# California Assessment of Student Performance and Progress

# California Science Test Training Items Scoring Guide *for* High School

California Assessment of Student Performance and Progress


*Prepared by Educational Testing Service ®*
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# CAST Training Items Scoring Guide—High School

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# Introduction to Training Test Scoring Guide

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 samples 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 CAST, but additional samples will be provided over time. The samples cover a selection of items from performance expectations from high school.

The following information is presented along with each item:

- **Performance Expectations (PE) Code**: References the assessable evidence 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)**: Essential ideas in the science disciplines that all students should understand.
- **Crosscutting Concepts (CCC)**: Interdisciplinary skills that unify the study of science and engineering through common application across fields.
- **Depth of Knowledge (DOK):** A measure of complexity that considers the students' cognitive process in response to an item (There are four DOK levels, with 4 being the highest.)
- **Item-Level Claim Statement (ILCS)**: A brief statement that illustrates how an item aligns to the PE through at least two of the dimensions [An ILCS is included with each item to help item reviewers (1) identify the intent of the alignment, (2) determine if the alignment is appropriate and valid, and (3) identify the content reflected in item-level specifications.]
- **Item and Stimulus**: Item represents the question being asked, while stimulus is supporting information, graphics, animation or simulation included with some items.
- **Answer Key**: The expected student response or example response including score point value.

While each item is aligned to a specific PE through its dimensions, certain items, based on their contexts, incorporate aspects of environmental literacy outlined in the Environmental Principles and Concepts adopted by the State Board of Education in 2004. The items in this training test are not fully representative of the full range of ways items can incorporate environmental literacy.

Each item that follows has metadata as shown below. Metadata contains the specific information on the alignment of the item to the NGSS standards. 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

| Item | PE | SEP | DCI | CCC | DOK |
|---|---|---|---|---|---|
| 1 | HS-ESS2-5 | 3. Planning and carrying out Investigations | ESS2.C The Roles of Water in Earth's Surface Processes | 6. Structure and Function | 2 |

**ILCS**: Plan and carry out an investigation on the rate of water flow in a river and its impacts on the surrounding environment.

**Environmental Principle III:** Natural systems proceed through cycles that humans depend upon, benefit from, and can alter.

# High School Sample Items

| Item | PE | SEP | DCI | CCC | DOK |
|---|---|---|---|---|---|
| 1 | HS-ESS2-5 | 3. Planning and carrying out Investigations | ESS2.C The Roles of Water in Earth's Surface Processes | 6. Structure and Function | 2 |

**ILCS:** Plan and carry out an investigation on the rate of water flow in a river and its impacts on the surrounding environment.

**Environmental Principle III:** Natural systems proceed through cycles that humans depend upon, benefit from, and can alter.

A physics class was studying how different types of waves travel through different mediums: solids, liquids, and gases. The teacher proposed the following statement.

"Two sound waves with identical frequencies are traveling through identical containers of an inert gas. Wave A has an amplitude of 0.3 cm. Wave B has an amplitude of 0.6 cm."

Based on the teacher's statement, complete the sentence by using the menus.

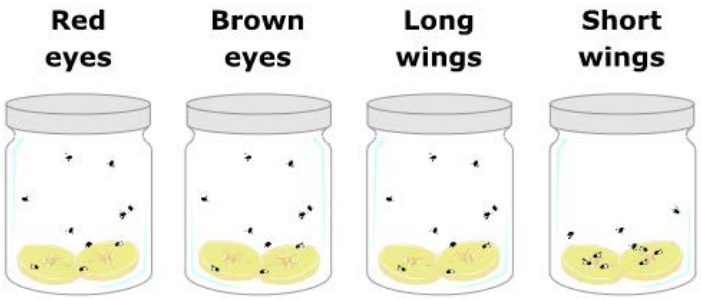
Wave B has greater [ ▾ ] than Wave A, but both waves must have the same [ ▾ ].

**Key:** First drop-down menu: energy. Second drop-down menu: wavelength. (1 point)

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

**ILCS:** Analyze and interpret heritable traits between two fruit flies and explain why certain traits are not present within the population of offspring.

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.




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

*Key follows on the next page.*

**1 point**

**Exemplar:**

“There are no flies with short wings because the alleles for long wings are dominant.”

OR

“There are no flies with short wings because the alleles for short wings are recessive.”

**Rubric:**

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**

**Exemplar:**

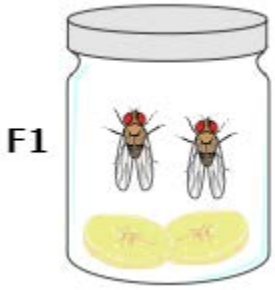
“There are no short-winged flies because short wings are a lethal mutation and the offspring did not survive.”

