial understanding of the 2.0 content with major errors or gaps in 3.0 content.		
Score 1.0	**With help, a partial understanding of the 2.0 content and some of the 3.0 content.**	

Homeostasis

Grade: 9-12 **Subject:** Biology **Pre:** November 1 **Post:** November 30

Standards

Unit Title	Homeostasis		Expectation Unwrapped
Priority Standard	9-12.LS1.A.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, stomata response to moisture and temperature, or root development in response to water levels.] • Planning and Carrying Out Investigations ○ Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence and in the design o decide on types, quantity, and accuracy of data needed to produce reliable measurements; o consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); o refine the design accordingly.
	9-12.LS1.A.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 stimuli. Similar cells work together to form tissues. Tissues work together to form organs. Organs work together to form organ systems. Organ systems interact to form an organism.] • Developing and Using Models ○ Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.
Supporting Standards		Develop a model to identify and describe the relevant parts of body systems in multicellular organisms	Listed on the item specification linked to the standard's code
		Describe the relationships between components	Listed on the item specification linked to the standard's code
		Use a model to illustrate how the interactions between systems provides specific functions in multicellular organisms	Listed on the item specification linked to the standard's code
		Make a distinction between the accuracy of the model and actual body systems and functions it represents	Listed on the item specification linked to the standard's code

**Click on standard code above to see Item Specifications from DESE and Released Items*

Instructional Ideas/Notes

		Assessed on Post Test	Instructional Ideas/Prerequisite Knowledge
Priority Standard	9-12.LS1.A.3	Yes	
	9-12.LS1.A.2	Yes	

Key Vocabulary

determination	homeostasis	organism	differentiation	feedback
stimulus	tissue	negative feedback	response	organ
positive feedback	response	cell	Organ system	thermoregulation
Vasoconstriction	Vasodilation			

Common Assessments

FA 1	FA 2	Post

Proficiency Scale

Proficiency Scale: A score of 3.0 correlates with grade-level proficiency on the priority standard.

Score	Learning Goal	Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences or applications that go beyond what was taught. For example, the student may:** ● Make a distinction between the accuracy of the mode and actual body systems and functions it represents.	● Explain how an increase in body temperature affects its oxygen consumption when it is at rest in living organisms.
3.5 In addition to 3.0 performance, in-depth inferences and applications with partial success.		
Score 3.0	**The student exhibits no major errors or gaps in the learning goal (complex ideas and processes).** **The student will:** ● Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis ● Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms	● Body system poster explaining how the system interacts with at least one other system.
2.5 No major errors or gaps in 2.0 content and partial knowledge of 3.0 content.		
Score 2.0	**The student exhibits no major errors or gaps in the simpler details and processes.** **The student will:** ● Identify the function of organ system and plant structures.	● Low blood pressure can be life threatening. To help maintain a stable blood pressure receptors in the heart detect changes in blood pressure. Information about the blood pressure changes is then sent to the brain. If blood pressure is too low, the brain sends a message to the heart to beat faster.
1.5 Partial understanding of the 2.0 content with major errors or gaps in 3.0 content.		
Score 1.0	**With help, a partial understanding of the 2.0 content and some of the 3.0 content.**	
0.5 With help, a partial understanding of the 2.0 content but not of the 3.0 content.		
Score 0.0	**Even with help, no understanding of skill or content demonstrated.**	

DNA Structure and Function

Grade: 9-12 **Subject:** Biology **Pre:** December 1 **Post:** December 17

Standards

Unit Title	DNA Structure and Function		Expectation Unwrapped
Priority Standard	9-12.LS1.A.1	Construct a model of how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.	• [Clarification Statement: Genes are the regions in DNA that code for proteins. Basic transcription and translation explain the roles of DNA and RNA in coding the instructions for making polypeptides.] • Constructing Explanations and Designing Solutions ○ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Supporting Standards		Recognize and recall academic vocabulary	Listed on the item specification linked to the standard's code
		Demonstrate base-pairing rules	Listed on the item specification linked to the standard's code
		Compare the functions of mRNA, tRNA and rRNA	Listed on the item specification linked to the standard's code
		Compare and contrast DNA and RNA	Listed on the item specification linked to the standard's code

**Click on standard code above to see Item Specifications from DESE and Released Items*

Instructional Ideas/Notes

		Assessed on Post Test	Instructional Ideas/Prerequisite Knowledge
Priority Standard	9-12.LS1.A.1	Yes	

