

CALIFORNIA

Assessment of Student Performance and Progress

California Science Test Training Items Scoring Guide

2016–17 Administration



Measuring the Power of Learning.™



California Assessment of
Student Performance and Progress

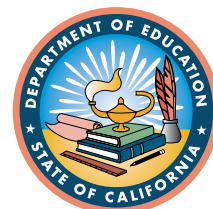


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Guide Content



Note: The purpose of the California Science Test (CAST) training test is to introduce students and test administrators to new item types. This is the first generation of CAST training test; future versions will include corrections, new test items, and other improvements.

This California Science Test (CAST) training items scoring guide offers details about the items, student response types, correct responses, and related scoring considerations for the included sample of training items. These items have been selected to show some of the new approaches to measuring the California Next Generation Science Standards (CA NGSS) that can be found in the assessment. The training test items are not fully representative of all possible item types included in the pilot or field test for the CA NGSS, but additional samples will be provided over time. The sample covers a selection of items from grade five, grade eight, and high school. The various item types are not limited to a particular grade level and could appear for any grade.

Within this guide, the following information is presented along with each item:

- Grade Level: The intended grade level of the item
- Performance Expectations (PE): Assessable statements of what students should know and be able to do
- Science and Engineering Practices (SEP): Descriptions of behaviors that scientists and engineers engage in as they investigate the natural world and design solutions, respectively
- Disciplinary Core Ideas (DCI): Most essential ideas in the major science disciplines that all students should understand during 13 years of school
- Crosscutting Concepts (CCC): Interdisciplinary skills that unify the study of science and engineering through their common application across fields
- Depth of Knowledge (DOK): A measure of complexity that considers the student's cognitive process in response to an item. There are four DOK levels, with 4 being the highest.
- Item and stimulus: A representation of the item and any associated stimulus material
- Answer Key: The expected student response or example response from score point value
- Rubric and sample student response for each score point for short answer items: Score point representations for student responses

A short description of the alignment of the item is provided as well. Each item is aligned to a specific PE but may align through an emphasis or focus on the different dimensions of the PE (the SEP, DCI, or CCC). Within each dimension and the overall alignment to the PE, the items may have differing degrees of alignment as well. Some items may align more strongly to the DCI and SEP while others align better to the SEP and less strongly to the CCC. The training test samples represent some, but not all, possible degrees of alignment to the three dimensions of the PEs.

The items included also represent a range of difficulties and cognitive approaches to the assessment of the CA NGSS. However, this sample is not yet fully representative of the full range of item difficulty that will be available later.

The first seven sample items are representative of a set of items collectively treated as a performance task from grade five. The 2017 pilot test will include one performance task. The next four sample items are from grade eight and are similar to items that will appear on the pilot test prior to the performance task. The final six sample items are from a high school performance task.

The sample items will include numbered instructional text preceding each grade level's section of items as well as introductory text for performance tasks. Following are examples of introductory and instructional text for performance tasks.

2



The next set of eight items are grade five sample items.

Additional information regarding the California Science Test (CAST) is available on the CDE CAASPP Science Assessments Web page at <http://www.cde.ca.gov/ta/tg/ca/caasppscience.asp>.

3



In this performance task, you will learn about algae blooms in lakes. You will run tests on the water samples collected from rivers. Then you will answer seven questions related to algae blooms.

Each item that follows has a metadata table like the one shown below. The item number in the table preceding each sample item corresponds to the sequence number of the item as it appears in the training test.

Example of Metadata Table:

Item	Grade	PE	SEP	DCI	CCC	DOK
4	5	5-LS2-1	2. Developing and using models	LS2.A Interdependent Relationships in Ecosystems	4. Systems and system models	2

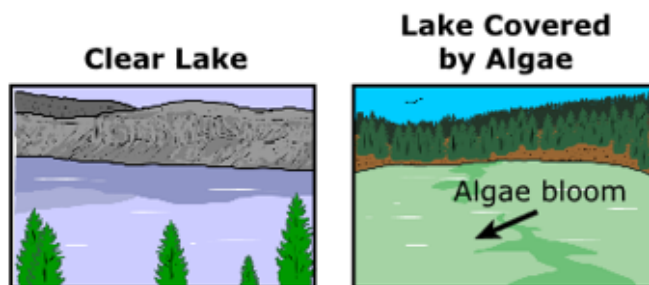
Grade Five Sample Items

The following stimulus accompanies grade five items numbered 4, 5, 6, 7 and 8 in the training test.

Our science class is learning about the environment. Today, we are going to observe some ways that living and non-living things affect each other in a lake habitat. We will explore plants, animals, and water.



Many lakes have clear water that may appear blue. A clear blue lake has few plants growing in the water. Other lakes appear green. The green color is caused by a type of plant called algae. Algae can cover the water's surface. A large amount of algae on a lake is called an algae bloom. A lake with an algae bloom is not healthy and has poor water quality.



The algae bloom will keep animals from living in the lake. This occurs because when algae die, they decompose. The decomposers use oxygen in the water to break down the dead algae. Oxygen used by decomposers is not available for fish and other water animals that need oxygen to survive.

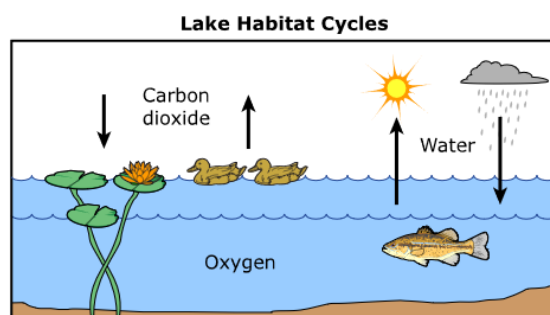
One cause for an algae bloom is when a lot of nitrogen flows into the lake. The nitrogen often comes from fertilizers that farmers put on their fields. The nitrogen can also come from cattle waste. The fertilizers run off the land during rainfall.