**Rubric:**

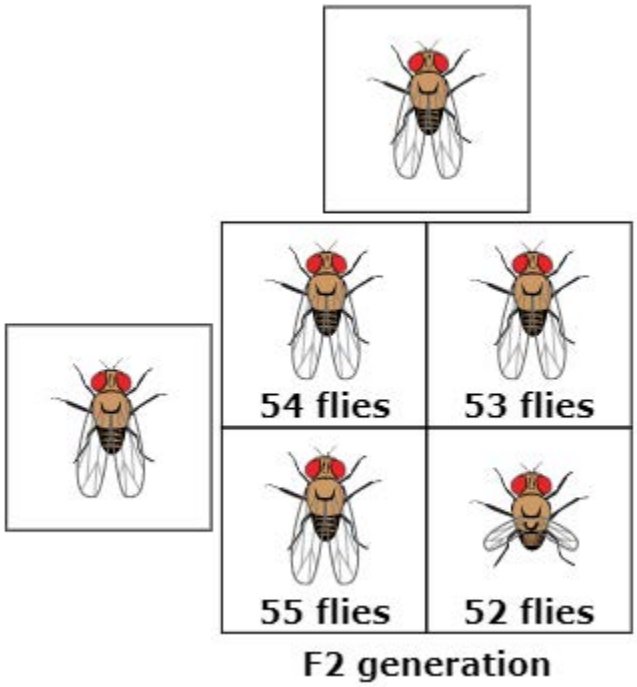
The student demonstrates little or no understanding of the Performance Expectation.

**The following stimulus accompanies high school items numbered 3 and 4 in the training test.**

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



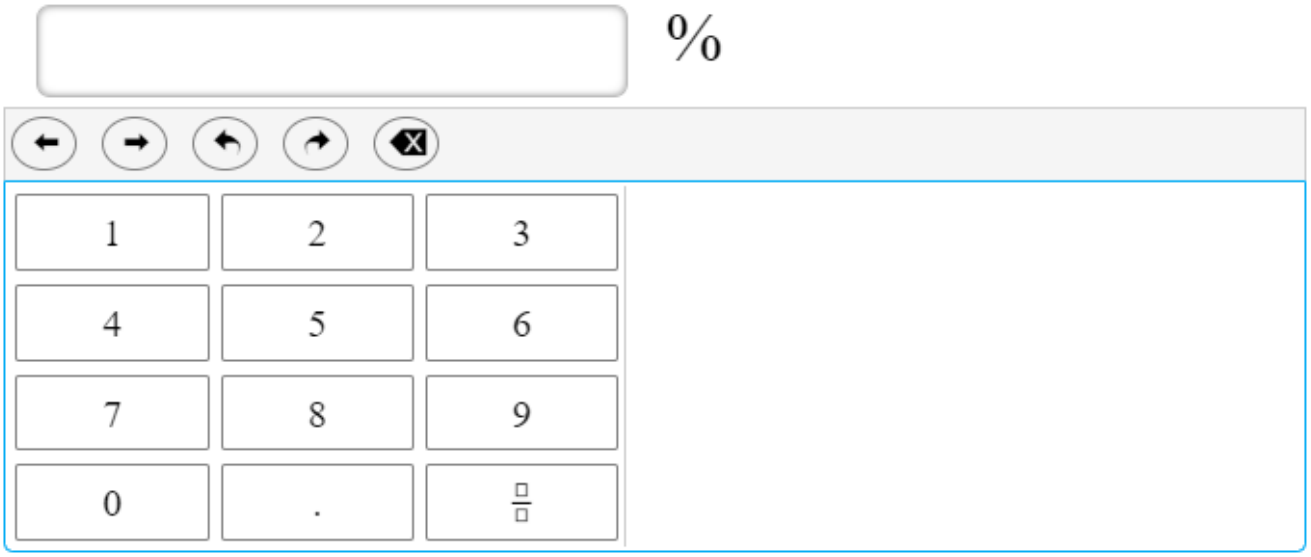

The number and phenotype of the offspring are shown below.