DNA Structure and Function

Key Vocabulary

nucleotide	double helix	base pairing rules	polymer	DNA
deoxyribose	phosphate group	RNA	transcription	RNA polymerase messenger RNA (mRNA)
ribosomal RNA (rRna)	transfer RNA (tRNA)	translation	codon	stop codon
anticodon	mutation	frameshift mutation	mutagen	point mutation

Common Assessments

CFA 1	CFA 2	CFA 3	Post

Proficiency Scale

Proficiency Scale: A score of 3.0 correlates with grade-level proficiency on the priority standard.

Score	Learning Goal	Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences or applications that go beyond what was taught. For example, the student may:** ● Defend the argument that mutations are beneficial to species survival.	● Create an advertisement (either in electronic or paper form) for a real world example where a mutation has benefitted a species.
3.5 In addition to 3.0 performance, in-depth inferences and applications with partial success.		
Score 3.0	**The student exhibits no major errors or gaps in the learning goal (complex ideas and processes).** **The student will:** ● Construct a model of how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.	● Label a DNA strand with no word bank and circle a nucleotide ● Given a template and codon chart transcribe and translate a segment of DNA ● Given a template and codon chart transcribe and translate a mutated segment of DNA and compare it to a non mutated segment
2.5 No major errors or gaps in 2.0 content and partial knowledge of 3.0 content.		
Score 2.0	**The student exhibits no major errors or gaps in the simpler details and processes.** **The student will:** ● demonstrate base-pairing rules. ● compare the functions of mRNA, tRNA, rRNA. ● compare and contrast DNA and RNA	● Label a flowchart to show the progression of protein synthesis from DNA to mRNA to tRNA to amino acids to protein
1.5 Partial understanding of the 2.0 content with major errors or gaps in 3.0 content.		
Score 1.0	**With help, a partial understanding of the 2.0 content and some of the 3.0 content.**	
0.5 With help, a partial understanding of the 2.0 content but not of the 3.0 content.		
Score 0.0	**Even with help, no understanding of skill or content demonstrated.**	

Mitosis and Meiosis

Grade: 9-12 **Subject:** Biology **Pre:** January 10 **Post:** February 4

Standards

Unit Title	Mitosis and Meiosis		Expectation Unwrapped
Priority Standard	9-12.LS1.B.1	Develop and use models to communicate the role of mitosis, cellular divisions, and differentiation in producing and maintaining complex organisms.	• [Clarification Statement: Major events of the cell cycle include cell growth, DNA replication, preparation for division, separation of chromosomes, and separation of cell contents.] • Developing and Using Models ○ Use a model based on evidence to illustrate the relationships between systems or between components of a system.
Supporting Standard		Recognize and recall academic vocabulary	Listed on the item specification linked to the standard's code
Priority Standard	9-12.LS3.A.1	Develop and use models to clarify relationships about how DNA in the form of chromosomes is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction.	• Developing and Using Models ○ Develop a model based on evidence to illustrate the relationships between systems or components of a system.
Supporting Standards		Recognize and recall academic vocabulary	Listed on the item specification linked to the standard's code
		Recognize that chromosomes hold DNA that codes for proteins which are expressed as the heritable traits of organisms	Listed on the item specification linked to the standard's code
Priority Standard	9-12.LS3.B.1	Compare and contrast asexual and sexual reproduction with regard to genetic information and variation in offspring.	• Developing a Model ○ Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.
Supporting Standards		Develop a visual representation to compare and contrast asexual and sexual reproduction	Listed on the item specification linked to the standard's code
		Describe the relationship between sexual and asexual reproduction	Listed on the item specification linked to the standard's code

**Click on standard code above to see Item Specifications from DESE and Released Items*

Instructional Ideas/Notes

		Assessed on Post Test	Instructional Ideas/Prerequisite Knowledge
Priority Standards	9-12.LS1.B.1	Yes	
	9-12.LS3.A.1	Yes	
	9-12.LS3.B.1	Yes	

Key Vocabulary

chromosome	autosome	mitosis	chromatid	karyotype
cytokinesis	centromere	cell cycle	spindle	homologous chromosome
interphase	somatic cell	DNA replication	replication fork	daughter cells
hydrogen bonds	DNA polymerase	chromatin	haploid	diploid
fertilization	somatic cell	gamete	meiosis	crossing over
independent assortment	law of segregation	asexual reproduction	binary fission	sexual reproduction
autosomes	sex chromosome	zygote	sperm	egg
polar body				