Item	Grade	PE	SEP	DCI	CCC	DOK
4	5	5-LS2-1	2. Developing and using models	LS2.A Interdependent Relationships in Ecosystems	4. Systems and system models	2

4



Students are making a model to show some cycles in a lake habitat. Their unfinished model is shown.



The students want to show one way oxygen is added to the water. The students need to put an arrow on the diagram pointing from one source that produces oxygen. What is the source of the oxygen?

- Ⓐ cloud
- Ⓑ duck
- Ⓒ fish
- Ⓓ plant

Key: D

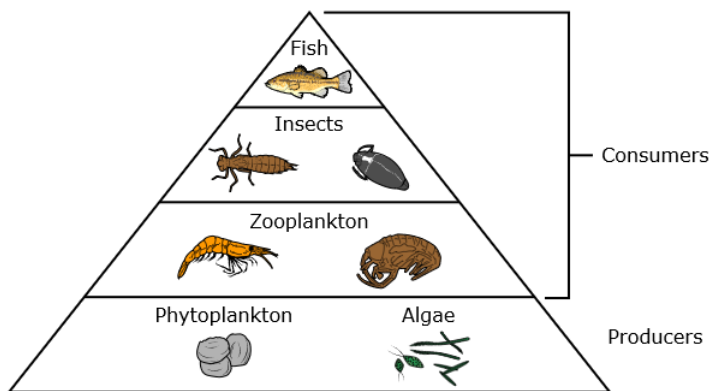
Rubric: (1 point) The student selects the correct source of the oxygen in the water.

Item	Grade	PE	SEP	DCI	CCC	DOK
5	5	5-LS2-1	2. Developing and using models	LS2.A Interdependent Relationships in Ecosystems	4. Systems and system models	2

5



The energy pyramid shows different organisms in a healthy lake. Explain how an energy pyramid can show how matter flows among organisms.



Exemplar:

(1 point) “The pyramid shows that zooplankton eat matter in phytoplankton and algae. Insects eat matter in zooplankton, and fish eat matter in insects.”

(0 points) “Algae eat fish.” OR student provides off-topic, unclear, or no response.

Rubric:

(1 point)

The student demonstrates full understanding of the Performance Expectation, including

- developing a model to describe a phenomenon AND how food of almost any kind of animal can be traced back to plants;
- that organisms are related in food webs in which some animals eat the animals that eat plants;
- that some organisms, such as fungi and bacteria, break down dead organisms and therefore operate as decomposers;
- that decomposition eventually restores (recycles) some materials back to the soil;
- that organisms can survive only in environments in which their particular needs are met;
- that a healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life; OR
- that newly introduced species can damage the balance of an ecosystem.

(0 points) The student demonstrates little or no understanding of the Performance Expectation.

Item	Grade	PE	SEP	DCI	CCC	DOK
6	5	5-LS2-1	2. Developing and using models	LS2.A Interdependent Relationships in Ecosystems	4. Systems and system models	2

6



Zooplankton are shown below insects in the pyramid. An algae bloom causes the number of zooplankton in a lake to decrease. If insects increase, which of the following will most likely happen to zooplankton?

- Ⓐ They will increase.
- Ⓑ They will decrease.
- Ⓒ They will become extinct.
- Ⓓ They will remain unchanged.

Key: B

Rubric: (1 point) The student selects the most likely consequence of a decrease in zooplankton.

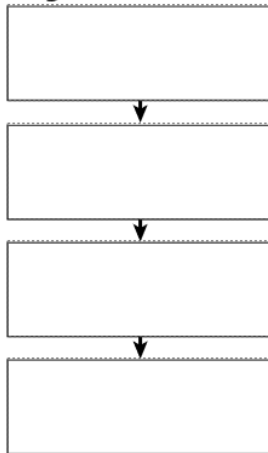
Item	Grade	PE	SEP	DCI	CCC	DOK
7	5	5-ESS2-1	2. Developing and using models	ESS2.A Earth Materials and Systems	4. Systems and system models	2

7



Based on what you know about algae blooms, drag the steps to place them in the correct order in the model.

Algae Bloom Model



Decomposers reduce the amount of oxygen in the water during an algae bloom.

Nitrogen runs off into lakes.

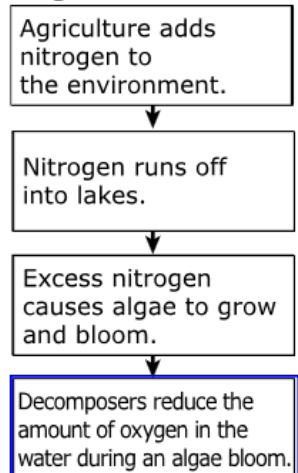
Excess nitrogen causes algae to grow and bloom.

Agriculture adds nitrogen to the environment.

Key: (shown at right)

Rubric: (1 point) The student places the steps in the correct order.

Algae Bloom Model



Item	Grade	PE	SEP	DCI	CCC	DOK
8	5	5-ESS3-1	8. Obtaining, evaluating, and communicating information	ESS3.C Human Impacts on Earth Systems	4. Systems and system models	2

8



Citizens of a town near a lake are concerned about the water quality of their lake. Which type of data would show that an algae bloom may be happening in the lake? Select all that apply.

