HSA Science (NGSS) Grades 5 and 8 and Biology 1 End of Course (NGSS) Exam

Test Design, Test Blueprints, and Sample Items

The 2019-2020 school year will feature a new test design for science tests taken in grades 5 and 8, as well as the Biology 1 End of Course Exam. Assessments this year will be solely testing the Next Generation Science Standards. The tests will be presented in an adaptive manner for all online assessments; therefore, the items are selected one at a time based on the blueprint and how the student answers previous items. This means that tests will be uniquely adaptive for each student, maximizing the information obtained from student responses for students at all ability levels. If students are re-administered the test for a second opportunity, the student will not see the same question again. Further, the test will not have a separate segment for field test items, as was seen from the past 2 years. The test will be one segment and will have field test items embedded. Students will see a variety of subject domains throughout their test.

Test Design

Each student's test will consist of: 6 clusters (two each from physical, life, and Earth science for grades 5 and 8) and 12 stand-alone items (4 from each domain of science but addressing different sub-areas than addressed by the clusters). There will also be embedded field test items (either 1 cluster or 4 to 6 stand-alone items) included in each student's test.

The NGSS assessments will use an adaptive matrix design.

- Adaptiveness: The difficulty of items presented to a student will depend on their performance on earlier items.
- Matrix Design: The matrix design ensures that the breadth of NGSS is measured in each classroom. Using a Matrix Design means that:
    - There will be reporting of reliable and valid individual student scores as well as reporting related to the NGSS performance expectations (PEs) at higher levels of aggregation.
    - Each student will have two clusters and 4 stand-alone items in each area of science. Physical, Life, and Earth Space Science for Grade 5 and 8. In the case of the Biology 1 EOC (NGSS) Exam, the areas will be: From Molecules to Organisms–Structure and Function; Ecosystems–Interactions, Energy, and Dynamics; and, Heredity and Evolution.
    - Collectively, across a class ($n \geq 20$), 3 to 5 students will respond to items linked to each PE covered by the test or exam.
    - Items will be randomly assigned taking into consideration factors such as difficulty and response time.

Test Blueprint for the HSA Grade 5 Science (NGSS) Test

Grade 5			
The grade 5 test covers the NGSS performance expectations (PEs) for grades 3 through 5. PEs incorporate Disciplinary Core Ideas, Science and Engineering Practices, and Cross-Cutting Concepts.			
Students will be asked to apply their knowledge and skills to address 18 different phenomena during the assessment.			
	Clusters	**Stand-Alone Items**	**Total**
Physical Science	**2**	**4**	**6**
PS1: Matter and Its Interactions **PEs:** 5-PS1-1, 5-PS1-2, 5-PS1-3, 5-PS1-4 **PS2: Motion and Stability: Forces and Interactions** **PEs:** 3-PS2-1, 3-PS2-2, 3-PS2-3, 3-PS2-4, 5-PS2-1			
PS3: Energy **PEs:** 4-PS3-1, 4-PS3-2, 4-PS3-3, 4-PS3-4, 5-PS3-1			
PS4: Waves and Their Applications in Technologies for Information Transfer **PEs:** 4-PS4-1, 4-PS4-2, 4-PS4-3			
Life Science	**2**	**4**	**6**
LS1: From Molecules to Organisms: Structure and Function **PEs:** 3-LS1-1, 4-LS1-1, 4-LS1-2, 5-LS1-1			
LS2: Ecosystems: Interactions, Energy, and Dynamics **PEs:** 3-LS2-1, 5-LS2-1			
LS3: Inheritance and Variation of Traits **PEs:** 3-LS3-1, 3-LS3-2			
LS4: Biological Evolution: Unity and Diversity **PEs:** 3-LS4-1, 3-LS4-2, 3-LS4-3, 3-LS4-4			
Earth and Space Science	**2**	**4**	**6**
ESS1: Earth's Place In the Universe **PEs:** 4-ESS1-1, 5-ESS1-1, 5-ESS1-2			
ESS2: Earth's Systems **PEs:** 3-ESS2-1, 3-ESS2-2, 4-ESS2-1, 4-ESS2-2, 5-ESS2-1, 5-ESS2-2			
ESS3: Earth and Human Activity **PEs:** 3-ESS3-1, 4-ESS3-2, 4-ESS3-1, 5-ESS3-1			
	Clusters	**Stand-Alone Items**	**Total**
Operational Total	**6**	**12**	**18**
Operational "Questions" Total **Each cluster asks student to respond to 5 to 7 questions**	**~ 36**	**12**	**~ 48**
Field Test Item Total	1 cluster or up to 6 stand-alone items		
Total Items on Test including questions within clusters	**Approximately 54**		