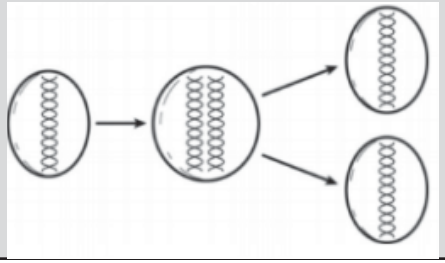
Mitosis and Meiosis

Common Assessments

CFA 1	CFA 2	CFA 3	Post

Proficiency Scale

Proficiency Scale: A score of 3.0 correlates with grade-level proficiency on the priority standard.

Score	Learning Goal	Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences or applications that go beyond what was taught. For example, the student may:** ● Evaluate two models for which better explains the process of mitosis, cellular division, or differentiation in producing and maintaining complex organisms	● Stop Motion video of a model students have created showing
3.5 In addition to 3.0 performance, in-depth inferences and applications with partial success.		
Score 3.0	**The student exhibits no major errors or gaps in the learning goal (complex ideas and processes).** **The student will:** ● Develop or use a model to explain the process of mitosis, cellular division, or differentiation in producing and maintaining complex organisms.	● The model below shows a cell undergoing a process The process is necessary in order to: 
2.5 No major errors or gaps in 2.0 content and partial knowledge of 3.0 content.		
Score 2.0	**The student exhibits no major errors or gaps in the simpler details and processes.** **The student will:** ● **Recognize the process of mitosis, cellular division, or differentiation.**	● Recognize and recall academic vocabulary: chromosome, chromatin, haploid, diploid, fertilization, zygote, somatic cell, gamete, sperm, Page 1 of 2 egg, meiosis, crossing-over, independent
1.5 Partial understanding of the 2.0 content with major errors or gaps in 3.0 content.		
Score 1.0	**With help, a partial understanding of the 2.0 content and some of the 3.0 content.**	
0.5 With help, a partial understanding of the 2.0 content but not of the 3.0 content.		
Score 0.0	**Even with help, no understanding of skill or content demonstrated.**	

Mitosis and Meiosis

Heredity

Grade: 9-12 **Subject:** Biology **Pre:** February 4 **Post:** March 11

Standards

Unit Title	Heredity		Expectation Unwrapped
Priority Standard	9-12.LS3.B.4	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	• [Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] • Analyzing and Interpreting Data ○ Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
Supporting Standard		Recognize and recall academic vocabulary	Listed on the item specification linked to the standard's code
		Understand patterns of probability	Listed on the item specification linked to the standard's code
		Recognize that chromosomes hold DNA that code for proteins which are expressed as the heritable traits of an organism	Listed on the item specification linked to the standard's code

Priority Standard	9-12.LS3.B.2	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial or neutral effects to the structure and function of the organisms.	• [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may or may not result in making different proteins.] • Developing and Using Models ○ Use a model based on evidence to illustrate the relationships between systems or between components of a system.
Supporting Standards		Develop a model to identify and describe structural changes to DNA and the effects of the changes	Listed on the item specification linked to the standard's code
		Describe the relationships between components, including the relationship between genotype and phenotype	Listed on the item specification linked to the standard's code
		Illustrate the structure and function of the organism and the organism's overall fitness	Listed on the item specification linked to the standard's code

Priority Standard	9-12.LS3.B.3	Make and defend a claim that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) mutations 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 (e.g., crossing over, independent assortment, mutations from replication, mutations from environmental factors).] • Engaging in Argument from Evidence ○ Make and defend a claim based on evidence about the natural world that reflects scientific knowledge and student-generated evidence.
Supporting Standards		Make a claim and describe supporting evidence that includes the idea that inheritable genetic variations may result from meiosis, during replication or environmental factors	Listed on the item specification linked to the standard's code
		Use reasoning and valid evidence to describe how new combinations of DNA can arise from several sources, including meiosis, errors during replication and mutations caused by environmental factors	Listed on the item specification linked to the standard's code
		Defend a claim against counterclaims and critique by evaluating counterclaims and critique by evaluating counterclaims and by describing the connections between the relevant and appropriate evidence and the strongest claim	Listed on the item specification linked to the standard's code