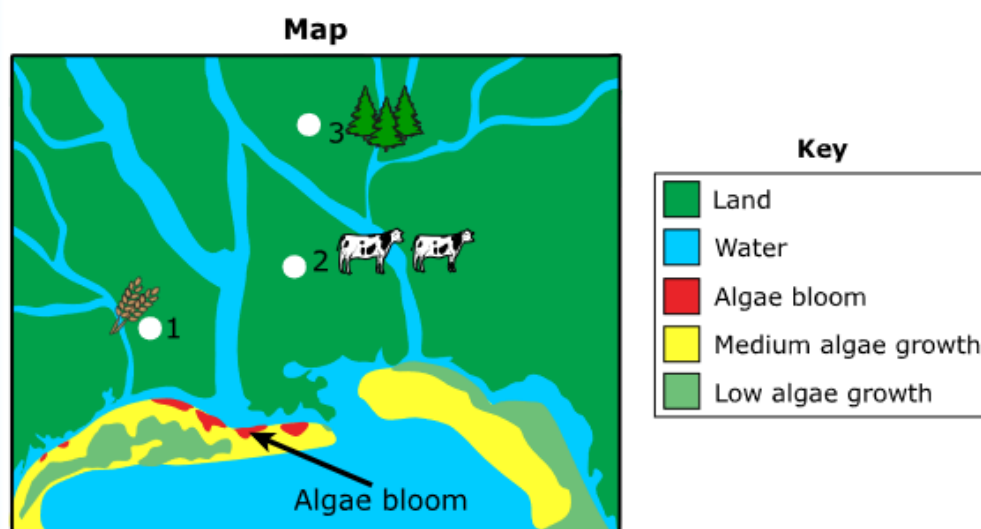
- ☐ Fish populations decreasing over time
- ☐ Lake water volume increasing over time
- ☐ Color of the lake water changing over time
- ☐ Lake water temperatures decreasing over time
- ☐ Nitrogen levels in lake water increasing over time

Key: 1st, 3rd, and 5th options

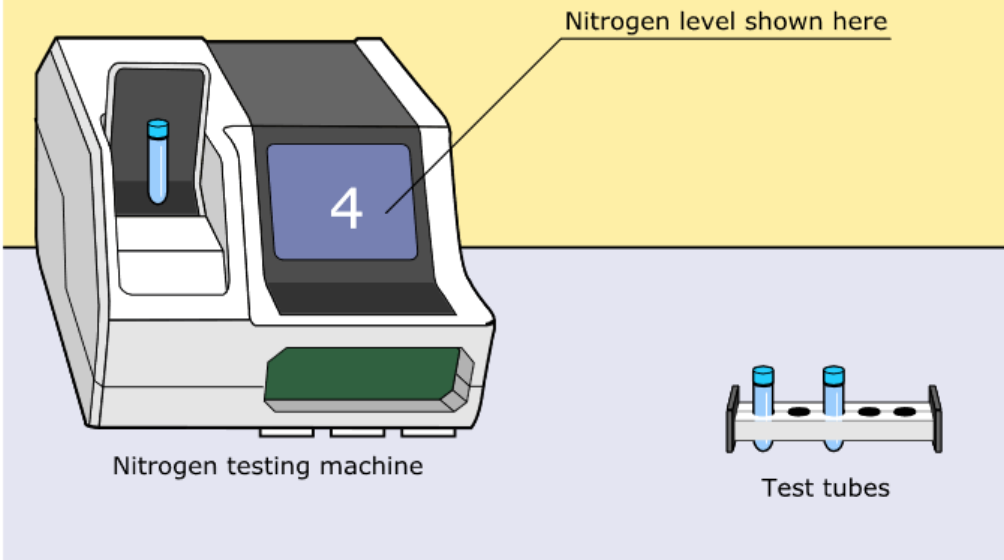
Rubric: (1 point) The student selects the correct types of data.

The following text and simulation compose the stimulus that accompanies grade five items numbered 9 and 10 in the training test.

Our class is studying a lake with an algae bloom. The map shows a river system flowing into a lake. Scientists collected water samples from three different points on the rivers, as shown on the map. There is a wheat farm at point 1, a cattle ranch at point 2, and a forest at point 3. The scientists put the water samples from the river into test tubes and took them to a lab. The scientists used a machine to measure the levels of nitrogen in the water samples.



Select a test tube to place in the nitrogen testing machine. Click the Run button to watch the simulation. The table will show the nitrogen level in that water sample. Repeat for all three test tubes.



Select Test Tube:

Test Tube 3 ▾

Run

Source of Water Sample	Nitrogen Level
1 - Wheat farm	12
2 - Cattle ranch	7
3 - Forest	4

Clear All Rows

This section will be completed by the student within the test delivery system.

Item	Grade	PE	SEP	DCI	CCC	DOK
9	5	5-ESS3-1	8. Obtaining, evaluating, and communicating information	ESS3.C Human Impacts on Earth Systems	4. Systems and system models	2

9



Based on the information, choose the policies that most likely protect lakes from algae blooms. Select all that apply.

- ☐ Prevent river water from flowing into lakes.
- ☐ Crops and cattle need to be kept far away from rivers.
- ☐ Limit the number of cattle that can live in areas near rivers.
- ☐ On fields near rivers, only plant crops that grow very quickly.
- ☐ Limit the number of people that can visit the lake at one time.

Key: 2nd and 3rd options

Rubric: (1 point) The student selects the correct policies.