Test Blueprint for the HSA Grade 8 Science (NGSS) Test

Grade 8			
The grade 8 test covers the NGSS performance expectations (PEs) for grades 6 through 8. PEs incorporate Disciplinary Core Ideas, Science and Engineering Practices, and Cross-Cutting Concepts.			
Students will be asked to apply their knowledge and skills to address 18 different phenomena during the assessment.			
	Clusters	**Stand-Alone Items**	**Total**
Physical Science	**2**	**4**	**6**
PS1: Matter and Its Interactions **PEs:** MS-PS1-1, MS-PS1-2, MS-PS1-3, MS-PS1-4, MS-PS1-5, MS-PS1-6			
PS2: Motion and Stability: Forces and Interactions **PEs:** MS-PS2-1, MS-PS2-2, MS-PS2-3, MS-PS2-4, MS-PS2-5			
PS3: Energy **PEs:** MS-PS3-1, MS-PS3-2, MS-PS3-3, MS-PS3-4, MS-PS3-5			
PS4: Waves and Their Applications in Technologies for Information Transfer **PEs:** MS-PS4-1, MS-PS4-2, MS-PS4-3			
Life Science	**2**	**4**	**6**
LS1: From Molecules to Organisms: Structure and Function **PEs:** MS-LS1-1, MS-LS1-2, MS-LS1-3, MS-LS1-4, MS-LS1-5, MS-LS1-6, MS-LS1-7, MS-LS1-8			
LS2: Ecosystems: Interactions, Energy, and Dynamics **PEs:** MS-LS2-1, MS-LS2-2, MS-LS2-3, MS-LS2-4, MS-LS2-5			
LS3: Inheritance and Variation of Traits **PEs:** MS-LS3-1, MS-LS3-2			
LS4: Biological Evolution: Unity and Diversity **PEs:** MS-LS4-1, MS-LS4-2, MS-LS4-3, MS-LS4-4, MS-LS4-5, MS-LS4-6			
Earth and Space Science	**2**	**4**	**6**
ESS1: Earth's Place In the Universe **PEs:** MS-ESS1-1, MS-ESS1-2, MS-ESS1-3, MS-ESS1-4			
ESS2: Earth's Systems **PEs:** MS-ESS2-1, MS-ESS2-2, MS-ESS2-3, MS-ESS2-4, MS-ESS2-5, MS-ESS2			
ESS3: Earth and Human Activity **PEs:** MS-ESS3-1, MS-ESS3-2, MS-ESS3-3, MS-ESS3-4, ME-ESS3-5			
	Clusters	**Stand-Alone Items**	**Total**
Operational Total	**6**	**12**	**18**
Operational "Questions" Total **Each cluster asks student to respond to 5 to 7 questions**	**~ 36**	**12**	**~ 48**
Field Test Item Total	1 cluster or up to 6 stand-alone items		
Total Items on Test including questions within clusters	**Approximately 54**		