**Click on standard code above to see Item Specifications from DESE and Released Items*

Instructional Ideas/Notes

		Assessed on Post Test	Instructional Ideas/Prerequisite Knowledge
Priority Standards	9-12.LS3.B.4	Yes	
	9-12.LS3.B.2	Yes	
	9-12.LS3.B.3	Yes	

Key Vocabulary

chromosome	genes	genotype	probability	genetics

Heredity

trait	punnett square	genetic variation	heterozygous	Monohybrid cross
allele	homozygous	sex-linked	dominant	recessive
Incomplete dominance	heredity	phenotype	genetic	Genetic recombination
genetics	codominance	Complete dominance	Law of segregation	Law of independent assortment
carrier	testcross			

Common Assessments

CFA 1	CFA 2	Post

Proficiency Scale

Proficiency Scale: A score of 3.0 correlates with grade-level proficiency on the priority standard.

Score	Learning Goal	Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences or applications that go beyond what was taught. For example, the student may:** ● Evaluate evidence to make and defend a claim about the causes of inheritable genetic variation. ● Use DNA data to evaluate evidence for the cause of genetic variation in individuals and in populations. ● Use a model to explain and predict variation and distribution of traits in a population as they relate to genetic and environmental factors.	● Genetic Disorder Case Study
3.5 In addition to 3.0 performance, in-depth inferences and applications with partial success.		
Score 3.0	**The student exhibits no major errors or gaps in the learning goal (complex ideas and processes). The student will:** ● Use evidence to make and defend a claim about the causes of inheritable genetic variation. ● Use DNA data to defend a claim with evidence for the cause of genetic variation in individuals and in populations. ● Use a model to explain the variation and distribution of traits in a population.	● Practice Problems using various strategies for Monohybrid and complex patterns. ● In humans, dimples are dominant over not having dimples. A man who is heterozygous of dimples has a child with a woman who does not have dimples. What are the genotypic and phenotypic ratios from the cross?
2.5 No major errors or gaps in 2.0 content and partial knowledge of 3.0 content.		
Score 2.0	**The student exhibits no major errors or gaps in the simpler details and processes. The student will:** ● Make a claim about the causes of inheritable genetic variation. ● Use DNA data to describe genetic variation in individuals in a population. ● Perform mathematical functions to determine probability of a trait in a population.	● In humans, dimples are dominant over not having dimples. A man who is heterozygous of dimples has a child with a woman who does not have dimples. What is the probability of their child having dimples?
1.5 Partial understanding of the 2.0 content with major errors or gaps in 3.0 content.		
Score 1.0	**With help, a partial understanding of the 2.0 content and some of the 3.0 content.** ● **Identify a claim about the causes of inheritable genetic variation.** ● **Recognize DNA data to describe genetic variation in individuals in a population.** ● **Recognize the probability of a trait in a population.**	**What causes genetic variation within a population ?**

Biological Evolution

Grade: 9-12 **Subject:** Biology **Pre:** March 21 **Post:** April 14

Standards

Unit Title	Biological Evolution		Expectation Unwrapped
Priority Standard	9-12.LS4.A.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, but are not limited to, similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development. Communicate could include, but is not limited to, written report, and oral discussion.] • Obtaining, Evaluating, and Communicating Information ○ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).
Supporting Standard		Communicate that together, the patterns observed at multiple spatial and temporal scales provide evidence for causal relationships relating to biological evolution and common ancestry	Listed on the item specification linked to the standard's code
Priority Standard	9-12.LS4.A.2	Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.	• [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] • Obtaining, Evaluating, and Communicating Information ○ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

Biological Evolution

Priority Standard	9-12.LS4.B.1	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	• [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.] • Constructing Explanations and Designing Solutions ○ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Supporting Standards		Use reasoning to connect the evidence, along with the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	Listed on the item specification linked to the standard's code

Priority Standard	9-12.LS4.B.2	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.] • Analyzing and Interpreting Data ○ Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
Supporting Standards		Organize given data by frequency, distribution and variation of expressed traits in the population	Listed on the item specification linked to the standard's code
		Perform and use appropriate statistical analyses of data, including probability measures, to determine the relationship between a trait's occurrence within a population and environmental factors	Listed on the item specification linked to the standard's code
		Analyze and interpret data to explain the distribution of expressed traits	Listed on the item specification linked to the standard's code