Item	Grade	PE	SEP	DCI	CCC	DOK
10	5	5-ESS3-1	8. Obtaining, evaluating, and communicating information	ESS3.C Human Impacts on Earth Systems	4. Systems and system models	2

10



A rancher had cattle at Point 2 on the map. Later the rancher sold the cattle and turned the land into a park. Describe the most likely changes to the lake with no cattle present near the rivers. Use one example of a non-living thing and one example of a living thing.

Exemplar:

(2 points) “Nitrogen in water decreases. Populations of fish increase.” OR “Algae bloom shrinks.”

(1 point) Any one of the following: “Nitrogen decreases.” OR “Fish increase.” OR “Less algae”

(0 points) “Nitrogen increases.” OR “Water animals decrease.” OR “Algae increases.” OR student provides off-topic, unclear, or no response.

Rubric:

(2 points) The student demonstrates full understanding of the Performance Expectation, including the ability to

- obtain and combine information from reliable media to explain phenomena or solutions to a design problem; AND
- demonstrate an understanding of human activities in agriculture, industry, or everyday life that have major effects on any one of the following:
 - Land
 - Vegetation
 - Streams
 - Oceans
 - Air
 - Outer space; AND
- demonstrate an understanding of actions individuals OR communities take to help protect Earth’s resources and environments

(1 point) The student demonstrates partial understanding of the Performance Expectation.

(0 points) The student demonstrates little or no understanding of the Performance Expectation.

Grade Eight Sample Items

Item	Grade	PE	SEP	DCI	CCC	DOK
12	8	MS-ESS1-1	2. Developing and using models	ESS1.B Earth and the Solar System	1. Patterns	2

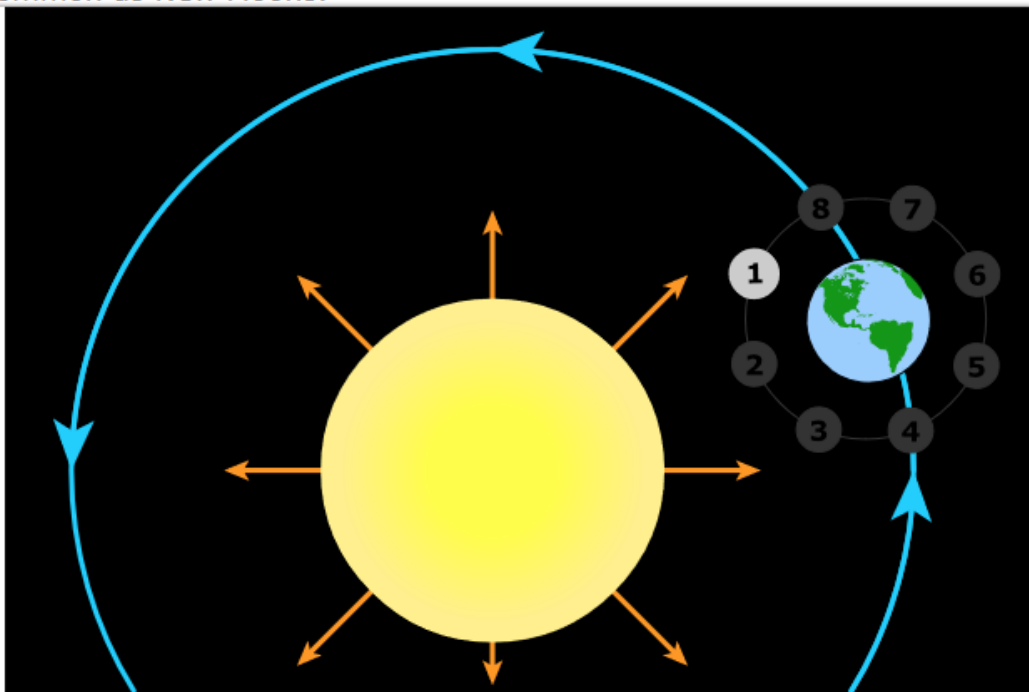
12



The Moon goes through monthly phases that include a New Moon. Total solar eclipses are relatively uncommon, occurring less than once per year on average.

Drag the slider to position the Moon where there could possibly be a total solar eclipse as seen from Earth in this model. Click the Submit button when you are done.

Then provide an explanation in the text box for why total solar eclipses are not as common as New Moons.



Submit

Moon Position

Functionality: The student uses the dynamic slider to move the Moon to the correct position number in the model.

Key: Position 2

Rubric: (1 point) The student places the Moon in the correct position number. Any other position is incorrect and worth zero points.

Item	Grade	PE	SEP	DCI	CCC	DOK
13	8	MS-ESS1-1	2. Developing and using models	ESS1.B Earth and the Solar System	1. Patterns	2

13



Why are total solar eclipses less common than New Moons?

Exemplar: “The total solar eclipse only happens when the Moon, Earth, and Sun line up in a straight line.” OR “The total solar eclipse is rare because the Moon doesn’t always line up in the right place to block the Sun.”

Rubric:

(1 point) The student demonstrates full understanding of the Performance Expectation, including

- aspects of supporting an argument with evidence, data, or a model; AND
- that the Sun is a star that appears larger and brighter than other stars because it is closer to Earth. Stars range greatly in their distance from Earth.

(0 points) The student demonstrates little or no understanding of the Performance Expectation.

