

The following pages include the answer key for all machine-scored items.

Unit 1

Item Number	Answer Key	Performance Expectations
1	D	HS-LS1-1 HS-LS1-2
2	D	
3	Top box: Cell Bottom box: Organism	
4	The amino acid sequence in the reading passage provides evidence that the OP5a gene includes at least one sequence in which two copies of the codon for the amino acid lysine appear adjacent to one another.	
5	Top box: Active site Bottom box: Amino acid sequence	
6	See Rubric	
7	B	HS-LS1-5 HS-LS1-7
8	C	
9	Increases carbon dioxide: Plants respire; Insects respire; Snails respire. Decreases carbon dioxide: Plants photosynthesize.	
10	Top two boxes: oxygen and glucose Bottom two boxes: carbon dioxide and water	
11	Point 1 (0 min) = 5,000 Point 2 (16 min) = 35,000 Point 3 (32 min) = 30,000 Point 4 (48 min) = 20,000	
12	See Rubric	
13	A	HS-LS2-1 HS-LS2-2
14	C	
15	Years of Rapid Population Growth for Wolves: Years 1-9 Years of Stabilization for Wolf Population: Years 15-20 Approximate Carrying Capacity of Wolves in Yellowstone: Between 85-100 wolves	
16	Elk Carrying Capacity: Decreased Bison Carrying Capacity: Increased [Explanation: During the 20-year period, the elk population decreased as the wolf population increased. When the wolf	

	population stabilized between Years 16-20, the elk population also stabilized at a much lower population than they were at the beginning of the data collection period. This suggests that the wolves limited (decreased) the carrying capacity of the elk. The bison population steadily rose from 1000 to 3500 individuals during the data collection period, indicating that carrying capacity increases.]
17	Wolves are introduced to the park. The number of elk calves born to every 100 female elk: decreased . The overall elk population: decreased . Competition for plants elk eat: decreased . Availability of resources for bison: increased . Bison population: increased . [Explanation: According to Figure 3, the elk birth rate decreased. The elk death rate also increased, so the elk population decreased. More resources were available to the bison, so the bison population increased.]
18	See Rubric

Unit 2

Item Number	Answer Key	Performance Expectations
1	D	HS-LS2-4 HS-LS1-6
2	A, B	
3	$(t + 1) = 0.1(t)$	
4	Obtained from sources other than photosynthesis: Nitrogen Used to construct all protein molecules: Hydrogen, Carbon, Oxygen, Nitrogen	
5	Change in body mass through growth is largely accounted for by molecules synthesized by phytoplankton during photosynthesis . These must include material from a variety of sources because this process does not produce all the substances required for growth .	
6	See Rubric	
7	B	HS-ETS1-4 HS-LS4-6
8	D	
9	Correct graph will have a linear function with negative slope.	
10	Investigate whether the program successfully reduces the impact of cattle ranching: predict the proportion of eggs hatched under this program that are expected to survive . Investigate whether the program is economical: predict the cost per fish of implementing this program relative to others .	
11	1. Collect initial data on real conditions. 2. Construct simulation of existing conditions in a representative area. 3. Simulate changes in the condition based on the design.	

	4. Implement the design in a test area. 5. Compare predicted and real design outcomes. 6. Refine the design and simulation.	
12	See Rubric	
13	D	
14	D	
15	21% [explanation: 5 plants out of 24 have the extremely short phenotype (5 cm, 6 cm) or extremely tall phenotype (28 cm, 30 cm, and 31 cm)]	HS-LS3-3 HS-LS3-2
16	Plant A must have the genotype ROS/ros and plant C must have the genotype ros/ros . During reproduction of plant A and plant C, the process of genetic recombination can result in offspring with normal or short phenotypes.	
17	In order to produce this outcome, the plants had to be raised under identical conditions , so that the role of the environment in causing variations in plant growth would be minimized.	
18	See Rubric	