Priority Standard	9-12.LS4.C.1	Construct an explanation based on evidence of how natural selection leads to adaptations 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.] • Constructing Explanations and Designing Solutions

			○ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review), and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Supporting Standards		Identify examples of adaptations that may have resulted from variations favored by natural selection	Listed on the item specification linked to the standard's code

Priority Standard	9-12.LS4.C.2	Evaluate the evidence 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, droughts, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.] • Engaging in Argument from Evidence ○ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.
Supporting Standards		Identify and describe additional evidence that was not provided but is relevant to the claims and to evaluating the given evidence	Listed on the item specification linked to the standard's code
		Use additional evidence to assess the validity, reliability, strengths and weaknesses of the given evidence, along with its ability to support logical and reasonable arguments about the outcomes of group behavior	

**Click on standard code above to see Item Specifications from DESE and Released Items*

Instructional Ideas/Notes

		Assessed on Post Test	Instructional Ideas/Prerequisite Knowledge
Priority Standards	9-12.LS4.A.1	Yes	
	9-12.LS4.A.2	Yes	
	9-12.LS4.B.1	Yes	
	9-12.LS4.B.2	Yes	
	9-12.LS4.C.1	Yes	
	9-12.LS4.C.2	Yes	

Key Vocabulary

evolution	variation	adaption	artificial selection	heritability
natural selection	population	fitness	gene pool	allele frequency
normal distribution	directional selection	stabilizing selection	disruptive selection	speciation
extinction	species	biogeography	Fossil	embryology
Homologous structures	Analogous structure	Vestigial structure		

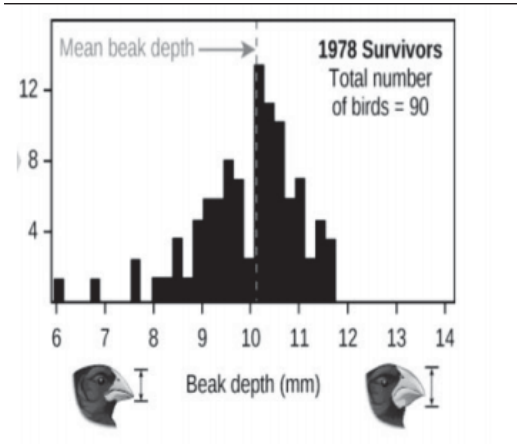
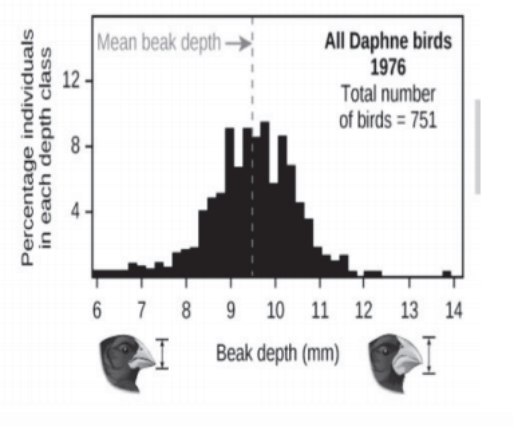
Common Assessments

CFA 1	CFA 2	CFA 3	Post

Proficiency Scale

Proficiency Scale: A score of 3.0 correlates with grade-level proficiency on the priority standard.

Score	Learning Goal	Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences or applications that go beyond what was taught. For example, the student may:** ● Analyze experimental data to determine the effect variations may have on a population's advantage for survival. ● According to data, predict the impact on future generations if environmental factors were to remain constant/change.	● Daphne birds can be classified into two categories of beak depths, shallow or deep. Shallow beaks have a beak depth less than 9mm and deeper beaks have a beak depth of 10mm or more. In 1976 the mean beak depth was 9.5mm and there were groups of birds on either side of this mean. The graphs show mean beak depth for the Daphne bird. Study the differences from 1976 to 1978. Note a drought occurred in 1977.