Item	Grade	PE	SEP	DCI	CCC	DOK
14	8	MS-PS3-1	4. Analyzing and interpreting data	PS3.A Definitions of Energy	3. Scale, proportion, and quantity	2

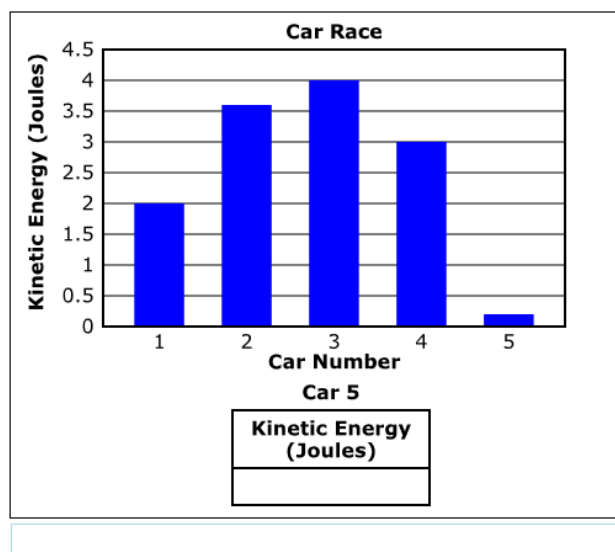
14



Students are studying how mass and velocity affect the kinetic energy of an object. The students race five cars. The winning car has the most kinetic energy. The graph shows the results for the race.

Click the bar location for Car 5 to show Car 5 finished with the third-highest kinetic energy.

Car 5 raced with a velocity of 2.0 meters per second (m/s). Based on the kinetic energy shown in the graph for Car 5, complete the table by determining the mass to two decimal places for Car 5.



Mass (kilograms)	Velocity (m/s)
	2.0

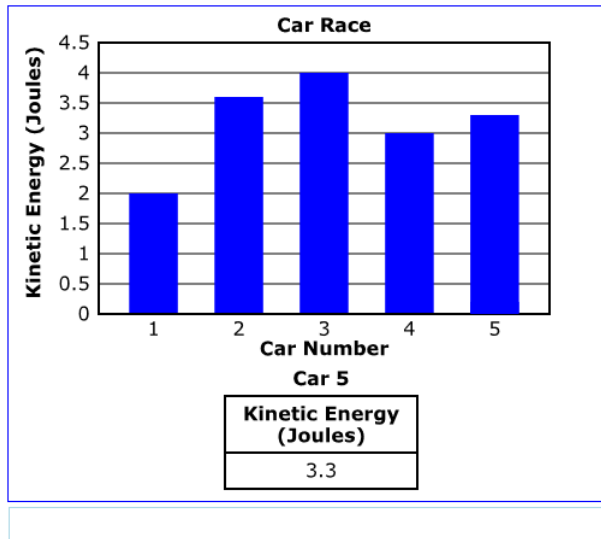
I

Functionality: The value of the kinetic energy appears under the graph when the student moves the Car 5 bar to any point at 0.1 J intervals between 0.2 J and 4.5 J on the graph.

Exemplar:

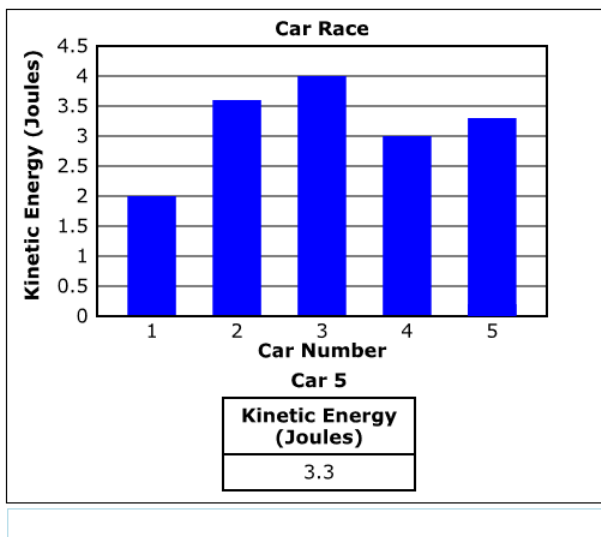
(2 points) The student receives 1 point for correct placement of the bar on the graph and 1 point for correct calculation of mass for a possible total of 2 points.

An example of correct bar graph placement (1 point)



Mass (kilograms)	Velocity (m/s)
	2.0

An example of correctly calculated mass (1 point)



Mass (kilograms)	Velocity (m/s)
1.65	2.0

Rubric:

(2 points)

- The student moves the bar to a correct height and correctly calculates the mass.

(1 point)

- The student moves the bar to a height between 3.1 and 3.5 J (inclusive) on the bar graph. Any height less than or equal to 3.0 J or greater than or equal to 3.6 J is incorrect and worth zero points. OR
- The student enters a mass in the table that equals the kinetic energy listed in the first column of the table (which is from the bar graph) based on use of the following equation: $0.5 \times \text{mass} \times (\text{velocity})^2$. The velocity used for this formula should be 2.0 m/s, as shown in the table. Any number combinations that do not yield the kinetic energy in the first column of the table based on the equation given $[0.5 \times \text{mass} \times (2.0)^2]$ are incorrect and worth zero points.

(0 points)

- The student places the bar at an incorrect height in the graph and incorrectly calculates the mass.

Item	Grade	PE	SEP	DCI	CCC	DOK
15	8	MS-LS2-1	4. Analyzing and interpreting data	LS2.A Interdependent Relationships in Ecosystems	2. Cause and effect: mechanism and explanation	2

(Item 15 continues on the following page.)