Test Blueprint for the Biology 1 (NGSS) End of Course Exam

Biology End of Course Exam			
The Biology 1 EOC Exam covers the NGSS Life Science performance expectations (PEs) for high school as well as three Earth Space Science PEs. The PEs incorporate Disciplinary Core Ideas, Science and Engineering Practices, and Cross-Cutting Concepts.			
Students will be asked to apply their knowledge and skills to address 18 different phenomena during the assessment.			
	Clusters	**Stand-Alone Items**	**Total**
LS1: From Molecules to Organisms: Structure and Function	**2**	**4**	**6**
Structure and Function, Growth and Development of Organisms, and Organization for Matter and Energy Flow in Organisms **PEs:** HS-LS1-1 HS-LS1-2, HS-LS1-3, HS-LS1-4, HS-LS1-5, HS-LS1-6, HS-LS1-7			
LS2: Ecosystems: Interactions, Energy, and Dynamics	**2**	**4**	**6**
Interdependent Relationships in Ecosystems, Cycles of Matter and Energy Transfer in Ecosystems, Ecosystem Dynamics, Functioning, and Resilience, and Social Interactions and Group Behavior. *Also including HS-ESS2-6 Cycling of Matter through Earth's Spheres and HS-ESS3-3 Human Impacts on Earth Systems* **PEs:** HS-LS2-1, HS-LS2-2, HS-LS2-3, HS-LS2-4, HS-LS2-5, HS-LS2-6, HS-LS2-7, HS-LS2-8, HS-ESS2-6*, HS-ESS3-3*			
LS3 and LS4: Heredity and Evolution	**2**	**4**	**6**
LS3: Structure and Function, Inheritance of Traits, Variation of Traits **PEs:** HS-LS3-1, HS-LS3-2, HS-LS3-3			
LS4: Evidence of Common Ancestry and Diversity, Natural Selection, and Adaptation. *Also including HS-ESS2-7 Earth's Systems* **PEs:** HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS4-6, HS-ESS2-7*			
	Clusters	**Stand-Alone Items**	**Total**
Operational Total	**6**	**12**	**18**
Operational "Questions" Total **Each cluster asks student to respond to 5 to 7 questions**	**~ 36**	**12**	**~ 48**
Field Test Item Total	1 cluster or up to 6 stand-alone items		
Total Items on Test including questions within clusters	**Approximately 54**		

*ESS2-6, ESS2-7, ESS3-3 Performance Expectations are also examined in the End of Course exam

Sample Items

Example Cluster: This cluster, called Yellowstone Ecosystem, is designed for middle school addressing the PE MS-LS2-4. This page presents the phenomenon. The following has the associated parts of the cluster.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
[Clarification Statement: Emphasis is on recognizing patterns in data and making inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

Willow populations in Yellowstone National Park have increased since wolves were reintroduced to the park in 1995.

Willows are small trees that grow best in marshlike environments. After studying the Yellowstone food web shown in Diagram 1 and the population data for the park shown in Table 1, students arrive at two different hypotheses.

Diagram 1. Yellowstone Food Web

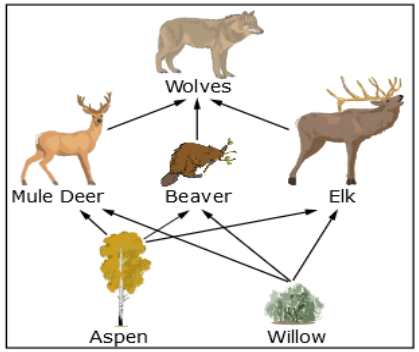


Table 1. Yellowstone Population Data

	Wolves	Elk	Beaver	Mule Deer
1995	31	16,791	10	2,014
2004	171	8,335	120	2,014

Note: These data are approximate.

Hypothesis 1:
When wolves were reintroduced to Yellowstone, the wolves preyed upon the elk, which allowed the beavers to eat more willow. This led to more beavers and beaver dams. Beaver dams create marsh environments that willows do well in, allowing the willow's population to increase.

Hypothesis 2:
When wolves were reintroduced to Yellowstone, they preyed upon all animal species that ate plants. With fewer plant-eating animals eating willows, fewer willow plants were eaten and the population of willow plants increased.

Your Task

In the questions that follow, you will analyze and evaluate these two competing hypotheses.

Part A

Click on each box and select a word/phrase that completes the table with the Yellowstone population data from 1995 and 2004 and the hypothesis those data support.

Table 2. Summary of Yellowstone Population Data and Supported Hypotheses

Data	Hypothesis Supported
Elk population	
Beaver population	
Mule deer population	

- increased
- decreased
- had no change

- Supports Hypothesis 1
- Supports Hypothesis 2
- Supports both hypotheses
- Supports neither hypothesis

Part B

Which hypothesis is best supported by the evidence?

- (A) All of the evidence is consistent with Hypothesis 1.
- (B) All of the evidence is consistent with Hypothesis 2.
- (C) Most of the evidence is consistent with Hypothesis 1.
- (D) Most of the evidence is consistent with Hypothesis 2.
- (E) The evidence does not favor either hypothesis.

Part C

Aspen trees are shown in Diagram 1. Moose and bison are two plant-eating animal species that are not shown in Diagram 1 but are also part of the Yellowstone food web.

Based on Hypothesis 2, click on each box to select a word/phrase to make a prediction about what would happen to the moose, bison, and aspen tree populations after the reintroduction of wolves.