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

**ILCS:** Analyze the data collected and interpret the percent of offspring that have a particular trait.

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

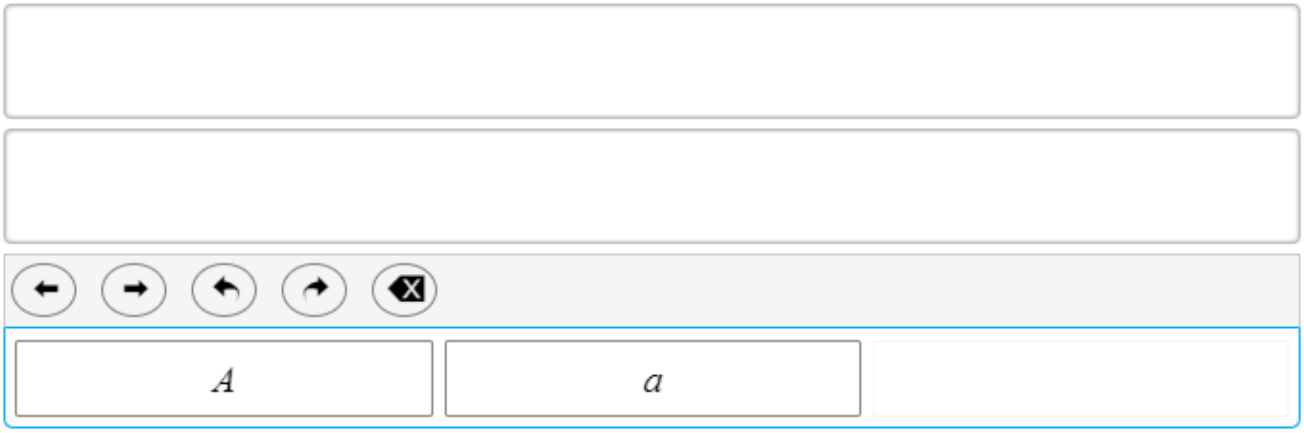



**Key:** 50 (1 point)

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

**ILCS:** Interpret the results of the Punnett square in terms of recognizing the parental genotypes.

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?

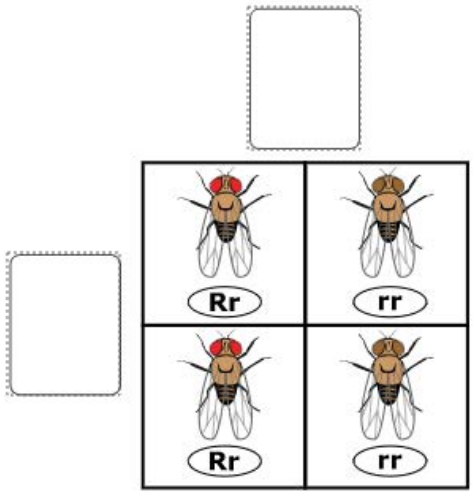



**Key:** Aa, Aa (1 point)

| Item | PE | SEP | DCI | CCC | DOK |
|---|---|---|---|---|---|
| 5 | HS-LS3-2 | 7. Engaging in argument from evidence | LS3.B Variation of Traits | 2. Cause and effect: mechanism and explanation | 2 |

**ILCS:** Analyze the evidence provided in the Punnett square to determine the correct parental genotypes that would be expected to produce the offspring shown.

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.

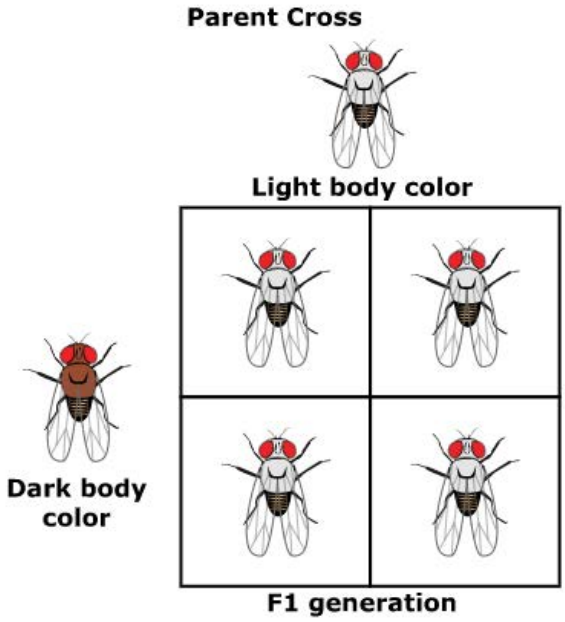




**Key:** Rr, rr (1 point)

| Item | PE | SEP | DCI | CCC | DOK |
|---|---|---|---|---|---|
| 6 | 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 |

**ILCS:** Understand how particular traits are maintained in a population and construct an explanation based on the results of the Punnett square.

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.




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.

**2 points**

**Exemplar:**

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

*Key continues on the next page.*

**Rubric:**

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**

**Exemplar:**

“The alleles for dark body color are recessive.” OR “Homozygous offspring can appear later.”

**Rubric:**

The student demonstrates a partial understanding of the Performance Expectation.

**0 points**

**Exemplar:**

“The alleles for dark body color are dominant and will appear in the offspring.”

**Rubric:**

The student demonstrates little or no understanding of the Performance Expectation.