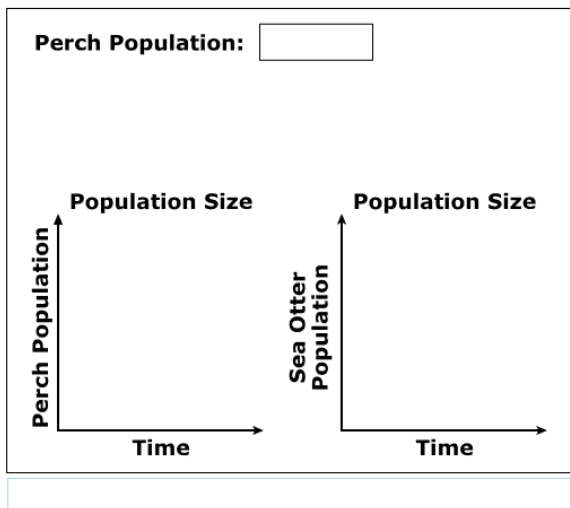
15



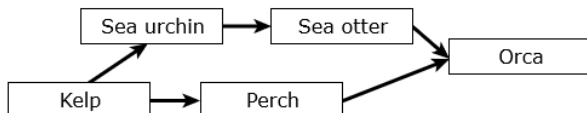
A student studies how changes in resources affect different populations in a kelp forest ecosystem off the coast of California.

Use the drop-down menu to choose whether to increase or decrease a population of perch, a type of fish, living in the kelp forest.

Changes in the perch population directly affect the sea otter population. The changes in both the perch and sea otter populations appear on the graphs.



The diagram shows part of the food web for the kelp forest ecosystem.



Use the relationships shown in the food web and the lines on the graphs to predict the changes in the other populations of the kelp forest.

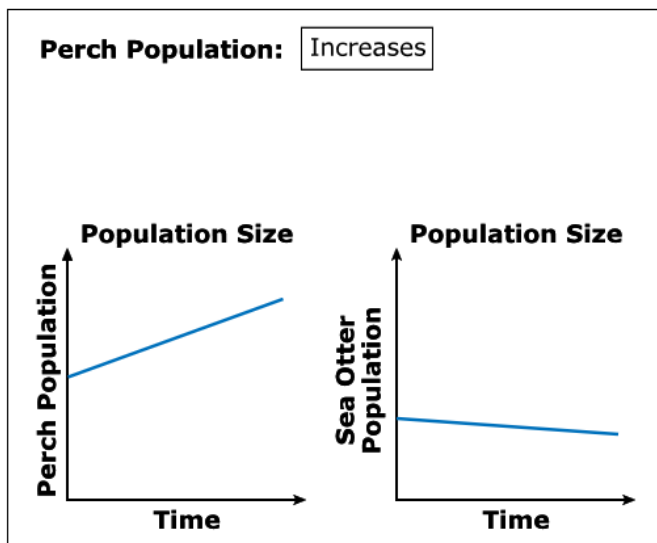
Organism	Relative Change
Orca	<div> <div></div> <div></div> <div></div> <div></div> </div>
Sea urchin	<div> <div></div> <div></div> <div></div> <div></div> </div>
Kelp	<div> <div></div> <div></div> <div></div> <div></div> </div>

Functionality: The student selects either “Increases” or “Decreases” from the drop-down menu for perch population. The graphs autopopulate for the perch and sea otter populations. The student completes the table by identifying the impact (Increases, Decreases, or Remains steady) on the populations of orcas, sea urchins, and kelp.

Exemplar: (1 point)

Choice: The student chooses “Increases” from the drop-down menu for perch population.

The graphs for the “Increases” selection are shown.



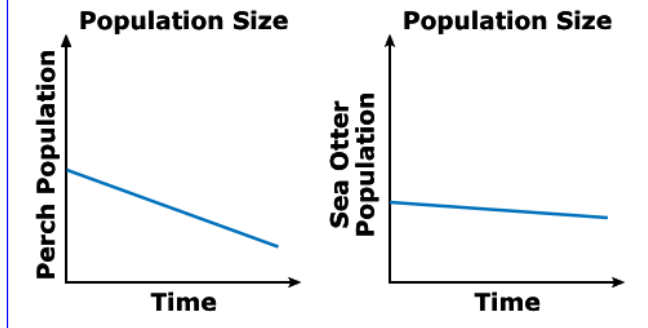
Key: The orca population increases, the sea urchin population decreases, and the kelp population decreases.

OR

Choice: The student chooses “Decreases” from the drop-down menu for perch population.

The graphs for the “Decreases” selection are shown.

Perch Population:



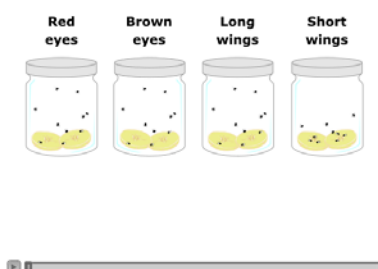
Key: The orca population decreases, the sea urchin population increases, and the kelp population decreases.

Rubric: (1 point) The student chooses the correct impacts for the initial selection.

High School Sample Items

Item	Grade	PE	SEP	DCI	CCC	DOK
18	High School	HS-LS4-3	4. Analyzing and interpreting data	LS4.B Natural Selection	1. Patterns	2

You will be using fruit flies, *Drosophila melanogaster*, to study genetics. Fruit flies are studied because they have a short life cycle and have only 4 pairs of chromosomes. The flies will be crossed to observe the inheritance patterns of eye color and wing shape. The fruit flies are kept in jars with pieces of banana to serve as a nutrient source. The fruit flies were ordered from a supply company, and each jar contains its own phenotype. You will use the jars containing different fruit flies to answer questions. Click the play button to watch the animation.



18

Based on the results in the data table, explain why there are no flies with short wings. Type your answer in the box below.

Exemplar:

- “There are no short-winged flies because long wings are dominant.” OR
- “There are no short-winged flies because short wings are recessive.”