- preyed on by wolves
- it has the same prey as wolves
- its consumers are preyed on by wolves
- it is not preyed on by wolves

Table 3. Population Predictions

Species	Population after Wolf Reintroduction	Reason for Impact on Population
Moose		
Bison		
Aspen tree		

- increase
- decrease
- stayed the same

Part D

Based on Hypothesis 1, and the information in Diagram 1, Table 1, and Table 3 from part C, click on each box to select **two** different predictions.

Table 4. Population Predictions

Prediction Number	Prediction Statement
1	
2	

- Willows would grow in more places thoughout the park.
- Willows would have more leaves on each plant.
- The aspen population would increase.
- Aspen would have more leaves on each tree.

Example Stand-Alone 1: The stand-alone aligns to PE HS-LS2-6.

HS-LS2-6. Evaluate the claims, evidence, and reasoning that 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

[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.]

Ranchers have raised livestock on the island of Crete since 10,000 BCE. Goats and sheep raised on a mountain on Crete eat shrubs, grass, and leaves from the lower branches of trees.

Figure 1 shows the number of livestock grazed on the mountaintop from 1961 to 1991.

Figure 1. Livestock on Mountain from 1961 to 1991

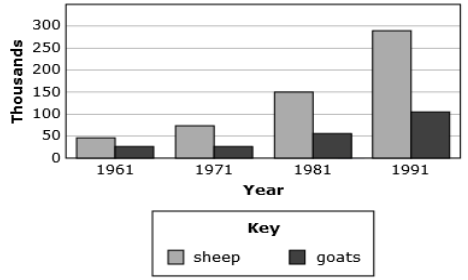
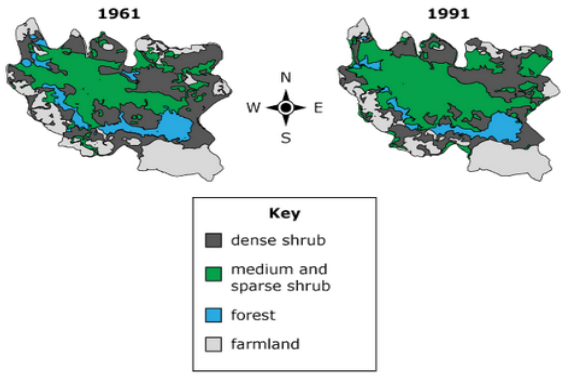


Figure 2 shows the land cover of the mountaintop from 1961 to 1991.

Figure 2. Mountain Land Cover from 1961 to 1991



Select the **three** characteristics that provide evidence that the mountain ecosystem has changed.

- [ ] density of shrubs
- [ ] amount of farmland
- [ ] livestock habitat size
- [ ] total number of livestock
- [ ] ratio of forest to farmland

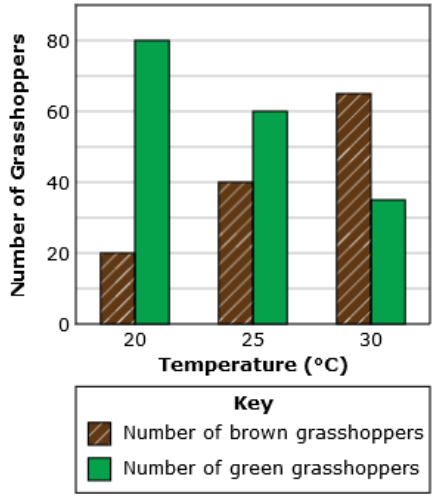
Example Stand-Alone 2: The stand-alone aligns to PE 3-LS3-2.

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.
[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]

Adult grasshoppers in Asia can be brown or green.

Young grasshoppers are placed in different boxes. Each box is set to one of three temperatures: 20°C, 25°C, or 30°C. The grasshoppers are raised in the boxes. Once the grasshoppers are grown, the numbers of brown grasshoppers and green grasshoppers are counted. The results are shown in Graph 1.

Graph 1. The Effect of Temperature on the Color of Grasshoppers



Which statement **best** supports the claim that temperature affects the color of the grasshoppers?

Ⓐ The number of green grasshoppers in each box is different.

Ⓑ There are 20 brown grasshoppers and 80 green grasshoppers in the 20°C box.

Ⓒ There is the same number of brown grasshoppers and green grasshoppers in each box.

Ⓓ The number of brown grasshoppers in the boxes increased as the temperature increased.