Unit 3

Item Number	Answer Key	Performance Expectations
1	A	
2	A	
3	Correct answer: Tissues	
4	In her investigation, humidity and carbon dioxide content of air in the plant's environment will be independent variables, and whether stomata are open or closed will be the dependent variable.	HS-LS1-3 HS-LS1-2
5	A stoma operates on the flow of water vapor into and out of the leaf by acting as a two-way gate .	
6	See Rubric	
7	C	
8	D	
9	Column filled to level 0.5 [Explanation: 0.5 is the only non-zero option on the slider below the critical 0.9 density].	
10	A student is interning with a conservation group that seeks to restore the size and diversity of bird populations on Santa Cruz Island. The student designs a plan of reducing and then controlling the size of sheep populations . The student explains that when this solution is implemented, the ecosystem overall can be expected to show stability because forces for change are	HS-LS2-6 HS-LS2-7

	removed.	
11	One conservation plan for the island proposes reducing sheep population density to 1.5 individuals per hectare in all areas where it is above 1.5. Based on the evidence in tables 1 and 2, this solution would be beneficial because the predicted plant cover would be approximately 68% . This would represent a sheep impact on plant growth with a status between moderate and severe .	
12	See Rubric	
13	C	
14	D	
15	Based on the experimental results, exposing the same test pondweed to a light intensity of 250 W/m ² should result in a rate of release of 105 oxygen bubbles per minute.	
16	In the pond, energy from the sun drives the cycling of matter that is needed to sustain life processes. Pondweed produces the carbon-based molecule glucose through photosynthesis and glucose reacts with oxygen to form energy during aerobic respiration . In the absence of oxygen, pondweed produces energy in a different way which is evidenced by the differences in percentages of carbon in ethanol between the two groups of plants.	HS-LS2-3 HS-LS2-5
17	Input: Oxygen Process: Aerobic respiration	
18	See Rubric	

Unit 4

Item Number	Answer Key	Performance Expectations
1	A	
2	C	
3	Cause at Microscopic Level: Change in the nucleotide sequence of DNA. Effect at Microscopic Level: Change in the protein produced. Symptom: Decrease in immune system function.	
4	The student concludes that the disorder of Horse 1 must result from errors in meiosis . The effect of these errors is to cause problems with newly formed zygotes , which can be concluded based on the fact that horses with this disorder cannot produce offspring.	HS-LS3-1 HS-LS3-2
5	The student argues that this horse disorder is similar to SCID in that it is caused by hereditary material received from the parents, and also because it requires two copies of the gene in order to produce symptoms.	
6	See Rubric	
7	C	
8	C	HS-LS4-2
9	High winds result in temperature mixing of water. Because Chaetognath prey populations are sensitive to temperature , the	HS-LS4-5

	Chaetognath do not maintain their current population sizes.	
10	<ol style="list-style-type: none"> 1. Prey populations increase in body size but decrease in number 2. Individuals with larger mouths show an increased probability of survival 3. Genes for longer body lengths spread through successive worm generations 4. A new species emerges 	
11	It would need to eat more than 1213 prey to have a chance of passing its genes on to the next generation as evidenced by it being a larger worm consuming smaller prey at that ocean level.	
12	See Rubric	
13	B	
14	D	
15	90% [Explanation: The evidence is based on the 90% identical information content between the two sequences.]	
16	<p>Correct Order:</p> <ol style="list-style-type: none"> 1. Despite high genetic uniformity, genetic variation exists 2. Different resource and threat patterns in distinct environments act on sub-populations 3. Natural selection acts in different patterns on existing genetic material 4. Distinct sets of heritable adaptations accumulate 5. New species begin to form 	<p>HS-LS4-1</p> <p>HS-LS4-2</p>
17	The student explains that in the state shown in the diagram, the species was exposed to one land-based and one water-based set of selection pressures, with the aquatic environment ultimately providing the greatest survival opportunities. In response, the species over time became more fully adapted to aquatic living .	
18	See Rubric	