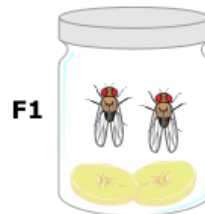
Rubric:

(1 point) The student demonstrates a full understanding of the Performance Expectation, including aspects of applying concepts of statistics and probability in the expression of genetic information. 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.

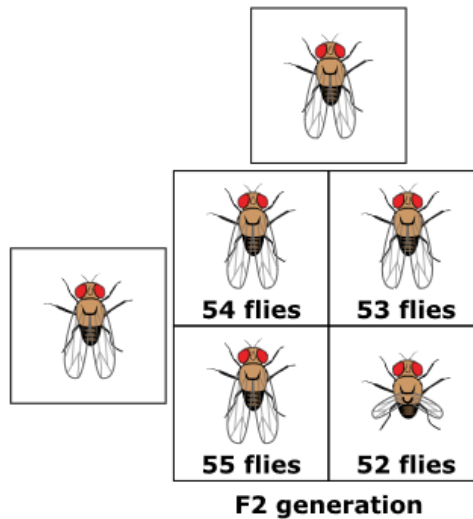
(0 points) The student demonstrates little or no understanding of the Performance Expectation.

The following stimulus accompanies high school items numbered 19 and 20 in the training test.

To further the study, two flies from the offspring of the F1 generation are crossed and produce an F2 generation.



The number and phenotype of the offspring are shown below.



Item	Grade	PE	SEP	DCI	CCC	DOK
19	High School	HS-LS3-3	4. Analyzing and interpreting data	LS3.B Variation of Traits	3. Scale, proportion, and quantity	2

19



What percent of the F2 generation is expected to be heterozygous for long wings?

 %

←

→

↶

↷

✖

1	2	3
4	5	6
7	8	9
0	.	$\frac{\Box}{\Box}$

Key: 50

Rubric: (1 point) The student enters the correct percent.

Item	Grade	PE	SEP	DCI	CCC	DOK
20	High School	HS-LS3-3	4. Analyzing and interpreting data	LS3.B Variation of Traits	3. Scale, proportion, and quantity	2

20



Using "A" to represent the dominant trait and "a" to represent the recessive trait, what are the genotypes of the parents in the F1 generation?

←
→
↶
↷
✖

A

a

Key: Aa, Aa

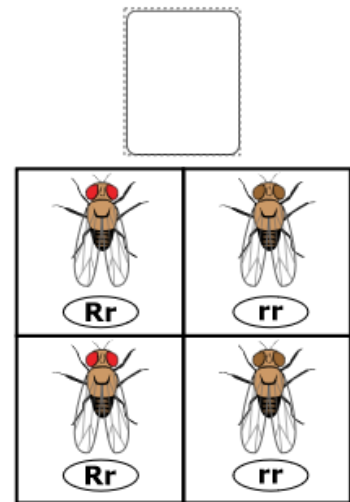
Rubric: (1 point) The student enters the correct genotypes.

Item	Grade	PE	SEP	DCI	CCC	DOK
21	High School	HS-LS3-2	7. Engaging in argument from evidence	LS3.B Variation of Traits	2. Cause and effect: mechanism and explanation	2

21

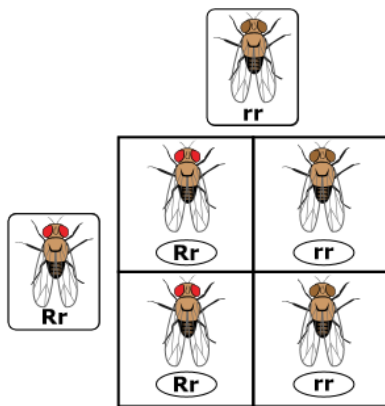


Using the Punnett square provided, drag the correct parents that would be expected to produce approximately 50% homozygous brown-eyed offspring and 50% heterozygous offspring.



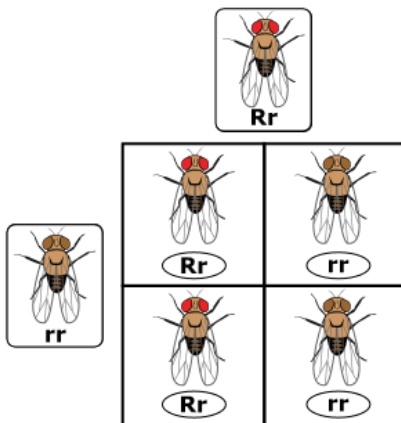
Key: Rr, rr

Exemplar: The student may put the Rr genotype in the left box and the rr genotype in the top box.



OR

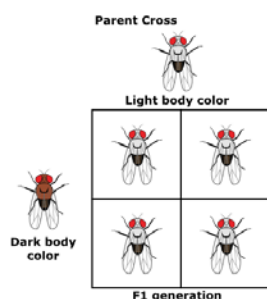
The student may put the rr genotype in the left box and the Rr genotype in the top box.



Rubric: (1 point) The student correctly enters the genotypes.

Item	Grade	PE	SEP	DCI	CCC	DOK
22	High School	HS-LS4-2	6. Constructing explanations (for science) and designing solutions (for engineering)	LS4.B Natural Selection	2. Cause and effect: mechanism and explanation	3

To allow the students to observe an additional trait, the teacher gives them a fly with a darker body color than the other flies, which have a lighter body color. The students crossed the dark-body-colored fly with the light-body-colored fly. The cross is represented in the Punnett square below.



22

The students then crossed two flies from the F1 generation and recorded the following results:

162 light-body-colored fruit flies
52 dark-body-colored fruit flies

Explain how the dark body color of the fruit flies remained in the gene pool.