		  a. If the drought continued, what is a reasonable expectation for the distribution of beak depths in the bird species? b. Which explanation describes the predicted pattern of beak changed due to the continued drought?
3.5 In addition to 3.0 performance, in-depth inferences and applications with partial success.		
Score 3.0	**The student exhibits no major errors or gaps in the learning goal (complex ideas and processes).** **The student will:** ● Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. ● Analyze displays of pictorial data to compare	● Station review of similar structures of various organisms. ● Biochemical Evidence for Evolution (Textbook) ● Investigating Lizard Populations (Textbook) ● Natural selection graphing activity Peppered Moth Simulation

	patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. ● 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. ● 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. ● Construct an explanation based on evidence of how natural selection leads to adaptations of populations. ● Evaluate the evidence 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	
2.5 No major errors or gaps in 2.0 content and partial knowledge of 3.0 content.		
Score 2.0	**The student exhibits no major errors or gaps in the simpler details and processes.** **The student will:** ● Students identify connections between each line of evidence and the claim of common ancestry and biological evolution.	● **Vocabulary sort** ● **Natural Selection graph identification** ● **Evolution Concept Map**
1.5 Partial understanding of the 2.0 content with major errors or gaps in 3.0 content.		
Score 1.0	**With help, a partial understanding of the 2.0 content and some of the 3.0 content.**	

Ecology

Grade: 9-12 **Subject:** Biology **Pre:** April 18 **Post:** May 27

Standards

Unit Title	Ecology		Expectation Unwrapped
Priority Standard	9-12.LS2.A.1	Explain how various biotic and abiotic factors affect the carrying capacity and biodiversity of an ecosystem using mathematical and/or computational representations.	• [Clarification Statement: Examples of biotic factors could include relationships among individuals (e.g., feeding relationships, symbioses, competition) and disease. Examples of abiotic factors could include climate and weather conditions, natural disasters, and availability of resources. Genetic diversity includes within a population and species within an ecosystem. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.]
Supporting Standard		Identify the limiting factors (biotic and abiotic) that may affect the carrying capacity of a population within an ecosystem	Listed on the item specification linked to the standard's code
Priority Standard	9-12.LS2.B.2	Communicate the pattern of cycling of matter and the flow of energy among trophic levels in an ecosystem	• [Clarification Statement: Emphasis is on using a model of stored energy in biomass to describe the transfer of energy from one trophic level to another. Emphasis is on atoms and molecules as they move through an ecosystem. Mathematical representation could be, but is not limited to, data that has been manipulated, a data table, a graph, an equation, etc.]
Supporting Standard		Identify the claims about the cycling of matter and energy flow among organisms in an ecosystem	Listed on the item specification linked to the standard's code
		Describe how claims can be expressed as a mathematical relationship in the components of a food web	Listed on the item specification linked to the standard's code
Priority Standard	9-12.LS2.B.3	Use a model that illustrates the roles of photosynthesis, cell respiration, decomposition and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere and geosphere.	• [Clarification Statement: The primary forms of carbon include carbon dioxide, hydrocarbons, waste, and biomass. Examples of models could include simulations and mathematical and conceptual models.]
Supporting Standards		Use evidence from a given model to identify and describe the inputs and outputs of photosynthesis and cellular respiration	Listed on the item specification linked to the standard's code
		Describe the contribution of photosynthesis and cellular respiration to the exchange of carbon within and among the biosphere, atmosphere, hydrosphere	Listed on the item specification linked to the standard's code

		and geosphere in the given model	

Priority Standard	9-12.LS2.C.1	Evaluate the claims, evidence and reasoning that the interactions in ecosystems maintain relatively consistent populations of species while conditions remain stable, but changing conditions may result in new ecosystem dynamics	• [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 or sea level rise. New ecosystem dynamics should be interpreted as characteristics of that new ecosystem.]
Supporting Standards		Identify the given explanation that is supported by the claims, evidence and reasoning to be evaluated, and which includes the following idea: The complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem	Listed on the item specification linked to the standard's code
		Assess the logic of the reasoning, including the relationship between degree of change and stability in ecosystems, and the utility of the reasoning in supporting the explanation of how modest biological or physical disturbances in an ecosystem result in maintenance of relatively consistent numbers and types of organisms	Listed on the item specification linked to the standard's code

Priority Standard	9-12.LS2.C.2	Design, evaluate and/or refine solutions that positively impact the environment and biodiversity	• [Clarification Statement: Examples of solutions may include captive breeding programs, habitat restoration, pollution mitigation, energy conservation, agriculture and mining programs, and ecotourism.]
Supporting Standards		Design a solution that increases positive impact on the environment and biodiversity and that relies on scientific knowledge of the factors affecting changes and stability in biodiversity.	Listed on the item specification linked to the standard's code
		Describe and quantify the criteria and limitations for the solution to the problem, along with the trade-offs in the solution	