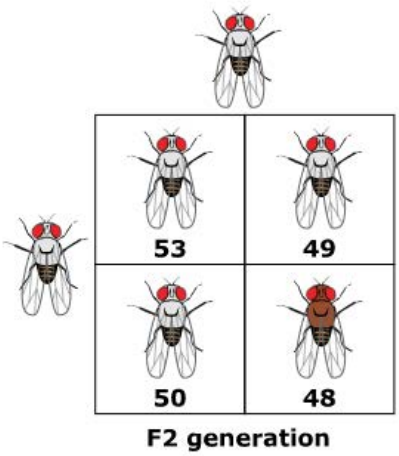
| Item | PE | SEP | DCI | CCC | DOK |
|---|---|---|---|---|---|
| 7 | HS-LS4-3 | 4. Analyzing and interpreting data | LS4.B Natural Selection | 1. Patterns | 2 |

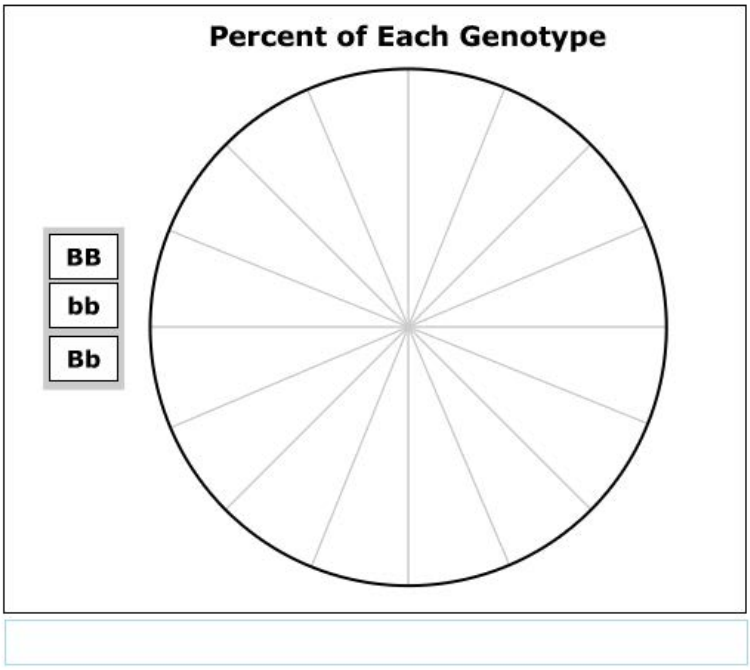
**ILCS:** Interpret the data presented in the Punnett square to determine the correct percentages of genotypes.

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.




*Key follows on the next page.*

**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.

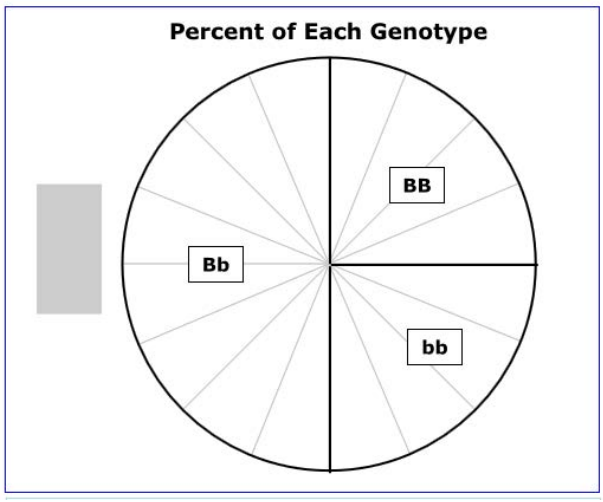
**Key:** The student correctly labels the pie chart:

One-half (50%) represents Bb.

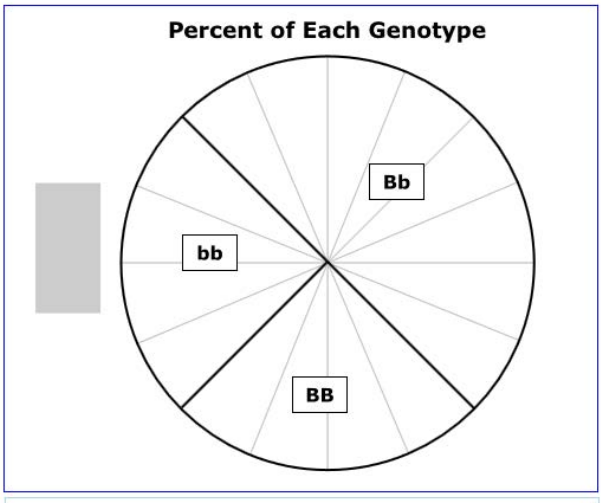
One-fourth (25%) represents BB.

One-fourth (25%) represents bb.

**Exemplars:** (1 point)




OR




OR any pie chart representing the correct percentages and labeling