Exemplar:

(2 points) "Light-bodied flies carry a recessive allele for dark body color, and the offspring homozygous for the recessive trait appear."

(1 point) "The dark body is recessive." OR "Homozygous offspring can appear later."

Rubric:

(2 points) The student demonstrates a full understanding of the Performance Expectation, including

- aspects of constructing explanations based on evidence obtained from a variety of sources; AND
- that natural selection occurs only if there is variation in the genetic information between organisms in a population.

(1 point) The student demonstrates a partial understanding of the Performance Expectation.

(0 points) The student demonstrates little or no understanding of the Performance Expectation.

Item	Grade	PE	SEP	DCI	CCC	DOK
23	High School	HS-LS4-3	4. Analyzing and interpreting data	LS4.B Natural Selection	1. Patterns	2

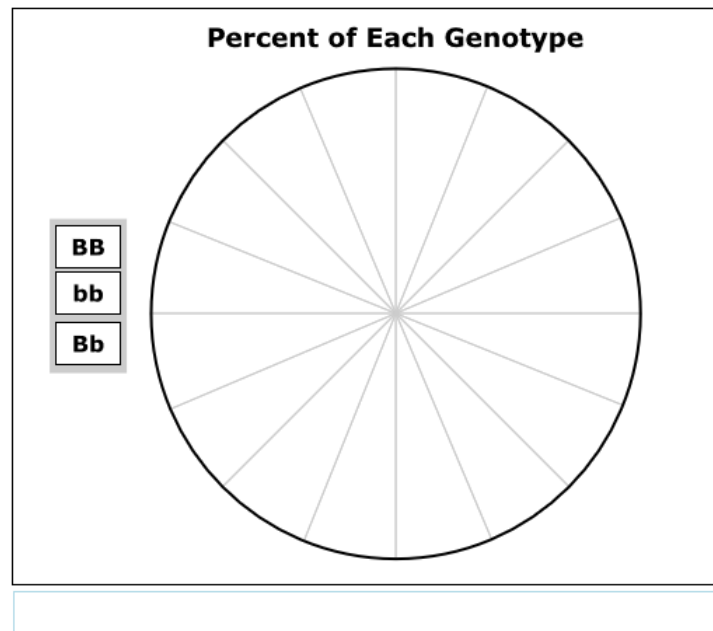
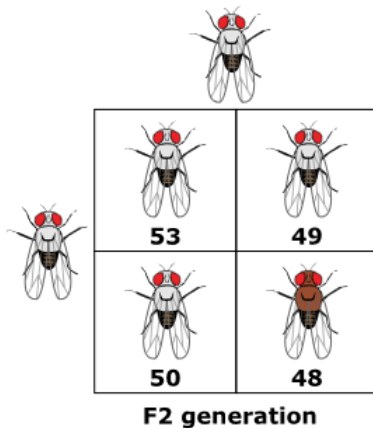
23



The Punnett square shows the possible results of a cross between two flies from the F1 generation.

Click on the lines in the circle to create a pie graph representing the percent of offspring of each genotype in the Punnett square.

Drag the genotype into the appropriate section of the pie chart based on the results in the Punnett square.

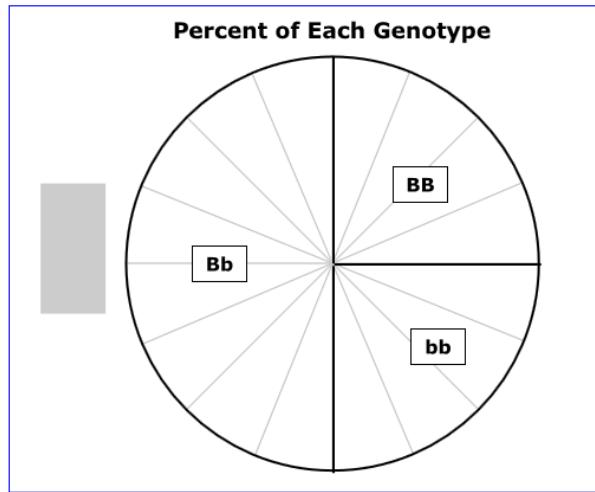


Functionality: The student chooses line segments inside the circle to create a pie chart and then places genotype labels on the sections of the pie chart.

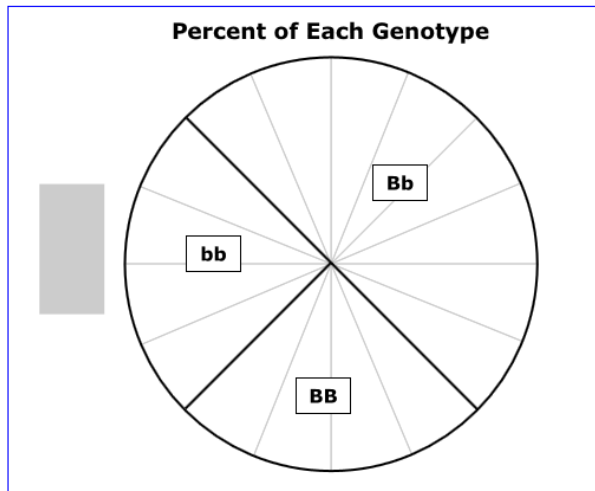
Key: The student correctly labels the pie chart:

- One-half (50%) represents Bb.
- One-fourth (25%) represents BB.
- One-fourth (25%) represents bb.

Exemplars:



OR



Rubric: (1 point) The student correctly labels three portions of the pie chart to represent the genotypes.