Priority Standard	9-12.LS4.C.3	Create or revise a model to test a solution to mitigate adverse impacts of human activity on biodiversity.	• [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species or to genetic variation of organisms for multiple species.]
Supporting Standards		Describe or identify the components a model including human activity and the factors that affect biodiversity	Listed on the item specification linked to the standard's code
		Show an understanding of the reliance of ecosystem function and productivity on biodiversity, and that take into account the limitations of the cost, safety and reliability as well as cultural and environmental impacts	Listed on the item specification linked to the standard's code
		Identify possible negative consequences of solutions that would outweigh benefits	Listed on the item specification linked to the standard's code

**Click on standard code above to see Item Specifications from DESE and Released Items*

Instructional Ideas/Notes

		Assessed on Post Test	Instructional Ideas/Prerequisite Knowledge
Priority Standards	9-12.LS2.A.1	Yes	
	9-12.LS2.B.2	Yes	
	9-12.LS2.B.3	Yes	
	9-12.LS2.C.1	Yes	
	9-12.LS2.C.2	Yes	
	9-12.LS4.C.3	Yes	

Ecology

Key Vocabulary

ecology	community	ecosystem	biome	biotic
abiotic	biodiversity	keystone species	habitat	niche
producer	autotroph	consumer	heterotroph	food chain
herbivore	carnivore	omnivore	detritivore	decomposer
biomass	energy pyramid	competition	predation	symbiosis
mutualism	commensalism	parasitism	population density	survivorship curve
carrying capacity	limiting factor	exponential growth	logistic growth	primary succession
secondary succession				

Common Assessments

CFA 1	CFA 2	Post

Proficiency Scale

Proficiency Scale: A score of 3.0 correlates with grade-level proficiency on the priority standard.

Score	Learning Goal	Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences or applications that go beyond what was taught. For example, the student may:** ● Communicate and defend a scientific argument on the impact of humans on the species in ecosystems. ● Analyze current theories that are being questioned and compare them to new theories that have emerged to challenge older ones (e.g., theories of evolution, extinction, global warming) ● Calculate the amount of energy increase/decrease as it transfers through the trophic levels.	● Sketch and label a food pyramid to include the amount of energy and kCal available at each trophic level.
3.5 In addition to 3.0 performance, in-depth inferences and applications with partial success.		
Score 3.0	**The student exhibits no major errors or gaps in the learning goal (complex ideas and processes).** **The student will:** ● Explain how various biotic and abiotic factors affect the carrying capacity and biodiversity of an ecosystem using mathematical and/or computational representations. ● Communicate the pattern of cycling of matter and the flow of energy among trophic levels in an ecosystem ● Use a model that illustrates the roles of photosynthesis, cell respiration, decomposition and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere and geosphere. ● Evaluate the claims, evidence and reasoning that the interactions in ecosystems maintain relatively consistent populations of species while conditions remain stable, but changing conditions may result in new ecosystem dynamics ● Design, evaluate and/or refine solutions that positively impact the environment and biodiversity ● Create or revise a model to test a solution to mitigate adverse impacts of human activity on biodiversity.	● Card sorting, Station classifying and matching formative assessment ● Construct and analyze predator/prey relationship graphs ● Graph populations, identify the carrying capacity and applicable limiting factors. ● Sketch and label energy flow in food webs.
2.5 No major errors or gaps in 2.0 content and partial knowledge of 3.0 content.		
Score 2.0	**The student exhibits no major errors or gaps in the simpler details and processes.** **The student will:** ● Identify the limiting factors (biotic and abiotic) that may affect the carrying capacity of a population within an ecosystem ● Identify manmade or naturally occurring	● Identify and classify limiting factors ● Identify and classify ● environmental events

	environmental events in ecosystems. ● Recognize and Recall terminology: symbiotic, mutualism, commensalism, parasitism, cooperative, competitive, limiting factors, carrying capacity, diversity.	
1.5 Partial understanding of the 2.0 content with major errors or gaps in 3.0 content.		
Score 1.0	**With help, a partial understanding of the 2.0 content and some of the 3.0 content.**	